

UNIVERSIDAD MIGUEL HERNÁNDEZ DE ELCHE

ESCUELA POLITÉCNICA SUPERIOR DE ELCHE

MÁSTER EN INGENIERÍA INDUSTRIAL



"AUTOCERTIFICACIÓN ATEX DE UN  
PANEL DE INTERFAZ COMO EQUIPO DE  
CATEGORÍA 3 Y DISEÑO DE UNA CAJA  
PARA SU CERTIFICACIÓN ATEX COMO  
COMPONENTE DE CATEGORÍA 2"

TRABAJO FIN DE MÁSTER

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## **0 RESUMEN EXTENDIDO**

El siguiente trabajo final de máster ha sido realizado en inglés, por lo que se incluye como capítulo 0 un resumen extendido del contenido del mismo.

El TFM consta de tres partes claramente diferenciadas:

- Introducción a las atmósferas explosivas ATEX.
- Autocertificación ATEX de un panel de interfaz como equipo de categoría 3.
- Diseño de una caja para su certificación ATEX como componente de categoría 2.

Cada uno de estos puntos ha sido resumido a continuación. Para cada uno se ha extraído la información considerada esencial o relevante.

### **0.1 INTRODUCCIÓN A LAS ATMÓSFERAS EXPLOSIVAS – ATEX**

#### **0.1.1 ATMÓSFERAS EXPLOSIVA – ATEX**

ATEX hace referencia al riesgo que generan las atmósferas explosivas que ocurren en el lugar de trabajo debido a la presencia de gases inflamables o polvo combustible mezclados en el aire, que pueden generar riesgo de explosión.

La palabra ATEX viene del francés, ATmosphère EXplosibles, y se usa para referirse a dos directivas europeas:

- DIRECTIVA 1999/92/CE DEL PARLAMENTO EUROPEO Y DEL CONSEJO, de 16 de diciembre de 1999, relativa a las disposiciones mínimas para la mejora de la protección de la salud y la seguridad de los trabajadores expuestos a los riesgos derivados de atmósferas explosivas.
- DIRECTIVA 2014/34/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO, de 26 de febrero de 2014, sobre la armonización de las legislaciones de los Estados miembros en materia de aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas.

##### **0.1.1.1 DIRECTIVA 1992/92/EC**

Esta directiva trata la seguridad y salud del trabajador en su lugar de trabajo con respecto a las atmósferas explosivas. Las directivas son actos legislativos en los cuales se establecen objetivos que todos los países de la UE deben cumplir. Sin embargo, corresponde a cada país elaborar sus propias leyes sobre cómo alcanzar esos objetivos. En España es el Real Decreto 681/2003, de 12 de junio, el que transpone al ordenamiento jurídico español esta Directiva europea.

La Directiva 1999/92/EC pone en el empresario la responsabilidad de realizar una evaluación del riesgo en el lugar de trabajo para identificar los riesgos de explosión y tomar las medidas pertinentes para mitigarlos. A continuación se ha extraído la información destacada de dicha Directiva:

- Artículo 1: objeto y ámbito de aplicación. Esta Directiva establece las disposiciones mínimas para la protección de la seguridad y la salud de los trabajadores que pudieran verse expuestos a riesgos derivados de atmósferas explosivas según se definen en el artículo 2.
- Artículo 2: definición. A los efectos de la presente Directiva, se entenderá por “atmósfera explosiva” la mezcla con el aire, en condiciones atmosféricas, de sustancias inflamables en forma de gases, vapores, nieblas o polvos, en la que, tras una ignición, la combustión se propaga a la totalidad de la mezcla no quemada.
- Artículo 3: prevención de explosiones y protección contra las mismas. Con objeto de prevenir las explosiones y de proporcionar una protección contra las mismas, el empresario deberá tomar medidas de carácter técnico y/u organizativo en función del tipo de actividad, siguiendo un orden de prioridades y conforme a los principios básicos siguientes:
  - impedir la formación de atmósferas explosivas, o, cuando la naturaleza de la actividad no lo permita,
  - evitar la ignición de atmósferas explosivas, y
  - atenuar los efectos perjudiciales de una explosión de forma que se garantice la salud y la seguridad de los trabajadores.

Estas medidas se combinarán o completarán, cuando sea necesario, con medidas contra la propagación de las explosiones. Se revisarán

periódicamente y, en cualquier caso, siempre que se produzcan cambios significativos.

- Artículo 4: evaluación de los riesgos de explosión. El empresario evaluará los riesgos específicos derivados de las atmósferas explosivas, teniendo en cuenta, al menos:
  - la probabilidad de formación y la duración de atmósferas explosivas,
  - la probabilidad de la presencia y activación de focos de ignición, incluidas las descargas electrostáticas,
  - las instalaciones, las sustancias empleadas, los procesos industriales y sus posibles interacciones,
  - las proporciones de los efectos previsibles.

Los riesgos de explosión se evaluarán globalmente.

En la evaluación de los riesgos de explosión se tendrán en cuenta los lugares que estén o puedan estar en contacto, mediante aperturas, con lugares en los que puedan crearse atmósferas explosivas.

- Artículo 5: obligaciones generales. Con objeto de preservar la seguridad y la salud de los trabajadores, y en aplicación de los principios básicos de evaluación de riesgos y de los principios establecidos en el artículo 3, el empresario tomará las medidas necesarias para que:
  - en los lugares en los que puedan formarse atmósferas explosivas en cantidades tales que puedan poner en peligro la salud y la seguridad de los trabajadores o de otras personas, el entorno de trabajo sea tal que el trabajo pueda efectuarse de manera segura,
  - en los entornos de trabajo en los que puedan formarse atmósferas explosivas en cantidades tales que puedan poner en peligro la salud y la seguridad de los trabajadores, se asegure una supervisión adecuada de los trabajadores con arreglo a la evaluación de riesgos mediante el uso de los medios técnicos apropiados.



- Artículo 6: obligación de coordinación. Cuando en un mismo lugar de trabajo se encuentren trabajadores de varias empresas, cada empresario será responsable de todos los asuntos que se encuentren bajo su control.  
  
Sin perjuicio de la responsabilidad individual de cada empresario prevista en la Directiva 89/391/CEE, el empresario que, con arreglo a la legislación o las prácticas nacionales, tenga la responsabilidad de ese lugar de trabajo, coordinará la aplicación de todas las medidas relativas a la seguridad y la salud de los trabajadores y precisará, en el documento de protección contra explosiones a que se refiere el artículo 8, el objeto, las medidas y las modalidades de aplicación de dicha coordinación.
- Artículo 7: áreas en las que pueden formarse atmósferas explosivas.
  - El empresario deberá clasificar en zonas, con arreglo al anexo I, las áreas en las que pueden formarse atmósferas explosivas.
  - El empresario deberá garantizar, en las áreas a que se refiere el apartado 1, la aplicación de las disposiciones mínimas establecidas en el anexo II.
  - En caso necesario, los accesos a las áreas en las que puedan formarse atmósferas explosivas en cantidades tales que supongan un peligro para la salud y la seguridad de los trabajadores deberán señalizarse con arreglo a lo dispuesto en el anexo III.
- Artículo 8: documento de protección contra explosiones (DPCE). En cumplimiento de las obligaciones establecidas en el artículo 4, el empresario se encargará de que se elabore y mantenga actualizado un documento, denominado en adelante «documento de protección contra explosiones». Dicho documento de protección contra explosiones deberá reflejar, en concreto:
  - que se han determinado y evaluado los riesgos de explosión,
  - que se tomarán las medidas adecuadas para lograr los objetivos de la presente Directiva,
  - las áreas que han sido clasificadas en zonas de conformidad con el anexo I,

- las áreas en que se aplicarán los requisitos mínimos establecidos en el anexo II,
- que el lugar y los equipos de trabajo, incluidos los sistemas de alerta, están diseñados y se utilizan y mantienen teniendo debidamente en cuenta la seguridad,
- que se han adoptado las medidas necesarias, con arreglo a la Directiva 89/655/CEE del Consejo (1), para que los equipos de trabajo se utilicen en condiciones seguras.

El documento de protección contra explosiones se elaborará antes de que comience el trabajo y se revisará siempre que se efectúen modificaciones, ampliaciones o transformaciones importantes en el lugar de trabajo, en los equipos de trabajo o en la organización del trabajo.

El empresario podrá combinar evaluaciones sobre riesgos de explosión ya existentes, documentos, u otros informes equivalentes elaborados en virtud de otros actos comunitarios.

Los aspectos mínimos que debe disponer el DPCE se enumeran a continuación:

- Que se han determinado y evaluado los riesgos de explosión.
- Que se tomarán las medidas adecuadas para lograr los objetivos del real Decreto 681/2003.
- Las áreas que han sido clasificadas en zonas, de conformidad con el anexo I del Real Decreto 681/2003.
- Las áreas en que se aplicarán los requisitos establecidos en el anexo II del Real Decreto 681/2003.
- Que el lugar y los equipos de trabajo, incluidos los sistemas de alerta, están diseñados y se utilizan y mantienen teniendo debidamente en cuenta la seguridad.
- Que se han adoptado las medidas necesarias para que los equipos de trabajo se utilicen en condiciones seguras.

El contenido de los anexos de esta Directiva se ha desarrollado en otras secciones de este TFM, para darles un contexto y que sus requisitos sean más fácilmente comprensibles.

#### 0.1.1.2 DIRECTIVA 2014/34/EU

La Directiva 2014/34/EU trata la armonización de las legislaciones de los Estados miembros en materia de aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas.

Esta Directiva regula el diseño, fabricación, comercialización, puesta en servicio y uso de los aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas, estableciendo los requisitos y procedimientos a seguir para la certificación de aparatos y sistemas de protección para uso en atmósferas explosivas.

Al igual que la Directiva 1999/92/EC, esta Directiva ha sido transpuesta a la legislación española por medio del Real Decreto 144/2016, de 8 de abril, y cuyo objeto es el establecimiento de los requisitos esenciales de salud y seguridad exigibles a los productos que constituyan una novedad en el mercado de la Unión Europea en el momento de introducirse en el mismo para su comercialización, con el fin de garantizar un elevado nivel de protección de la salud y la seguridad de las personas, así como de protección de los animales domésticos y de los bienes.

La Directiva 2014/34/EU se aplica a:

- aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas.
- dispositivos de seguridad, control y reglaje destinados a utilizarse fuera de atmósferas potencialmente explosivas pero que son necesarios o que contribuyen al funcionamiento seguro de los aparatos y sistemas de protección en relación con los riesgos de explosión.
- Los componentes destinados a ser incorporados en los aparatos y sistemas de protección mencionados en el primer punto.

El artículo 13 de la Directiva 2014/34/UE describe los procedimientos a seguir para la evaluación de la conformidad de los aparatos y sistemas de protección

para uso en atmósferas explosivas. A continuación, se enumeran los procedimientos aplicables a aparatos:

- a) para los grupos de aparatos I y II, categorías de aparatos M 1 y 1, el procedimiento de examen UE de tipo establecido en el anexo III, en combinación con uno de los siguientes:
  - conformidad con el tipo basada en el aseguramiento de la calidad del proceso de producción establecido en el anexo IV,
  - conformidad con el tipo basada en la verificación del producto, establecida en el anexo V;
- b) para los grupos de aparatos I y II, categorías de aparatos M 2 y 2:
  - i) para los motores de combustión interna y para los aparatos eléctricos de dichos grupos y categorías, el examen UE de tipo establecido en el anexo III, en combinación con uno de los siguientes procedimientos:
    - conformidad con el tipo basada en el control interno de la producción más ensayo supervisado de los productos establecida en el anexo VI,
    - conformidad con el tipo basada en el aseguramiento de la calidad del producto establecida en el anexo VII,
  - ii) para los demás aparatos de dichos grupos y categorías, el control interno de la producción establecido en el anexo VIII, y la comunicación de la documentación técnica prevista en el anexo VIII, punto 2, a un organismo notificado, que acusará recibo de dicho expediente lo antes posible y que lo conservará;
- c) para el grupo de aparatos II, categoría de aparatos 3, el control interno de la producción establecido en el anexo VIII;
- d) para los grupos de aparatos I y II, además de los procedimientos a que se refieren las letras a), b) y c) del presente apartado, podrá seguirse también la conformidad basada en la verificación por unidad establecida en el anexo IX.

Para la evaluación de la conformidad de los sistemas de protección se usará el procedimiento establecido en los apartados a) o d).

Estos procedimientos mencionados anteriormente se aplicarán también a componentes, excepto en lo que se refiere a la fijación del marcado CE y a la elaboración de la declaración UE de conformidad.

La siguiente tabla resume la información anterior:

Zona	Categoría	Nivel de protección	Equipo eléctrico	Equipo no eléctrico
0 / 20	1	Muy alto	Certificación a través de un Organismo Notificado	Certificación a través de un Organismo Notificado
1 / 21	2	Alto	Certificación a través de un Organismo Notificado	Autocertificación por el fabricante, y depósito y custodia del expediente técnico por un Organismo Notificado
2 / 22	3	Normal	Autocertificación por el fabricante	Autocertificación por el fabricante

La certificación de los sistemas de protección siempre se llevará a cabo por un Organismo Notificado.

Para que un producto esté en conformidad con la Directiva 2014/34/UE y sea apto para uso en zonas con atmósferas explosivas deberá cumplir los requisitos esenciales de salud y seguridad establecidos en el anexo II de la Directiva 2014/34/UE – REQUISITOS ESENCIALES DE SALUD Y SEGURIDAD RELATIVOS AL DISEÑO Y FABRICACIÓN DE APARATOS Y SISTEMAS DE PROTECCIÓN PARA USO EN ATMÓSFERAS POTENCIALMENTE EXPLOSIVAS:

- 1 Requisitos comunes relativos a los aparatos y a los sistemas de protección
  - 1.0 Requisitos generales

#### 1.0.1 Principios de integración de la seguridad frente a las explosiones

Los aparatos y sistemas de protección previstos para uso en atmósfera potencialmente explosiva deben estar diseñados con miras a la integración de la seguridad frente a las explosiones.

En este sentido, el constructor tomará medidas para:

- evitar ante todo, si es posible, que los aparatos y sistemas de protección produzcan o liberen ellos mismos atmósferas explosivas,
- impedir la ignición de atmósferas explosivas teniendo en cuenta la naturaleza de cada foco de ignición eléctrico o no eléctrico,
- en caso de que, a pesar de todo, se produjese una explosión que pudiera poner en peligro a personas, y, en su caso animales domésticos o bienes por efecto directo o indirecto, detenerla inmediatamente o limitar a un nivel de seguridad suficiente la zona afectada por las llamas y la presión resultante de la explosión.

#### 1.0.2 Los aparatos y sistemas de protección deberán diseñarse y fabricarse considerando posibles anomalías de funcionamiento para evitar al máximo situaciones peligrosas

Deberá tenerse en cuenta la posibilidad de una incorrecta utilización, razonablemente previsible.

#### 1.0.3 Condiciones especiales de control y mantenimiento


Los aparatos y sistemas de protección que estén sujetos a condiciones especiales de control y mantenimiento deberán diseñarse y fabricarse con arreglo a dichas condiciones.

#### 1.0.4 Condiciones del entorno del circundante

Los aparatos y sistemas de protección deberán diseñarse y fabricarse con arreglo a las condiciones del entorno circundante existentes o previsibles.

#### 1.0.5 Marcado

Cada aparato y sistema de protección deberá presentar, como mínimo, de forma indeleble y legible, las siguientes indicaciones:

- el nombre, el nombre comercial registrado o la marca registrada y la dirección del fabricante,
- el marcado CE (véase el anexo II del Reglamento (CE) no 765/2008),
- la designación de la serie o del tipo,
- el número de lote o de serie, si es que existe,
- el año de fabricación,
- el marcado específico de protección contra las explosiones  seguido del símbolo del grupo de aparatos y de la categoría,
- para el grupo de aparatos II, la letra «G» (referente a atmósferas explosivas debidas a gases, vapores o nieblas),

y/o

- la letra «D» referente a atmósferas explosivas debidas a la presencia de polvo.

Por otra parte, y siempre que se considere necesario, deberán asimismo presentar cualquier indicación que resulte indispensable para una segura utilización del aparato.

#### 1.0.6 Instrucciones

a) Cada aparato y sistema de protección deberá ir acompañado de instrucciones que contengan, como mínimo, las siguientes indicaciones:

- el recordatorio de las indicaciones previstas para el marcado, a excepción del número de lote o de serie (véase punto 1.0.5), que se completará eventualmente con aquellas indicaciones que faciliten el mantenimiento (como, por ejemplo, la dirección del reparador, etc.),
- instrucciones que permitan proceder sin riesgos:
  - a la puesta en servicio,
  - a la utilización,

- al montaje y desmontaje,
- al mantenimiento (reparación incluida),
- a la instalación,
- al ajuste,
- en su caso, la indicación de las zonas peligrosas situadas frente a los dispositivos de descarga de presión,
- en su caso, las instrucciones de formación,
- las indicaciones necesarias para determinar con conocimiento de causa si un aparato de una categoría indicada o un sistema de protección puede utilizarse sin peligro en el lugar y en las condiciones que se hayan previsto,
- los parámetros eléctricos y de presión, las temperaturas máximas de superficie u otros valores límite,
- en su caso, las condiciones especiales de utilización, comprendidas las indicaciones respecto a un posible mal uso del aparato que sea previsible según muestre la experiencia,
- en su caso, las características básicas de los instrumentos que pudieran montarse sobre el aparato o el sistema de protección.

b) Las instrucciones incluirán los planos y esquemas necesarios para la puesta en servicio, mantenimiento, inspección, comprobación del funcionamiento correcto y, en su caso, reparación del aparato o del sistema de protección, así como todas aquellas instrucciones que resulten útiles, especialmente en materia de seguridad.

c) Toda documentación de descripción del aparato o del sistema de protección deberá coincidir con las instrucciones en lo que se refiere a los aspectos de seguridad.

## 1.1 Selección de los materiales

1.1.1 Los materiales utilizados para la construcción de los aparatos y sistemas de protección no deberán provocar el desencadenamiento de una explosión, teniendo en cuenta las condiciones de funcionamiento previsibles.



- 1.1.2 Dentro del límite de las condiciones de utilización previstas por el fabricante, no deberán producirse, entre los materiales que se empleen y los constituyentes de la atmósfera potencialmente explosiva, reacciones que puedan dar lugar a una disminución de la protección contra explosiones.
- 1.1.3 Los materiales deberán elegirse teniendo en cuenta que los cambios previsibles de sus características y de la combinación compatible con otros materiales no conduzcan a una disminución de la protección; en particular por lo que respecta a la resistencia a la corrosión, la resistencia al desgaste, la conductividad eléctrica, la resistencia a los choques, el envejecimiento y los efectos de las variaciones de temperatura.
- 1.2 Diseño y fabricación
  - 1.2.1 Los aparatos y sistemas de protección deberán diseñarse y fabricarse teniendo en cuenta los conocimientos tecnológicos en materia de protección frente a las explosiones, a fin de que puedan funcionar de manera segura durante su duración previsible.
  - 1.2.2 Los componentes de montaje o de recambio previstos para los aparatos y sistemas de protección deberán estar diseñados y fabricados de manera que tengan una seguridad de funcionamiento adecuada a la utilización para la que están destinados por lo que se refiere a la protección contra las explosiones, siempre que se monten de acuerdo con las instrucciones del fabricante.
  - 1.2.3 Modo de construcción cerrada y prevención de defectos de estanqueidad

Los aparatos que puedan originar gases o polvos inflamables solo tendrán, en la medida de lo posible, cavidades cerradas.

De tener aberturas o defectos de estanqueidad, estas deberán ser, en la medida de lo posible, tales que las emisiones de gas o de polvo no puedan producir atmósferas explosivas en el exterior.

Los orificios de llenado y vaciado deberán diseñarse y equiparse de tal forma que se limite, en la medida de lo posible, la emisión de materias inflamables durante estas operaciones.

#### 1.2.4 Formación de polvo

Los aparatos y sistemas de protección destinados a ser utilizados en zonas donde exista polvo deberán diseñarse de tal forma que los depósitos de polvo que se formen en su superficie no lleguen a inflamarse.

Por regla general, la formación de polvo deberá limitarse todo lo posible. Los aparatos y sistemas de protección deberán poder limpiarse fácilmente.

Las temperaturas de superficie de las piezas de los aparatos deberán ser marcadamente inferiores a las temperaturas de incandescencia del polvo depositado.

Deberá tenerse en cuenta el espesor de la capa de polvo depositado y, en su caso, adoptar medidas para limitar las temperaturas y evitar que se acumule el calor.

#### 1.2.5 Medios de protección complementarios

Los aparatos y sistemas de protección que puedan estar expuestos a todo tipo de tensiones exteriores deberán ir provistos, si es necesario, de medios complementarios de protección.

Los aparatos deberán poder resistir las tensiones en las que trabajen sin que ello afecte a la protección contra las explosiones.

#### 1.2.6 Apertura sin peligro

Cuando los aparatos y sistemas de protección estén alojados en una caja o un contenedor cerrado que forme parte de la propia protección contra las explosiones no deberán poder abrirse más que con ayuda de una herramienta especial o mediante medidas de protección adecuadas.

#### 1.2.7 Protección contra otros peligros

Los aparatos y sistemas de protección deberán diseñarse y fabricarse de manera que:

- a) se eviten los peligros de heridas u otros daños que puedan producirse por contactos directos o indirectos;
- b) no se produzcan temperaturas de superficie de partes accesibles o de radiaciones que provocarían un peligro;
- c) se eliminen los peligros de naturaleza no eléctrica y revelados por la experiencia;
- d) condiciones de sobrecarga previstas no lleven a una situación peligrosa.

Cuando, para los aparatos y sistemas de protección, los riesgos a los que se refiere el presente punto estén cubiertos, total o parcialmente, por otra normativa de la Unión, no se aplicará la presente Directiva o dejará de aplicarse para dichos aparatos y sistemas de protección y para dichos riesgos a partir de la puesta en aplicación de dicha normativa específica de la Unión.

#### 1.2.8 Sobrecarga de los aparatos

Desde el momento en que se diseñan, deberán evitarse las sobrecargas peligrosas de los aparatos mediante dispositivos integrados de medición, regulación y control, concretamente mediante limitadores de sobreintensidad, limitadores de temperatura, interruptores de presión diferencial, indicadores volumétricos, relés de tiempo, cuentarrevoluciones y/o dispositivos similares de vigilancia.

#### 1.2.9 Sistemas de envoltura antideflagrante

Si las piezas que pueden inflamar una atmósfera explosiva están encerradas en una envoltura, deberá garantizarse que esta resista a la presión generada por una explosión interna de una mezcla explosiva y que impida la transmisión de la explosión a la atmósfera explosiva en torno a la envoltura.

#### 1.3 Focos potenciales de ignición

#### 1.3.1 Peligros derivados de diversos focos de ignición

No deberán producirse focos potenciales de ignición como chispas, llamas, arcos eléctricos, temperaturas de superficie elevadas, emisiones de energía acústica, radiaciones de tipo óptico, ondas electromagnéticas u otros focos del mismo tipo.

#### 1.3.2 Peligros originados por la electricidad estática

Deberán evitarse, por medio de medidas adecuadas, las cargas electrostáticas susceptibles de provocar descargas peligrosas.

#### 1.3.3 Peligros derivados de las corrientes eléctricas parásitas y de fuga

Se impedirá que se produzcan, en las partes conductoras del aparato, corrientes eléctricas parásitas o de fuga que den lugar, por ejemplo, a corrosiones peligrosas, al calentamiento excesivo de las superficies o a la formación de chispas capaces de provocar una ignición.

#### 1.3.4 Peligros derivados de un calentamiento excesivo

El diseño deberá ser tal que se evite, en la medida de lo posible, un recalentamiento excesivo debido al frotamiento o al choque que pueda producirse, por ejemplo, entre materiales situados en piezas giratorias o al introducirse cuerpos extraños.

#### 1.3.5 Peligros derivados del equilibrado de presiones

Desde el momento del diseño, por medio de dispositivos integrados de medición, de control o de regulación, deberá realizarse el equilibrado de presiones de forma que no desencadenen ondas de choque o compresiones que puedan provocar una ignición.

#### 1.4 Peligros debidos a influencias perturbadoras externas

##### 1.4.1 Los aparatos y sistemas de protección deberán diseñarse y fabricarse de tal manera que puedan cumplir con total seguridad la función para la que están previstos, incluso en presencia de condiciones ambientales cambiantes, tensiones parásitas, humedad, vibraciones, contaminación u otras influencias

perturbadoras externas, teniendo en cuenta los límites de las condiciones de explotación establecidas por el fabricante.

1.4.2 Las piezas de los aparatos deberán adecuarse a los esfuerzos mecánicos y técnicos previstos y resistir a la acción agresiva de las sustancias presentes o previsibles.

1.5 Requisitos para el equipo que contribuya a la seguridad

1.5.1 Los dispositivos de seguridad deberán funcionar independientemente de los de medición y/o control necesarios para el funcionamiento. En la medida de lo posible, deberá detectarse a través de medios técnicos adecuados, cualquier fallo de un dispositivo de seguridad, con la suficiente rapidez como para que haya una probabilidad mínima de aparición de una situación peligrosa.

Por norma general, deberá aplicarse el principio de seguridad positiva (seguridad en caso de fallo). Por norma general, los mandos relacionados con la seguridad deberán actuar directamente sobre los órganos de control correspondientes sin software intermedio.

1.5.2 En caso de fallo de los dispositivos de seguridad, los aparatos o sistemas de protección deberán ponerse, en la medida de lo posible, en posición de seguridad.

1.5.3 Los mandos de parada de emergencia de los dispositivos de seguridad deberán poseer, en la medida de lo posible, un sistema de bloqueo contra la reanudación del funcionamiento. Toda nueva orden de puesta en marcha solo podrá tener efecto sobre el funcionamiento normal si, previamente, ha vuelto a reconfigurarse de forma intencional el sistema de bloqueo de la reanudación del funcionamiento.

1.5.4 Dispositivos de mando y de representación visual

Si se utilizan dispositivos de mando y de representación visual, deberán diseñarse según principios ergonómicos para que

proporcionen un máximo de seguridad de utilización por lo que respecta a los riesgos de explosión.

1.5.5 Requisitos aplicables a los dispositivos destinados a la protección contra las explosiones que tengan una función de medición

Los dispositivos que tengan una función de medición, en la medida en que se empleen con aparatos utilizados en atmósferas potencialmente explosivas, deberán diseñarse y fabricarse conforme a los requisitos previsibles de funcionamiento y las condiciones especiales de utilización.

1.5.6 En caso de necesidad, deberá poder controlarse la precisión de lectura y la capacidad de funcionamiento de los dispositivos que tengan una función de medición.

1.5.7 El diseño de los dispositivos que tengan una función de medición deberá tener en cuenta un coeficiente de seguridad que garantice que el umbral de alarma se encuentra suficientemente alejado de los límites de explosividad y/o de inflamación de la atmósfera que se analice, habida cuenta, en particular, de las condiciones de funcionamiento de la instalación y de las posibles desviaciones del sistema de medición.

1.5.8 Riesgos derivados del software

En el diseño de aparatos, sistemas de protección y dispositivos de seguridad controlados mediante equipo lógico, deberán tenerse muy en cuenta los riesgos derivados de fallos en el programa.

1.6 Integración de requisitos de seguridad relacionadas con el sistema

1.6.1 Cuando los aparatos y sistemas de protección incluidos en procesos automáticos se aparten de las condiciones de funcionamiento previstas, deberán poder desconectarse de forma manual, siempre que ello no sea contrario a las buenas condiciones de seguridad.

1.6.2 La energía almacenada deberá disiparse de la manera más rápida y segura posible cuando se accionen los dispositivos de

desconexión de emergencia, de manera que deje de constituir un peligro.

Lo anterior no se aplica a la energía almacenada por vía electroquímica.

#### 1.6.3 Peligros derivados de un corte de energía

Los aparatos y sistemas de protección en los que un corte de energía pueda llevar consigo la propagación de nuevos peligros deberán poder mantenerse en situación de funcionamiento seguro, independientemente del resto de la instalación.

#### 1.6.4 Peligros derivados de un corte de energía

Los aparatos y sistemas de protección deberán estar equipados con entradas de cables y de conductos adecuadas.

Cuando los aparatos y sistemas de protección estén destinados a utilizarse en combinación con otros aparatos y sistemas de protección, las interfaces deberán ser seguras.

#### 1.6.5 Colocación de dispositivos de alarma que formen parte del aparato

Cuando un aparato o sistema de protección tenga dispositivos de detección o alarma destinados a controlar la formación de atmósferas explosivas, deberán proveerse las indicaciones necesarias para poder colocar dichos dispositivos en los lugares adecuados.

### 2 Requisitos suplementarios para los aparatos

#### 2.0 Requisitos aplicables a los aparatos de la categoría del grupo I

##### 2.0.1 Requisitos aplicables a la categoría M 1 de aparatos del grupo I

##### 2.0.1.1 Los aparatos deberán diseñarse y fabricarse de tal forma que los focos de ignición no se activen ni siquiera en caso de avería infrecuente.

Estarán provistos de medios de protección de forma que:

- en caso de fallo de uno de los medios de protección, al menos un segundo medio independiente asegure el nivel de protección requerido,
- en caso de que se produzcan dos fallos independientes el uno del otro, esté asegurado el nivel de protección requerido.

Si fuese necesario, los aparatos estarán provistos de medios especiales de protección complementarios. Deberán seguir siendo operativos en presencia de atmósferas explosivas.

2.0.1.2 Siempre que sea necesario, los aparatos deberán fabricarse de manera que no pueda entrar polvo en su interior.

2.0.1.3 Para evitar la ignición del polvo en suspensión, las temperaturas de superficie de las piezas de los aparatos deberán ser netamente inferiores a la temperatura de ignición de la mezcla polvo-aire previsible.

2.0.1.4 Los aparatos deberán diseñarse de tal manera que solo sea posible abrir aquellas partes de los mismos que puedan constituir focos de ignición, en ausencia de energía o en condiciones de seguridad intrínseca. Cuando no sea posible desactivar los aparatos, el fabricante deberá colocar una etiqueta de advertencia sobre la abertura de dichas partes de los aparatos.

Si fuere necesario, estarán provistos de mecanismos adecuados de bloqueo adicionales.

2.0.2 Requisitos aplicables a la categoría M 2 de aparatos del grupo I

2.0.2.1 Los aparatos estarán provistos de medidas de protección de manera que los focos de ignición no puedan activarse durante el funcionamiento normal incluso en condiciones rigurosas de explotación en particular las resultantes de una intensa utilización del aparato y de condiciones ambientales variables. En caso de atmósferas explosivas deberá poderse cortar la alimentación energética de los aparatos.



2.0.2.2 Los aparatos deberán diseñarse de tal manera que solo sea posible abrir aquellas partes de los mismos que puedan constituir focos de ignición en ausencia de energía o mediante mecanismos de bloqueo adecuados. Cuando no sea posible desactivar los aparatos, el fabricante deberá colocar una etiqueta de advertencia sobre la abertura de dichas partes de los aparatos.

2.0.2.3 En lo que se refiere a las medidas de protección contra las explosiones debidas a la presencia de polvo, deberán respetarse los requisitos correspondientes de la categoría M 1 de aparatos.

2.1 Requisitos aplicables a la categoría 1 de aparatos del grupo II

2.1.1 Atmósferas explosivas debidas a la presencia de gases, vapores o nieblas

2.1.1.1 Los aparatos deberán diseñarse y fabricarse de manera que eviten la activación de los focos de ignición, incluidos los resultantes de una avería infrecuente del aparato.

Estarán provistos de medios de protección de forma que:

- en caso de fallo de uno de los medios de protección, al menos un segundo medio independiente asegure el nivel de protección requerido,
- en caso de que se produzcan dos fallos independientes el uno del otro, esté asegurado el nivel de protección requerido.

2.1.1.2 Para los aparatos cuyas superficies puedan recalentarse, deberá garantizarse que, en el peor de los casos, no se supere la temperatura máxima de superficie indicada.

Se tendrá también en cuenta la elevación de temperatura resultante de la acumulación de calor y de reacciones químicas.

2.1.1.3 Los aparatos deberán diseñarse de tal manera que la apertura de las diferentes partes de los mismos que puedan constituir focos de ignición, solo sea posible en ausencia de energía o en condiciones de seguridad intrínseca. Cuando no sea posible desactivar los

aparatos, el fabricante deberá colocar una etiqueta de advertencia sobre la abertura de dichas partes de los aparatos.

Si fuere necesario, estarán provistos de mecanismos adecuados de bloqueo adicionales.

#### 2.1.2 Atmósferas explosivas debidas a la presencia de mezclas polvo-aire

2.1.2.1 Los aparatos deberán diseñarse y fabricarse de manera que se evite la ignición de mezclas polvo-aire, incluso la resultante de una avería infrecuente del aparato.

Estarán provistos de medios de protección de forma que:

- en caso de fallo de uno de los medios de protección, al menos un segundo medio independiente asegure el nivel de protección requerido,
- en caso de que se produzcan dos fallos independientes el uno del otro, esté asegurado el nivel de protección requerido.

2.1.2.2 Siempre que sea necesario, los aparatos deberán fabricarse de manera que solo pueda introducirse o evacuarse el polvo por los lugares previstos a tal efecto.

Las entradas de cables y piezas de conexión también deben satisfacer este requisito

2.1.2.3 Para evitar la ignición del polvo en suspensión, las temperaturas de superficie de las diferentes partes de los aparatos deberán ser marcadamente inferiores a la temperatura de ignición de la mezcla polvo-aire previsible.

2.1.2.4 Por lo que se refiere a la apertura sin peligro de las diferentes partes de los aparatos, se aplicará el requisito del punto 2.1.1.3.

#### 2.2 Requisitos aplicables a la categoría 2 de aparatos del grupo II

2.2.1 Atmósferas explosivas debidas a la presencia de gases, vapores o nieblas

2.2.1.1 Los aparatos estarán diseñados y fabricados de tal modo que se eviten los focos de ignición, incluso en caso de averías frecuentes o fallos de funcionamiento que deban tenerse habitualmente en cuenta.

2.2.1.2 Las piezas de los aparatos deberán diseñarse y fabricarse de manera que no se superen las temperaturas de superficie establecidas, incluso en caso de que el peligro derive de situaciones anormales previstas por el fabricante. 2.2.1.3 Los aparatos deberán diseñarse de manera que la apertura de las partes de los mismos que sean susceptibles de constituir focos de ignición solo sea posible en ausencia de energía o mediante mecanismos de bloqueo adecuados. Cuando no sea posible desactivar los aparatos, el fabricante deberá colocar una etiqueta de advertencia sobre la apertura de dichas partes de los aparatos.

2.2.2 Atmósferas explosivas debidas a la presencia de mezclas polvo-aire

2.2.2.1 Los aparatos deberán diseñarse y fabricarse de manera que eviten la ignición de mezclas polvo-aire, incluso la resultante de una avería frecuente del aparato o de fallos de funcionamiento que deban tenerse habitualmente en cuenta

2.2.2.2 En lo que se refiere a las temperaturas de superficie, se aplicará el requisito del punto 2.1.2.3.

2.2.2.3 Por lo que se refiere a la protección contra el polvo, se aplicará el requisito del punto 2.1.2.2.

2.2.2.4 Por lo que se refiere a la apertura sin peligro de las piezas de los aparatos, se aplicará el requisito del punto 2.2.1.3.

2.3 Requisitos aplicables a la categoría 3 de aparatos del grupo II

2.3.1 Atmósferas explosivas debidas a la presencia de gases, vapores o nieblas

2.3.1.1 Los aparatos deberán diseñarse y fabricarse de manera que se eviten los focos de ignición previsible en caso de funcionamiento normal.

2.3.1.2 Las temperaturas de superficie que aparezcan no deberán superar, en las condiciones de funcionamiento previstas, las temperaturas máximas de superficie establecidas. Solo será tolerable superar dichas temperaturas, de manera excepcional, cuando el fabricante adopte medidas complementarias de protección especiales.

2.3.2 Atmósferas explosivas debidas a la presencia de mezclas polvo-aire

2.3.2.1 Los aparatos deberán diseñarse y fabricarse de tal manera que los focos de ignición previsible en caso de funcionamiento normal no supongan un peligro de inflamación de las mezclas polvo-aire.

2.3.2.2 En lo que se refiere a las temperaturas de superficie, se aplicará el requisito del punto 2.1.2.3.

2.3.2.3 Los aparatos, incluidas las entradas de cables y las piezas de conexión previstas, deberán fabricarse teniendo presente el tamaño de las partículas de polvo, a fin de impedir la formación de mezclas polvo-aire potencialmente explosivas y la acumulación peligrosa de polvo en el interior.

3 Requisitos suplementarios para los sistemas de protección

3.0 Requisitos generales

3.0.1 Los sistemas de protección deberán tener unas dimensiones tales que reduzcan los efectos de las explosiones a un nivel de seguridad suficiente.

3.0.2 Los sistemas de protección deberán diseñarse y poder colocarse de forma que impidan que las explosiones se transmitan mediante reacciones peligrosas en cadena o por chorros de llamas, y que las explosiones incipientes se conviertan en detonaciones.

3.0.3 En caso de interrupción de la alimentación energética, los sistemas de protección deberán mantener su capacidad de funcionamiento durante un período adecuado para evitar situaciones peligrosas.

3.0.4 Los sistemas de protección no deberán tener fallos de funcionamiento debido a influencias perturbadoras externas.

### 3.1 Estudios y diseño

#### 3.1.1 Características de los materiales

La presión y la temperatura máximas que deben tenerse en cuenta para estudiar la resistencia de los materiales serán la presión previsible durante una explosión que sobrevenga en condiciones de utilización extremas y el efecto de calentamiento previsible debido a las llamas.

3.1.2 En caso de explosión, los sistemas de protección diseñados para resistir o contener las explosiones deberán resistir la onda de choque sin que se pierda la integridad del sistema.

3.1.3 Los accesorios conectados a los sistemas de protección deberán resistir la presión de explosión máxima prevista sin perder su capacidad de funcionamiento.

3.1.4 En el estudio y diseño de los sistemas de protección, se tendrán en cuenta las reacciones causadas por la presión en el equipo periférico y en las tuberías conectadas a este.

#### 3.1.5 Dispositivos de descarga

Cuando sea previsible que los sistemas de protección utilizados estén expuestos a situaciones en las que se sobrepase su resistencia, deberán preverse, en el momento del diseño, dispositivos de descarga adecuados, que no supongan peligro para el personal situado en las proximidades.

#### 3.1.6 Sistemas de supresión de explosiones

Los sistemas de supresión de explosiones deberán estudiarse y diseñarse de tal manera que, en caso de incidente, controlen lo

antes posible la explosión incipiente y se opongan a esta de la manera más adecuada, teniendo en cuenta el aumento máximo de presión y la presión máxima de la misma.

#### 3.1.7 Sistemas de desconexión

Los sistemas de desconexión previstos para aislar determinados aparatos en caso de explosión incipiente, con ayuda de dispositivos apropiados y en un lapso de tiempo lo más corto posible, deberán estudiarse y diseñarse de tal manera que permanezcan estancos a la transmisión de la llama interior y conserven su resistencia mecánica en las condiciones de servicio.

3.1.8 Los sistemas de protección deberán poder integrarse en los circuitos con un umbral de alarma adecuado a fin de que, si es necesario, haya una interrupción de la llegada y evacuación de productos así como una desconexión de las partes de los aparatos que no presenten garantías de poder funcionar de forma segura.

Como puede verse, los requisitos esenciales de salud y seguridad establecidos en el anexo II de la Directiva 2014/34/UE están redactados de forma muy genérica, sin proporcionar demasiada información sobre los requisitos que debe cumplir un producto para estar en conformidad con ellos. Esto hace que sea difícil demostrar la conformidad de un producto.

Por este motivo se usan normas, como por ejemplo las de la serie 60079 para equipos eléctricos, para ayudar en la tarea de demostrar conformidad con los requisitos esenciales de salud y seguridad. Si tras la aplicación de las normas quedase algún requisito para el cual no se ha demostrado la conformidad del producto, se justificará su conformidad por separado de las normas, aunque cabe destacar que en la mayoría de los casos en los que alguno de los requisitos se queda sin evaluar por las normas es debido a que dicho requisito no es aplicable al producto que está siendo evaluado.

Las normativas aceptadas para demostrar conformidad con los requisitos esenciales de salud y seguridad establecidos en el anexo II de la Directiva 2014/34/UE están publicados en el Diario Oficial de la Unión Europea, en el anexo II de la DECISIÓN DE EJECUCIÓN (UE) 2022/1668 DE LA COMISIÓN

de 28 de septiembre de 2022 sobre las normas armonizadas para los aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas, elaboradas en apoyo de la Directiva 2014/34/UE del Parlamento Europeo y del Consejo. Dichas normas se conocen como normas armonizadas y otorgan presunción de conformidad con los requisitos esenciales de salud y seguridad de la Directiva. A continuación se muestra como ejemplo un breve extracto de estas normas:

L 251/14		ES	Diario Oficial de la Unión Europea	29.9.2022
N.º	Referencia de la norma			
70.	EN 60079-1:2014 Atmósferas explosivas. Parte 1: Protección del equipo por envolventes antideflagrantes «d». (IEC 60079-1:2014).			
71.	EN 60079-2:2014 Atmósferas explosivas. Parte 2: Equipos de protección por envolventes presurizadas «p». (IEC 60079-2:2014). EN 60079-2:2014/AC:2015			
72.	EN 60079-5:2015 Atmósferas explosivas. Parte 5: Protección de equipos por relleno pulverulento «q». (IEC 60079-5:2015).			
73.	EN 60079-6:2015 Atmósferas explosivas. Parte 6: Protección del equipo por inmersión líquida «o». (IEC 60079-6:2015).			
74.	EN 60079-7:2015 Atmósferas explosivas. Parte 7: Protección del equipo por seguridad aumentada «e». (IEC 60079-7:2015). EN IEC 60079-7:2015/A1:2018			

Para más información sobre la Directiva 2014/34/UE y las normas armonizadas diríjense a la sección 1.

## **0.2 AUTOCERTIFICACIÓN ATEX DE UN PANEL DE INTERFAZ COMO EQUIPO DE CATEGORÍA 3**

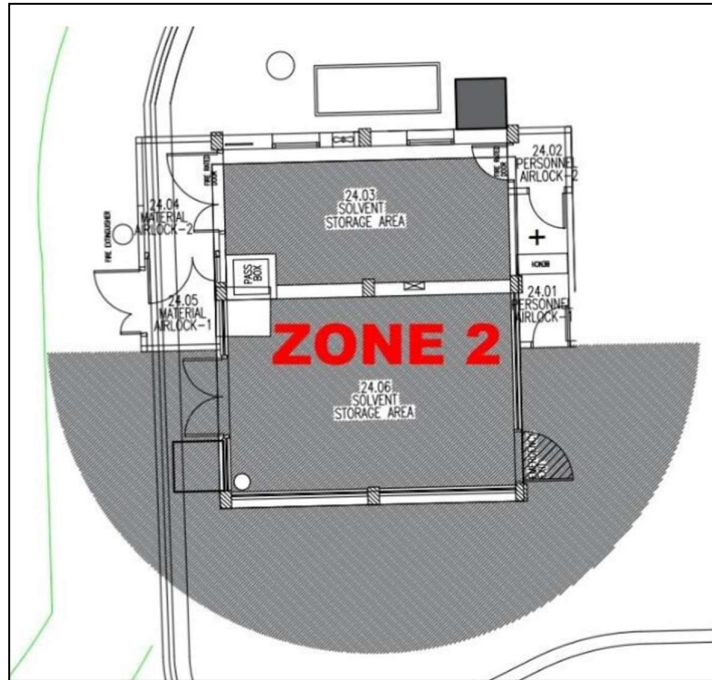
### **0.2.1 PLANTEAMIENTO**

Un empresario ha diseñado la disposición de su planta teniendo en consideración el hecho de que pueden formarse atmósferas explosivas.

Durante este proceso de diseño de la planta, como es requerido por la Directiva 1999/92/CE, el empresario ha elaborado un documento de protección contra explosiones (DPCE). Para la elaboración de este documento el empresario, que carece de los conocimientos necesarios relacionados con atmósferas explosivas ATEX, ha utilizado los servicios de una consultora que cuenta con personal cualificado (técnicos superiores en Prevención de Riesgos Laborales según requisito del RD 681/2003) y certificado (IsmATEX Nivel 3 por un Organismo Notificado).

El empresario ha tomado todas las medidas al alcance de su mano para impedir la formación de atmósferas explosivas, pero tras finalizar el diseño de la planta, el DPCE ha identificado que todavía existe un área en la que puede formarse una atmósfera explosiva. Tras analizar esta área se determina que es un área de trabajo en la que no es probable, en condiciones normales de explotación, la formación de una atmósfera explosiva consistente en una mezcla con aire de sustancias inflamables en forma de gas, vapor o niebla o en la que, en caso de formarse, dicha atmósfera explosiva solo permanece durante breves períodos de tiempo (<10 horas al año de atmósfera explosiva), y se clasifica como una Zona 2:





En esta Zona 2 se van a instalar un pulsador de alarma, varias luces, un altavoz y un panel de control. El pulsador de alarma, las luces y el altavoz son aparatos que pueden encontrarse con facilidad en el mercado ya con certificado ATEX, al ser productos estándar. Se muestra como ejemplo:



Sin embargo, el panel de control debe cumplir unos requisitos específicos para el funcionamiento de la planta y por sus características no se encuentra

disponible en el mercado. Por este motivo el empresario tiene que ponerse en contacto con fabricantes de paneles de control para que le hagan este panel de control a medida de las necesidades de su planta.

El empresario elige un fabricante con experiencia demostrada en la fabricación de aparatos ATEX para la fabricación del panel de control. El empresario acuerda con el fabricante que el panel de interfaz estará formado por una caja de acero inoxidable, con medidas aproximadas de 800 mm x 600 mm x 300 mm y que proporcione 18 entradas para pasacables de tamaño M20 en la cara inferior. El panel de control deberá incorporar las siguientes piezas:

- 2 fuentes de alimentación capaces de transformar 110Vac a 24Vdc.
- 1 módulo de redundancia para desacoplar las dos fuentes de alimentación y garantizar una alta disponibilidad y productividad.
- 1 conmutador de red con 14 puertos.
- 2 paneles de conexión de fibra óptica con un mínimo de 12 puertos y conector tipo LC.
- 3 bornes portafusibles.
- Bornes, bornes de tierra, tapas finales según sea necesario.
- Ángulos de fijación, señalizadores, raíl DIN, canales de cables según sea necesario.

El panel de interfaz deberá ser compatible con gases del grupo IIB, tendrá una clase de temperatura T3 o mejor (T4, T5 o T6) y su uso será posible en un rango de temperatura ambiente de  $T_a = -20^{\circ}\text{C}$  a  $+45^{\circ}\text{C}$ .

Equipos instalados en un área clasificada como Zona 2 deben ser como mínimo de categoría 3 ATEX. Esto quiere decir que el panel de interfaz puede ser categoría 1, 2 o 3.

Como hemos visto en el capítulo anterior, el artículo 13 de la Directiva 2014/34/UE nos indica los procedimientos a seguir para evaluar la conformidad de los aparatos para uso en atmósferas explosivas. En el caso de aparatos eléctricos de categoría 3 del grupo de aparatos II, el procedimiento a seguir es el control interno de la producción establecido en el anexo VIII de la Directiva.

El control interno de la producción es el procedimiento de evaluación de la conformidad mediante el cual el fabricante cumple las obligaciones establecidas


en el anexo VIII con respecto a la documentación técnica, a la fabricación del producto y al marcado CE y declaración UE de conformidad. Al utilizar el anexo VIII para la conformidad del producto el fabricante garantiza y declara, bajo su exclusiva responsabilidad, que los productos en cuestión satisfacen los requisitos pertinentes. En otras palabras, el fabricante puede preparar la documentación técnica necesaria para el producto, y declarar que está en conformidad con la Directiva 2014/34/UE y las normas aplicadas, sin necesidad de acudir a un Organismo Notificado para la certificación del producto.

Con esto en mente, el fabricante acuerda con el empresario que seguirá el procedimiento del anexo VIII de la Directiva 2014/34/UE para demostrar la conformidad del panel de control con respecto a los requisitos de la directiva, elaborando el expediente técnico y declarando bajo su responsabilidad conformidad con la directiva.

Tras estudiar las características del panel de control, y con el consentimiento del empresario, el fabricante decide que la mejor manera de afrontar el diseño y evaluación de la conformidad del panel de control es usando piezas ya certificadas (una caja componente Ex y componentes/equipos Ex eléctricos con su certificado ATEX propio), lo cual es una práctica habitual. También se usarán piezas sin certificado ATEX, pero estas no son relevantes para la evaluación de la conformidad ya que no poseen fuentes potenciales de ignición.

Finalmente se acuerda el uso de las siguientes piezas:

- Caja:


Fabricante	Rittal-Werk, Duolph Loh GmbH & Co. KG	
Modelo	KEL 9407.600	
Certificado	PTB 02 ATEX 1082 U	
Marcado	II 2 G Ex e IIC Gb	
Normas	EN 60079-0:2009 EN 60079-7:2007	

	EN 60079-31:2009	
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- Fuente de alimentación:


Fabricante	PULS GmbH	
Modelo	CP5.241	
Certificado	EPS 19 ATEX 1 201 X	
Marcado	II 3G Ex ec nC IIC T4 Gc	
Normas	EN 60079-0:2018 EN 60079-7:2015+A1:2018 EN 60079-15:2019	

- Módulo de redundancia:

Fabricante	PULS GmbH	
Modelo	YR20.242	
Certificado	EPS 11 ATEX 1 312 X	
Marcado	II 3G Ex ec IIC T4 Gc	
Normas	EN IEC 60079-0:2018 EN 60079-7:2015+A1:2018	

- Conmutador de red:

Fabricante	Moxa Inc.	
Modelo	EDS-516A-MM-SC	
Certificado	DEMKO 09 ATEX 0812123X	
Marcado	II 3 G Ex nA nC IIC T4 Gc	


Normas	EN 60079-0:2012+A11:2013	
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- Bornes portafusibles:

Fabricante	Weidmüller Interface GmbH & Co. KG	
Modelo	WSI 6	
Certificado	DEMKO 14 ATEX 1339U	
Marcado	II 3 G Ex ec IIC Gc	
Normas	EN IEC 60079-0:2018 EN IEC 60079-7:2015+A1:2018	

- Bornes, bornes de tierra, tapas finales según sea necesario.

Fabricante	Weidmüller Interface GmbH & Co. KG	
Modelo	Bornes: WDU 4 y WDU 2.5 Tapas finales: WAP 4 y WAP 2.5 Bornes de tierra: WPE 4 y WPE 2.5	
Certificado	DEMKO 14 ATEX 1338U	
Marcado	II 2 GD Ex eb IIC Gb	

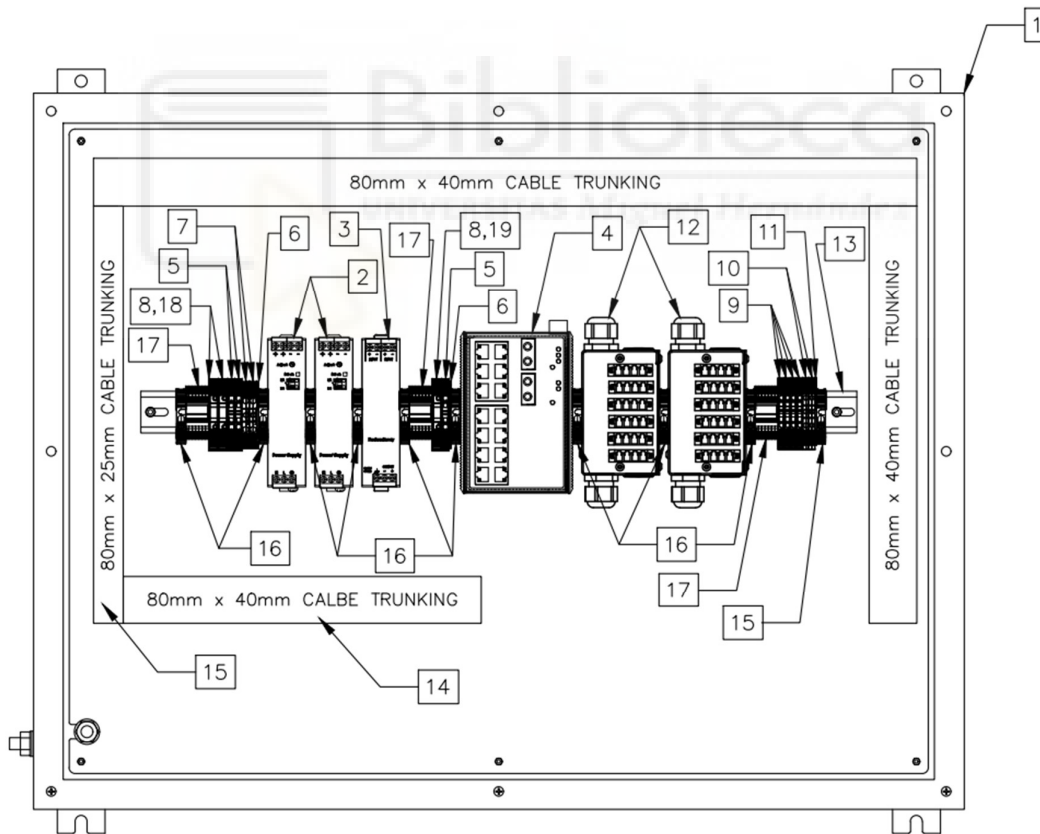
Normas	DEMKO 14 ATEX 1338U EN IEC 60079-7:2015+A1:2018	
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- Piezas sin certificado:

Pieza	Fabricante	Modelo
Panel de conexión de fibra óptica	Dinsapce	SNAP-12LC-MM-0M3
Raíl DIN	Weidmüller Interface GmbH & Co. KG	TS35
Canal de cables	Betaduct	80 x 40 80 x 25
Ángulo de fijación	Weidmüller Interface GmbH & Co. KG	EW 35
Señalizador	Weidmüller Interface GmbH & Co. KG	SCHT 5
Fusibles	Schurter	0001.2512 0001.2507

A continuación se muestran la lista de materiales y su distribución:

Bill of materials - Major parts							
Item	Quantity	Part	Manufacturer	Model no.	Certificate	Marking	Notes
1	1	Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb	Marking updated to Ex eb IIC Gb, refer to Appendix 2
2	2	Power supply	Puls GmbH	CP5.241	EPS 19 ATEX 1 201 X	II 3G Ex ec nC IIC T4 Gc	-
3	1	Redundancy module	Puls GmbH	YR20.242	EPS 11 ATEX 1 312 X	II 3G Ex ec IIC T4 Gc	-
4	1	Industrial ethernet switch	Moxa Inc.	EDS-516A-MM-SC	DEMKO 09 ATEX 0812123X	II 3 G Ex nA nC IIC T4 Gc	Marking updated to Ex ec nC IIC T4 Gc, refer to Appendix 2
5	3	4 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
6	2	4 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
7	2	4 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
8	3	Terminal block with fuse holder	Weidmuller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc	-
9	4	2.5 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
10	2	2.5 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
11	1	2.5 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
12	2	Fiber optic patch panel	Dinspace	SNAP-12LC-MM-0M 3	N/A	N/A	-
13	As required	DIN rail	Weidmuller Interface GmbH & Co. KG	TS35	N/A	N/A	-
14	As required	80 x 40 cable duct	Betaduct	10430034	N/A	N/A	-
15	As required	80 x 25 cable duct	Betaduct	10430024	N/A	N/A	-
16	10	End stop	Weidmuller Interface GmbH & Co. KG	EW 35	N/A	N/A	-
17	3	Label holder	Weidmuller Interface GmbH & Co. KG	SCHT 5	N/A	N/A	-
18	2	6.3A fuse	Schurter	0001.2512	N/A	N/A	-
19	1	2A fuse	Schurter	0001.2507	N/A	N/A	-
20					N/A	N/A	-







Una vez acordadas las características del panel de interfaz, se procede a la elaboración del expediente técnico.

Como estipula el anexo VIII de la Directiva 2014/34/UE, la documentación deberá permitir evaluar si el producto cumple los requisitos pertinentes, e incluirá un análisis y una evaluación del riesgo adecuados.

Especificará los requisitos aplicables y contemplará, en la medida en que sea pertinente para la evaluación, el diseño, la fabricación y el funcionamiento del producto; asimismo incluirá, cuando proceda, al menos los siguientes elementos:

- a) una descripción general del producto;
- b) planos de diseño y esquemas de los componentes, subconjuntos, circuitos, etc.;
- c) las descripciones y explicaciones necesarias para la comprensión de dichos planos y esquemas y del funcionamiento del producto;
- d) una lista de las normas armonizadas, aplicadas total o parcialmente, cuyas referencias se hayan publicado en el Diario Oficial de la Unión Europea y, cuando no se hayan aplicado esas normas armonizadas, la descripción de las soluciones adoptadas para cumplir los requisitos esenciales de salud y seguridad de la Directiva;



e) los resultados de los cálculos de diseño realizados, de los exámenes efectuados, etc.;

f) los informes sobre los ensayos

El expediente técnico generado consta de las siguientes partes:

- Resumen del equipo.
- Planos.
- Checklists de conformidad con la Directiva 2014/34/UE y las normas aplicadas.
- Evaluación de las piezas certificadas.
- Información de piezas no certificadas.
- Informes de ensayos.
- Manual del equipo.
- Declaración UE de conformidad.

A continuación se proporciona un breve resumen de cada apartado del expediente técnico.

## 0.2.2 EXPEDIENTE TÉCNICO

El expediente técnico generado consta de la información y documentación necesaria para declarar que el panel de control está en conformidad con la Directiva 2014/34/UE, siendo un aparato de Categoría 3 ATEX para uso en Zona 2. Consta de un resumen de la información relevante para la certificación, planos, checklists de conformidad, evaluación de las piezas certificadas, recopilación de datasheets de piezas no certificadas, informes de ensayos, manual y declaración UE de conformidad. El fabricante mantendrá la declaración UE de conformidad junto al expediente técnico durante un período de 10 años después de su introducción en el mercado, y estará a disposición de las autoridades nacionales durante este período de tiempo.

### 0.2.2.1 DESCRIPCIÓN GENERAL DEL EXPEDIENTE TÉCNICO

Aquí se presenta la información destacada del panel de control con respecto a la certificación del mismo:

- Se detalla el objeto de la certificación, que en este caso es la autocertificación del panel de interfaz NICP como equipo de categoría 3 ATEX para uso en zona 2.

- Se dan los datos del fabricante:

COMPANY NAME

ADDRESS LINE 1

ADDRESS LINE 2

POST CODE

COUNTRY

- Se enumeran la legislación y normas aplicadas:

Directiva 2014/34/UE	Aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas
EN IEC 60079-0:2018	Atmósferas explosivas – Parte 0: Equipo – Requisitos generales

EN IEC 60079-7:2015+A1:2018	Atmósferas explosivas – Parte 7: Protección del equipo por seguridad aumentada "e"
EN IEC 60079-15:2019	Atmósferas explosivas – Parte 15: Protección del equipo por modo de protección "n"

- Se especifica el nombre del equipo y su descripción: Network Interface Control Panel modelo NICP.

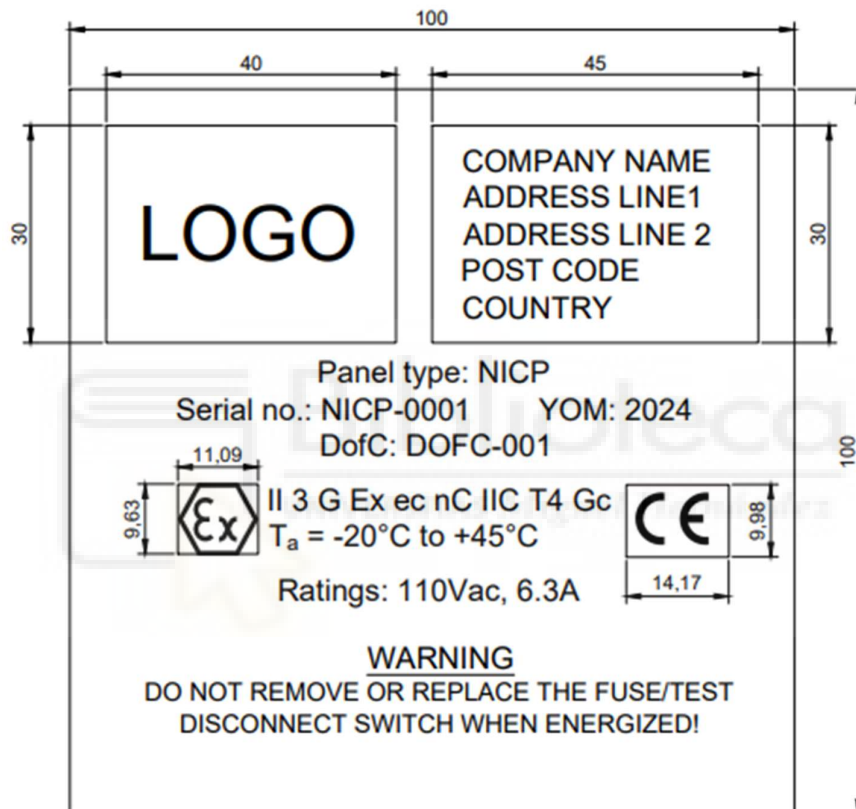
El panel de control de interfaz NICP está diseñado para ser instalado en un área clasificada como Zona 2 (ATEX Categoría 3) y está diseñado para interconectar cables Ethernet de cobre y datos en medios de fibra óptica. El panel NICP utiliza una envolvente certificada de acero inoxidable sin pintar, IP66, Ex eb (PTB 02 ATEX 1082 U) para instalar equipos y componentes eléctricos con certificación Ex. Dimensiones aproximadas son 600 mm (alto) x 780 mm (ancho) x 300 mm (fondo) con una sola puerta. El panel se suministra como una unidad completa, sin que el usuario final requiera ningún ensamblaje más que cablear el sistema. El NICP cuenta con 18 entradas M20 en la cara inferior de la envolvente.

EL NICP utiliza los siguientes componentes Ex:

Pieza	Fabricante	Modelo	Certificado	Marcado
Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb
Feed through terminal blocks	Weidmüller Interface GmbH & Co. KG	WDU 4 WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb
End plates		WAP 4 WAP 2.5		
Protective conductor		WPE 4		

terminal block		WPE 2.5		
Terminal block with fuse holder	Weidmüller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc

- Se muestra el marcado que lleva el equipo, en este caso se muestra la placa de marcado:



- Se proporciona una lista de los planos de certificación:

Título	Número	Revisión	Fecha
NICP – GENERAL ARRANGEMENT	NICP-GA-001	A	17.06.2024
NICP – INTERNAL LAYOUT	NICP-IL-001	A	17.06.2024

NICP – WIRING DIAGRAM	NICP-WD-001	A	17.06.2024
NICP – MARKING LABEL	NICP-ML-001	A	17.06.2024

- Se enumeran las condiciones especiales para la utilización segura. Estas condiciones se incluyen en el manual y deben ser evaluadas por el usuario final a la hora de realizar la instalación del producto. En este caso las condiciones son:
  - Se deben tomar medidas, ya sea en el equipo o externamente a el, para proporcionar el dispositivo de protección transitoria a un nivel que no exceda el 140% del voltaje nominal máximo.
  - Solo se utilizarán fusibles de repuesto proporcionados por el fabricante. Póngase en contacto con el fabricante si es necesario reemplazar los fusibles.
  - Solo se deben utilizar prensaestopas y tapones con clasificación IP66 debidamente certificados.
- Se enumeran las condiciones de fabricación. Estas condiciones son para el fabricante, y deben tenerse en consideración para cada unidad fabricada. En este caso hay que realizar un ensayo a cada unidad fabricada:
  - Cada unidad fabricada será sometida a un ensayo de Resistencia dieléctrica de acuerdo con la cláusula 6.1 de EN IEC 60079-7:2015+A1:2018. Consulte TR-001 para detalles de la prueba.
- Se llega a una conclusión en la que se establece que el panel de control NICP cumple con la Directiva 2014/34/EU: La evaluación realizada demuestra que el panel de control de interfaz de red NICP cumple con las normas enumeradas y está en conformidad con la Directiva 2014/34/UE.

#### 0.2.2.2 PLANOS

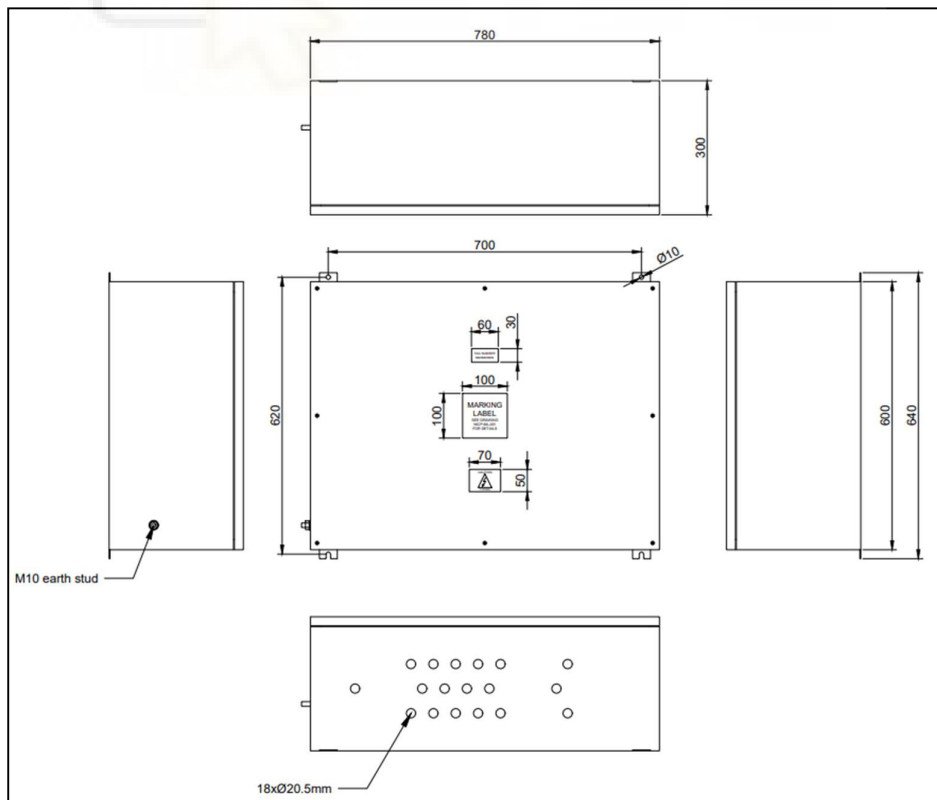
Los planos son una parte fundamental del expediente técnico, ya que en ellos se define las características del producto El producto deberá ser fabricado conforme a estos planos. Si se realiza algún cambio sin actualizar el expediente técnico el

producto dejaría de estar en conformidad con la Directiva y su uso podría no ser seguro. Cabe destacar que no son planos de fabricación ya que los planos de fabricación contienen información innecesaria para la certificación.

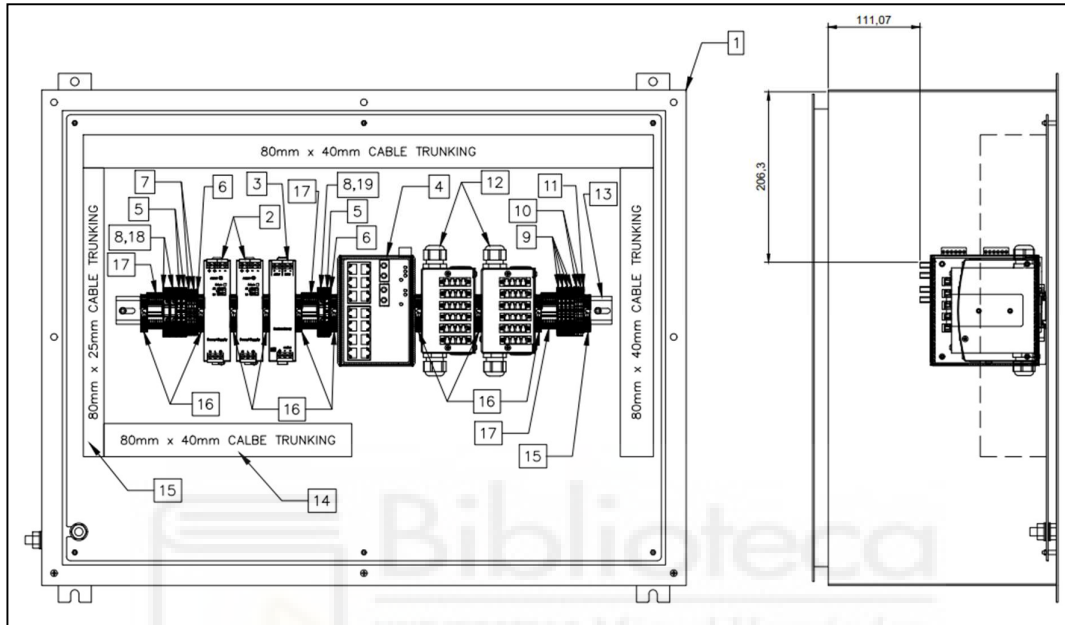
La lista de planos de certificación se muestra a continuación:

Título	Número	Revisión	Fecha
NICP – GENERAL ARRANGEMENT	NICP-GA-001	A	17.06.2024
NICP – INTERNAL LAYOUT	NICP-IL-001	A	17.06.2024
NICP – WIRING DIAGRAM	NICP-WD-001	A	17.06.2024
NICP – MARKING LABEL	NICP-ML-001	A	17.06.2024

- El plano NICP-GA-001 proporciona una vista general del panel de interfaz en la que se detallan medidas globales y se muestra la ubicación aproximada de los diferentes marcados que debe llevar la caja:

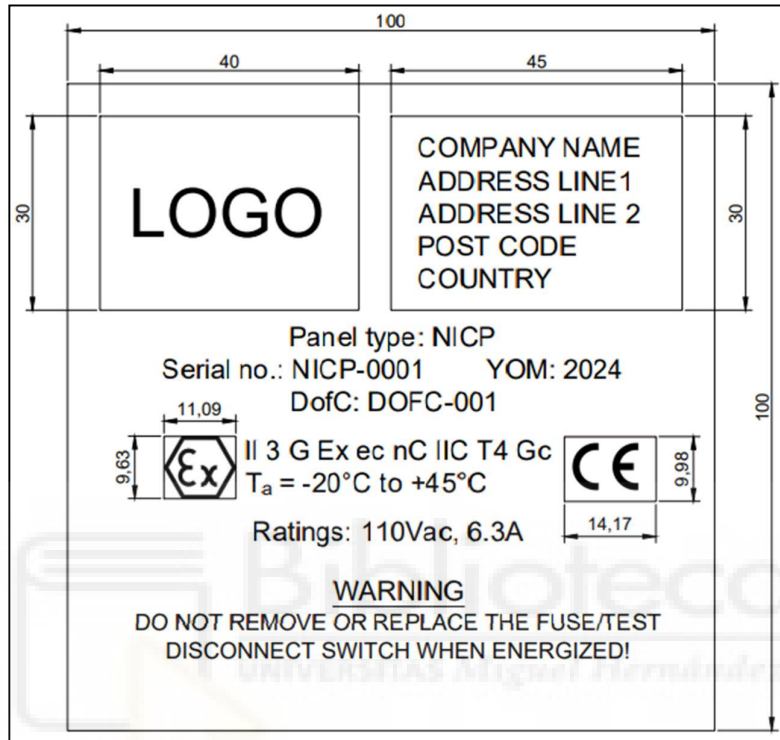


- El plano NICP-IL-001 proporciona una vista interna del panel, en la que se especifican las piezas instaladas en la caja, su distribución y las distancias entre las piezas y la caja. Esta vista está acompañada de una lista de piezas que incluye cantidades, fabricante y modelo, certificado y marcado:



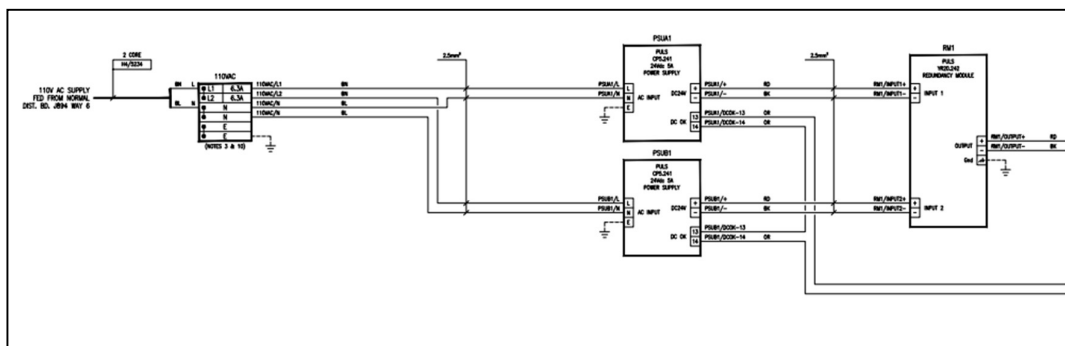
Bill of materials - Major parts							
Item	Quantity	Part	Manufacturer	Model no.	Certificate	Marking	Notes
1	1	Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb	Marking updated to Ex eb IIC Gb, refer to Appendix 2
2	2	Power supply	Puls GmbH	CP5.241	EPS 19 ATEX 1 201 X	II 3G Ex ec nC IIC T4 Gc	-
3	1	Redundancy module	Puls GmbH	YR20.242	EPS 11 ATEX 1 312 X	II 3G Ex ec IIC T4 Gc	-
4	1	Industrial ethernet switch	Moxa Inc.	EDS-516A-MM-SC	DEMKO 09 ATEX 0812123X	II 3 G Ex nA nC IIC T4 Gc	Marking updated to Ex ec nC IIC T4 Gc, refer to Appendix 2
5	3	4 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
6	2	4 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
7	2	4 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
8	3	Terminal block with fuse holder	Weidmuller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc	-
9	4	2.5 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
10	2	2.5 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
11	1	2.5 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
12	2	Fiber optic patch panel	Dinspace	SNAP-12LC-MM-OM 3	N/A	N/A	-
13	As required	DIN rail	Weidmuller Interface GmbH & Co. KG	TS35	N/A	N/A	-
14	As required	80 x 40 cable duct	Betaduct	10430034	N/A	N/A	-
15	As required	80 x 25 cable duct	Betaduct	10430024	N/A	N/A	-
16	10	End stop	Weidmuller Interface GmbH & Co. KG	EW 35	N/A	N/A	-
17	3	Label holder	Weidmuller Interface GmbH & Co. KG	SCHT 5	N/A	N/A	-
18	2	6.3A fuse	Schurter	0001.2512	N/A	N/A	-
19	1	2A fuse	Schurter	0001.2507	N/A	N/A	-
20					N/A	N/A	-

- El plano NICP-ML-001 detalla la placa de marcado ATEX. Contiene la información requerida por las normas y la Directiva 2014/34/UE, y estipula el material y tamaño:



- NOTES**
- This is a certification drawing. No changes are permitted without approval from the Certification Manager.
  - Label material: 3M label material 7872 (metalized polyester), 0.178 mm thick.
  - Black lettering on white background. Minimum character height is 3 mm.

- El plano NICP-WD-001 es el diagrama de cableado requerido por el cliente. A continuación se muestra un extracto:





### 0.2.2.3 CHECKLISTS DE CONFORMIDAD

Para determinar si el panel de control está en conformidad con la Directiva 2014/34/UE hay que evaluar el producto con respecto a los requisitos esenciales de salud y seguridad del anexo II de dicha Directiva. Como hemos visto con anterioridad, estos requisitos están redactados de forma genérica, por lo que la práctica común es aplicar normas armonizadas ATEX que proporcionan presunción de conformidad con los requisitos de la Directiva.

En el caso del panel de control se aplican las siguientes normas:

- EN IEC 60079-0:2018 – Atmósferas explosivas – Parte 0 – Requisitos generales.
- EN IEC 60079-7:2015+A1:2018 – Atmósferas explosivas – Parte 7: Protección del equipo por seguridad aumentada "e".
- EN IEC 60079-15:2019 – Atmósferas explosivas – Parte 15: Protección del equipo por modo de protección "n".

Para cada norma se elabora una checklist en el que se evalúa la conformidad del producto con cada una de las cláusulas de la norma. El veredicto de todas las cláusulas debe ser "pass" (si cumple los requisitos de la cláusula) o "N/A" (si dicha cláusula no es aplicable al producto).

La norma EN IEC 60079-0:2018, como su nombre indica, trata aspectos generales de cualquier tipo de producto. A continuación se muestran algunos ejemplos de las cláusulas evaluadas:

- Cláusula 5.1.1 – Temperatura ambiente:

Esta cláusula evalúa la temperatura ambiente en la que se puede usar el equipo. La norma nos dice que el rango de temperatura ambiente "normal" es de -20°C a +40°C. si el producto puede ser usado en un rango de temperatura ambiente diferente a este, esta información debe aparecer en la placa de marcado del producto:

## 5 Temperatures

### 5.1 Environmental influences

#### 5.1.1 Ambient temperature

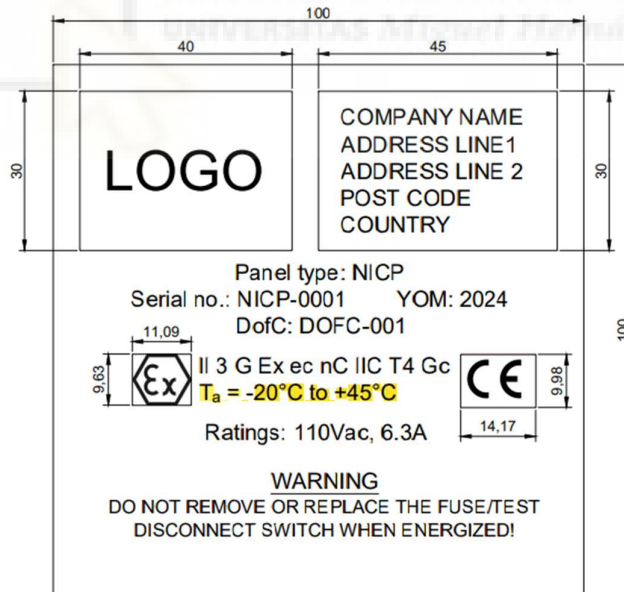
Equipment designed for use in a normal ambient temperature range of  $-20\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$  does not require marking of the ambient temperature range. However, equipment designed for use in other than this normal ambient temperature range is considered to be special. The marking shall then include either the symbol  $T_a$  or  $T_{amb}$  together with both the upper and lower ambient temperatures or, if this is impracticable, the symbol "X" shall be used to indicate specific conditions of use that include the upper and lower ambient temperatures. See item e) of 29.3 and Table 1.

NOTE The ambient temperature range is permitted to be a reduced range, e.g.  $-5\text{ }^{\circ}\text{C} \leq T_{amb} \leq 15\text{ }^{\circ}\text{C}$ .

**Table 1 – Ambient temperatures in service and additional marking**

Equipment	Ambient temperature in service	Additional marking
Normal	Maximum: $+40\text{ }^{\circ}\text{C}$ Minimum: $-20\text{ }^{\circ}\text{C}$	None
Special	Specified by the manufacturer	$T_a$ or $T_{amb}$ with the special range, for example, $-30\text{ }^{\circ}\text{C} \leq T_a \leq +40\text{ }^{\circ}\text{C}$ or the symbol "X"

En el caso del panel de control NICP, su rango de temperatura ambiente es de  $-20\text{ }^{\circ}\text{C}$  a  $+45\text{ }^{\circ}\text{C}$ , y por ello aparece en la placa de marcado como puede verse en la ilustración mostrada a continuación:



- Cláusula 5.1.2 – Fuentes de calentamiento o enfriamiento externas:

Esta cláusula nos indica que equipo que esté diseñado para estar conectado a una fuente externa de calentamiento o enfriamiento, como puede ser una tubería

o recipiente de proceso calentada, los valores de dicha fuente externa se especificarán en el certificado y las instrucciones del fabricante.

<p><b>5.1.2 External source of heating or cooling</b></p> <p>Where the equipment is intended to be physically connected to or influenced by a separate external source of heating or cooling, such as a heated or cooled process vessel or pipeline, the ratings of the external source shall be specified in the certificate and in the manufacturer's instructions.</p>
---

En el caso del panel de control NICK, el panel no estará conectado a ninguna fuente externa de calor o frío, por lo que esta cláusula no es aplicable.

A continuación se muestran estas dos cláusulas, que han sido extraídas de las checklists del apartado 2.4.1:

EN IEC 60079-0:2018			
Cláusula	Requerimiento – Test	Resultado – Observación	Veredicto
5.1	Influencias ambientales		
5.1.1	Temperatura ambiente	El equipo está diseñado para uso en un rango de temperatura ambiente de -20°C a +45°C, y por consiguiente este rango aparece en la placa de marcado.	Pass
5.1.2	Fuentes de calentamiento o enfriamiento externas	El equipo no está diseñado para ser conectado a una fuente externa de frío o calor.	N/A

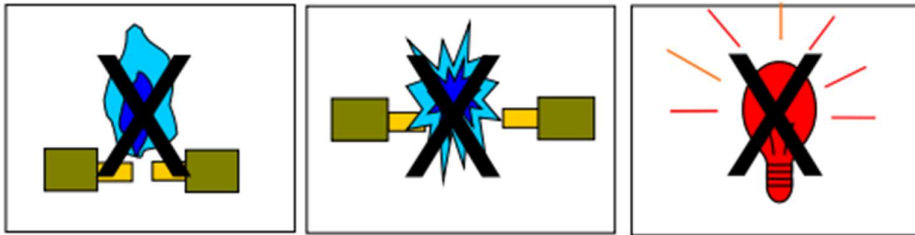
Para la evaluación completa de la norma EN IEC 60079-0:2018 dirijase a la sección 2.4.1.

La norma EN IEC 60079-7:2015+A1:2018, protección del equipo por seguridad aumentada “e”, se basa en dos principios fundamentales:

1. Arcos, chispas y superficies calientes se evitan a través del diseño del producto, y

2. La envolvente del producto tiene un nivel de protección mínimo de IP54.

En otras palabras, conductores a distintos potenciales están a una distancia que impide que se generen arcos y/o chispas. A mayor voltaje mayor debe ser la distancia de separación. El nivel de protección mínimo IP54 es requerido para evitar la introducción de objetos dentro del producto que puedan resultar en arcos o chispas, como por ejemplo introducir un destornillador en un panel de control que esté operativo y que el resultado sea un chispazo que provoque la explosión del gas potencialmente explosivo.



A continuación se muestran algunos ejemplos de las cláusulas evaluadas:

- Cláusula 4.10 – Nivel de protección proporcionado por la envolvente

Esta cláusula define los requisitos en cuanto al nivel de protección que debe proporcionar la envolvente del producto en función de sus características. En el caso del panel de control NICP, se requiere que la caja proporcione IP54:

#### 4.10 Degrees of protection provided by enclosures

**4.10.1** The degrees of protection as defined in tests of enclosures of IEC 60079-0, as applicable, shall be as prescribed in a), b), or c) unless otherwise specified in 4.10.2, 4.10.3, or Clause 5. For Level of Protection "ec", the tests of enclosures requirements of IEC 60079-0 are modified for the thermal endurance to heat preconditioning test to replace the 20 K above the service temperature ( $T_s + 20$  K) with 10 K above the service temperature ( $T_s + 10$  K).

- Enclosures containing bare conductive live parts shall provide at least the degree of protection IP54.
- Enclosures containing only insulated conductive live parts as in 4.6 shall provide at least the degree of protection IP44.
- Enclosures for containing only insulated conductive live parts as in 4.6, can provide a reduced degree of protection of IP23 for Group I, or IP20 for Group II, if solid foreign bodies are prevented from falling vertically through any openings into the enclosure. For this equipment, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall detail the degree of protection provided by enclosure and provide guidance on the protection by location that is required. An example of an application where this reduced degree of protection could be suitable is a clean environment.

For Level of Protection "ec", opening of the enclosure for maintenance purposes, is not considered normal operation, and the opening times requirement of IEC 60079-0 does not apply.

Esta cláusula también estipula los requisitos en caso de que la envolvente del producto incorpore orificios de drenaje o ventilación, y requisitos en caso de que el producto incorpore aparatos protegidos por el método de protección de seguridad intrínseca “i”, que en este caso no son aplicables ya que el panel de control NICP no incorpora ni orificios de drenaje ni aparatos protegidos por seguridad intrínseca “i”:

**4.10.2** The enclosure of electrical equipment may be provided with drain holes or ventilation openings to prevent the accumulation of condensation. The requirements are dependent upon the equipment grouping as follows:

- a) Equipment Group I – compliance with 4.10.1 is required.
- b) Equipment Group II – the inclusion of the drain holes or ventilation openings may reduce the degree of protection provided by the enclosure according to 4.10.1, but shall not be below IP44 for item a) of 4.10.1 or IP24 for item b) of 4.10.1.

When the presence of drain holes or ventilation openings reduces the degree of protection below the requirements of 4.10.1, the details of the drain holes or ventilation openings, including position and dimensions, shall be stated by the manufacturer and included in the descriptive documents in accordance with IEC 60079-0. For equipment with drain holes and ventilation openings that reduce the degree of protection, the certificate number shall include the “X” suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall detail the reduced degree(s) of protection provided by enclosure and note that environmental dust may enter the enclosure and compromise the electrical creepage and clearance.

**4.10.3** When there are circuits or apparatus with Type of Protection “i” where live maintenance has been permitted by the instructions, in accordance with IEC 60079-11 within the enclosure, either:

- a) the covers of the enclosure permitting access to energized non-intrinsically-safe circuits or apparatus shall have a label per item b) of Table 19; or
- b) all bare live parts not protected by the Type of Protection “i” shall have a separate internal cover providing at least the degree of protection IP30 when the enclosure of the equipment is open.

In addition, the internal cover shall have a label per item c) of Table 19 or other wording that would otherwise be required by IEC 60079-0 to be on the cover of the enclosure of the equipment.

The cover of the enclosure of the equipment shall have a label per item d) of Table 19.

A continuación se muestran estas dos cláusulas, que han sido extraídas de las checklists del apartado 2.4.1:

<b>EN IEC 60079-7:2015+A1:2018</b>			
<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
4.10	Nivel de protección proporcionado por la envolvente		

<b>EN IEC 60079-7:2015+A1:2018</b>			
<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
4.10.1	Requisitos de la envolvente	El panel de control NICP utiliza un envolvente (caja) debidamente certificada y con un nivel de protección IP66. Consulte el apartado 2.5.1 para más detalles acerca de la envolvente.	Pass
4.10.2	Envolvente con orificios para ventilación o drenaje	La envolvente del panel de control NICP no cuenta con orificios de drenaje o ventilación.	N/A
4.10.3	Envolventes con aparatos protegidos por seguridad intrínseca “i”	El panel de control NICP no incorpora aparatos protegidos por seguridad intrínseca “i”	N/A

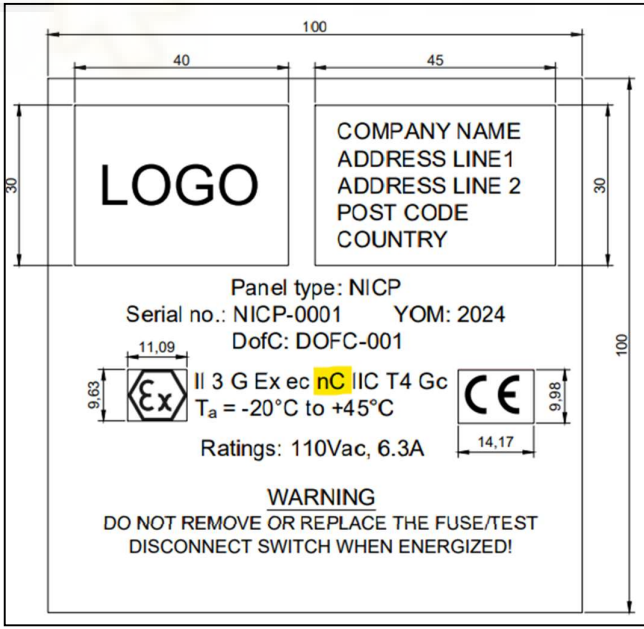
Para la evaluación completa de la norma EN IEC 60079-7:2015+A1:2018 diríjase a la sección 2.4.2.

Las normas EN IEC 60079-0:2018 y EN IEC 60079-7:2015+A1:2018 han sido aplicadas en su totalidad y proporcionan presunción de conformidad con la Directiva 2014/34/UE sin necesidad de aplicar ninguna otra norma.

Aunque no sea necesario aplicar ninguna otra norma al equipo, debe quedar constancia de que las fuentes de alimentación y al conmutador de red están protegidos por el método de protección “nC” (norma EN IEC 60079-15:2019, conocida como método simplificado) además del método de protección por seguridad aumentada “e”, y debe mencionarse en la evaluación del panel de control. A continuación se muestra la evaluación necesaria:

<b>EN IEC 60079-15:2019</b>	
1	<p>Alcance</p> <p>El equipo utiliza una fuente de alimentación y un conmutador de red debidamente certificados como Equipo Ex con tipo de protección Ex nC. Todos los aspectos del tipo de protección nC se relacionan con estas piezas y, como tal, la única evaluación requerida es la revisión de sus certificados y la evaluación de sus condiciones de uso. La evaluación de la idoneidad de estas piezas se realiza en el apartado 2.5.1 de este documento. No es necesaria ninguna consideración adicional.</p>

No es necesario aplicar esta norma el panel en su conjunto, pero al incorporar estas piezas hay que hacerlo saber al usuario final, y esto se consigue incluyendo la norma en el certificado (o declaración de conformidad UE) e incluyendo el marcado 'nC' propio de este método de protección en la placa de marcado del panel, acompañando al método de protección de seguridad aumentada "e":



Por último, también debe elaborarse una checklist evaluando la conformidad con respecto a los requisitos esenciales de salud y seguridad del anexo II de la



Directiva 2014/34/UE, pero en esta checklist se refiere a las normas aplicadas como justificación de la conformidad. Si algún requisito no es cubierto por las normas entonces se evalúa en esta checklist. Las normas “EN” incluyen un apartado en el que se enumera los requisitos del anexo 2 de la directiva que son cubiertos por la aplicación de la norma. A continuación se muestra un extracto de la tabla contenida en la norma En IEC 60079-7:2015+A1:2018:

<b>Essential Requirements of 2014/34/EU</b>	<b>Clause(s) / sub-clause(s) of this EN</b>	<b>Remarks / Notes</b>
1.0.1.	All clauses	This is the purpose of the Standard.
1.0.2.	4.2 / 4.3 / 4.4 / 4.6 / 5.2 / 5.3 / 5.4 / 5.6 / 5.8 / 5.9 / A.3 / A.5 / B.4.2	
1.0.2.	4/ 5 /A/B//F/G//H	
1.0.3.	5.2 / 5.3 / 5.6	
1.0.3.	5.2 / 5.3 / 5.6	
1.0.4.	4.2 / 4.6 / 4.8	
1.0.4.	4.2 / 4.6 / 4.8	
1.0.5.	5.2 / 5.3 / 5.7 / 5.9 / 8.1 / 8.2 / 9.4	
1.0.5.	9	
1.0.6.	5.7 / 8.2	
1.0.6.	9.3	

A continuación se muestra un ejemplo de un requisito cubierto por las normas y otro que no lo es, y cómo se ha evaluado en esta ocasión:

<b>DIRECTIVA 2014/34/EU – REQUISITOS ESENCIALES DE SEGURIDAD Y SALUD (ANEXO II)</b>			
<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
1	Requisitos comunes relativos a los aparatos y a los sistemas de protección		
1.0.1	Principios de integración de la seguridad frente a las explosiones	Cubierto por EN IEC 60079-0:2018 y EN IEC 60079-7:2015+A1:2018.	Pass



**DIRECTIVA 2014/34/EU – REQUISITOS ESENCIALES DE SEGURIDAD Y SALUD (ANEXO II)**

<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
1.2.4	Formación de polvo	El equipo no ha sido diseñado para aplicaciones con polvo	N/A

**0.2.2.4 EVALUACIÓN DE PIEZAS CERTIFICADAS**

Como parte del ejercicio de certificación hay que evaluar las piezas certificadas que forman parte del equipo final, con el objetivo de demostrar que su uso es apto en la aplicación final. Esta evaluación debe quedar grabada y formar parte del expediente técnico del equipo.

Para cada pieza certificada se debe evaluar lo siguiente:

- Las normas aplicadas en su certificación. Debe comprobarse que las normas usadas son las normas armonizadas que aparecen en el Diario Oficial de la UE.
- El marcado. Debe comprobarse que el marcado es compatible con la aplicación final (grupos de gas, nivel de protección...).
- Las condiciones específicas de uso. Debe evaluarse las condiciones de uso y justificar como el equipo cumple con estos requisitos.

A continuación se muestra como ejemplo la evaluación del certificado de la fuente de alimentación:



**BUREAU  
VERITAS**



(1) **Certificate of Conformity**

(2) **Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – Directive 2014/34/EU**

(3) Certificate Number:

**EPS 19 ATEX 1 201 X**

**Revision 1**

(4) **Equipment:** Power Supply (built-in):  
CP5.121; CP5.241; CP5.241-S1; CP5.241-S2; CP5.481

(5) **Manufacturer:** PULS GmbH

(6) **Address:** Elektrastr. 6  
81925 Muenchen  
Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this Certificate of Conformity and the documents therein referred to.

(8) Bureau Veritas Consumer Products Services Germany GmbH certifies based on a voluntary assessment that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II of the Directive 2014/34/EU. The examination and test results are recorded in the confidential documentation under the reference number 19TH0217.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

**EN IEC 60079-0:2018**


**EN 60079-7:2015 + A1:2018**

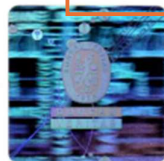
**EN IEC 60079-15:2019**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This Certificate of Conformity relates only to the design and the construction of the specified equipment in accordance with Directive 2014/34/EU. Further requirements of this Directive apply to the manufacture and supply of this equipment. Those requirements are not covered by this certificate.

(12) The marking of the equipment shall include the following:

 II 3G Ex ec nC IIC T4 Gc



Certification department of explosion protection

Hamburg, 2022-03-07

Ulrich Feike



**Annexe**

(13)

(14) **Certificate of Conformity EPS 19 ATEX 1 201 X** Revision 1

(15) Description of equipment:  
 Power supply (built-in use)

Electrical data:

<p><b>CP5.121:</b>  <b>Input:</b>          AC 100-240V<sup>(-15%/+10%)</sup>   1.6-0.7A   50-60Hz          DC 110-150V<sup>(+/-20%)</sup>   1.4A  <b>Output:</b>          DC 12-15V   12-9.6A (below +45 °C)          DC 12-15V   10-8.0A (at +60 °C)          DC 12-15V   7.5-6.0A (at +70 °C)          Derate linearly between +45 °C and +70 °C          Ambient temperature range: -25 °C to +70 °C</p>	<p><b>CP5.241, CP5.241-S1, CP5.241-S2:</b>  <b>Input:</b>          AC 100-240V<sup>(-15%/+10%)</sup>   1.6-0.7A   50-60Hz          DC 110-150V<sup>(+/-20%)</sup>   1.4A  <b>Output:</b>          DC 24-28V   6.0-5.1A (below +45 °C)          DC 24-28V   5.0-4.3A (at +60 °C)          DC 24-28V   3.8-3.2A (at +70 °C)          Derate linearly between +45 °C and +70 °C          Ambient temperature range: -25 °C to +70 °C</p>
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**CP5.481:**  
**Input:**  
 AC 100-240V<sup>(-15%/+10%)</sup> | 1.6-0.7A | 50-60Hz  
 DC 110-150V<sup>(+/-20%)</sup> | 1.4A  
**Output:**  
 DC 48-56V | 3.0-2.6A (below +45 °C)  
 DC 48-56V | 2.5-2.1A (at +60 °C)  
 DC 48-56V | 1.9-1.6A (at +70 °C)  
 Derate linearly between +45 °C and +70 °C  
 Ambient temperature range: -25 °C to +70 °C


All models optional with suffix "-C1" or "-C2"  
 - C1: completely coated with protective coating  
 - C2: partly coated with protective coating

(16) Reference number: 19TH0217

(17) Schedule of Limitations:

- The equipment shall be installed in an enclosure that provides a minimum ingress protection of IP 54 in accordance with EN 60079-0
- The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN 60664-1
- Ambient temperature range is -25 °C < T<sub>amb</sub> < +70 °C; derating conditions above +45 °C and different mounting orientations must be considered.

(18) Essential health and safety requirements:  
 Met by standards



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- Normas aplicadas: como puede verse en la imagen anterior, la fuente de alimentación está en conformidad con las normas EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 y EN IEC 60079-15:2019. Estas son las mismas ediciones de las normas que han sido aplicadas al panel de control NICP en este ejercicio de autocertificación y además son las ediciones de las normas que aparecen en el Diario Oficial de la UE. A continuación se muestra como aparece listada la norma EN IEC 60079-0:2018 en el Diario Oficial de la UE:

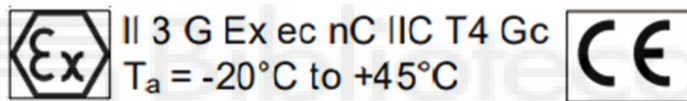
29.9.2022	ES	Diario Oficial de la Unión Europea	L 251/13
N.º	Referencia de la norma		
69.	EN IEC 60079-0:2018 Atmósferas explosivas. Parte 0: Equipo. Requisitos generales. (IEC 60079-0:2017).		

Si la fuente de alimentación usase una edición de la norma que no fuese la del Diario Oficial de la UE, habría que realizar una evaluación de las diferencias técnicas entre ambas ediciones y determinar si la pieza cumple con los requisitos de la última edición. Esto se ha realizado para el conmutador de red en el apartado 2.5.1.4.3.

- Marcado: el marcado que aparece en el certificado es:



Al compararlo con el marcado del panel de control NICKP:



Podemos ver que tanto el panel de control como la fuente de alimentación pueden ser usados con gases del Grupo IIC (hidrógeno), ambas tienen una clasificación de la temperatura superficial T4 (135°C) y ambas tienen un nivel de protección del equipo Gc (aptas para uso en Zona 2).

La fuente de alimentación podría tener unas características mejores, como por ejemplo ser clasificada como T3 o Gb, y podría ser apta para uso en el panel de control NICKP. Sin embargo, no sería aceptable declarar que el panel en su conjunto tiene mejores características que la fuente de alimentación.

- Por último, hay que evaluar las condiciones especiales para la utilización segura, que en este certificado vienen en el apartado “Schedule of limitations”:

(17) <u>Schedule of Limitations:</u>
- The equipment shall be installed in an enclosure that provides a minimum ingress protection of IP 54 in accordance with EN 60079-0
- The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN 60664-1
- Ambient temperature range is $-25\text{ }^{\circ}\text{C} < T_{\text{amb}} < +70\text{ }^{\circ}\text{C}$ ; derating conditions above $+45\text{ }^{\circ}\text{C}$ and different mounting orientations must be considered.

Su evaluación se muestra en la siguiente tabla:

Condiciones especiales para la utilización	Justificación de la conformidad
El equipo se instalará en una envolvente que proporcione una protección mínima de IP 54 de acuerdo con IEC 60079-0.	La fuente de alimentación ha sido instalada en una envolvente que proporciona protección IP66.
El equipo solo se utilizará en un área con un grado de contaminación no superior a 2, tal como se define en IEC 60664-1.	La fuente de alimentación ha sido instalada en una envolvente que proporciona protección IP66, por lo que el interior de la envolvente es considerado zona de contaminación 2 o mejor.
El rango de temperatura ambiente es $-25\text{ °C} < T_{\text{amb}} < +70\text{ °C}$ ; se deben considerar condiciones de reducción de potencia para temperaturas superiores a $+45\text{ °C}$ y diferentes orientaciones de montaje.	La fuente de alimentación está instalada en un equipo que tiene una temperatura ambiente nominal mínima de $-20\text{ °C}$ y una temperatura ambiente interna máxima dentro de la envolvente en la que está instalada de $58,81\text{ °C}$ (obtenida por ensayo). Consideraciones de reducción de potencia se encuentran a continuación de la tabla.

Los datos eléctricos de la fuente de alimentación se muestran a continuación:

**CP5.241, CP5.241-S1, CP5.241-S2:**

**Input:**

AC 100-240V<sup>(-15%/+10%)</sup> | 1.6-0.7A | 50-60Hz

DC 110-150V<sup>(+/-20%)</sup> | 1.4A

**Output:**

DC 24-28V | 6.0-5.1A (below +45 °C)

DC 24-28V | 5.0-4.3A (at +60 °C)

DC 24-28V | 3.8-3.2A (at +70° C)

Derate linearly between +45 °C and +70 °C

Ambient temperature range: -25 °C to +70 °

La salida de la fuente de alimentación (output) es inferior a 3,2 A, por lo que su uso es aceptable en una temperatura ambiente de hasta +70 °C según los datos eléctricos extraídos del certificado.

Por último, se deben revisar las instrucciones de instalación para realizar la correcta instalación de la fuente de alimentación, ya que en ella se explica como debe ser instalada.

La evaluación demuestra que se han tomado todas las medidas necesarias para el correcto uso de la fuente de alimentación, y que su uso en el panel de control NIPC está en conformidad con su certificado y por consiguiente es seguro.

Junto con la evaluación de las piezas, se recopila en el expediente técnico una copia de cada certificado y manual de instrucciones. Una copia del certificado y de las instrucciones se conserva en el expediente técnico.

#### 0.2.2.5 PIEZAS NO CERTIFICADAS

Las piezas no certificadas se limitan al raíl DIN, ángulos de fijación, señalizadores y canal de cables. Estas piezas no caen dentro del ámbito de la Directiva ATEX ya que no poseen fuentes de ignición propia, y no es necesario hacer ninguna evaluación para su uso salvo que todas estén dentro de sus límites de rango de temperatura.

La única pieza que se sale de lo dicho anteriormente es panel de conexión de fibra óptica, ya que si se deben hacer ciertas consideraciones para evaluar si su uso es aceptable:

- La fibra óptica es puramente un panel de conexión, que no proporciona amplificación ni tiene una PCB instalada.

- La evaluación de esta pieza está incorporada en las checklists de las normas EN IEC 60079-0 y EN IEC 60079-7.
- Al ser un conector de fibra óptica hay que considerar si es necesario aplicar la norma EN 60079-28 – Atmósferas explosivas – Parte 28: Protección de material y sistemas de transmisión que utilizan radiación óptica. El ámbito de aplicación de esta norma excluye equipos instalados en envolventes completamente cerrados que contenga la radiación óptica y que estén en conformidad con un tipo de protección apropiado para el nivel de protección requerido, y que proporcione un nivel de protección IP6X y en el que no haya absorbentes internos. En este caso la caja en la que se instalan tiene IP66, en el interior no existen absorbentes, y se realiza un ensayo de temperatura que demuestra que no existe un calentamiento excesivo.

Por lo tanto, la evaluación hecha en las checklists es suficiente para permitir el uso de esta pieza.

Se guardan copias de la datasheet de cada una de las piezas en el expediente técnico.

#### 0.2.2.6 ENSAYOS

Parte de la evaluación de conformidad con las normas aplicadas es determinar que ensayos son necesarios, si es que hay alguno que lo sea, y realizarlos en muestras representativas del producto cuya conformidad está siendo evaluada.

Para la evaluación de la conformidad del panel de control NICP, se determina que son necesarios realizar dos ensayos:

1. Ensayo de incremento de temperatura. La norma EN IEC 60079-0:2018 es la que requiere este ensayo.
2. Ensayo resistencia dieléctrica. La norma EN IEC 60079-7:2015+A1:2018 es la que requiere este ensayo.

Los demás ensayos mencionados en las normas no son necesarios porque el panel utiliza piezas certificadas, las cuales ya han sido sometidas a estos ensayos cuando su conformidad fue evaluada para emitir su certificado.

##### 0.2.2.6.1 INCREMENTO DE TEMPERATURA



La evaluación de la norma EN IEC 60079-0:2018 es la que nos lleva a tener que realizar estos ensayos de temperatura. El ensayo de incremento de temperatura consta de dos partes, medida de la temperatura de servicio y medida de la temperatura superficial máxima:

- Temperatura de servicio: La temperatura de servicio se mide aplicando el 100% del valor del voltaje nominal (110Vac) y se mantiene hasta que el ritmo de incremento de la temperatura no supere los 2K/h. Se mide la temperatura de servicio de partes no metálicas sobre las que dependa el tipo de protección aplicado. En este caso nos interesa medir el incremento de temperatura de la junta de silicona de la tapa de la caja, ya que si se sobrepasa el valor máximo estipulado en su certificado su uso no sería aceptable. Además de la junta hay que tomar medidas en los pasacables, en el punto de ramificación de los cables y hay que medir la temperatura ambiente en el interior del panel para poder determinar que las piezas certificadas están siendo usadas dentro de su rango de temperatura ambiente máximo.
- Temperatura superficial máxima: La temperatura superficial máxima se mide aplicando el 90% y el 110% del valor del voltaje nominal (99Vac y 121Vac respectivamente) y se mantiene hasta que el ritmo de incremento de la temperatura no supere los 2K/h. Se mide la temperatura máxima en la superficie externa del panel de interfaz y también en los componentes eléctricos instalados en el interior del panel ya que el método de protección por seguridad aumentada “e” permite que el gas potencialmente explosivo entre dentro del panel y entre en contacto con los componentes eléctricos. En este caso nos interesa medir el incremento de temperatura en varios puntos de la superficie externa del panel y en la superficie de los componentes eléctricos que generen más calor. Usando una cámara termográfica con el panel en marcha se determina que la fuente de alimentación es la parte que experimenta mayor incremento de temperatura. Además, se decide medir en uno de los bornes y en el fusible.

Debe quedar constancia del equipo usado para realizar el ensayo, y verificar que esté dentro del período de calibración:



Equipo	Número de serie	Fecha de calibración
TC-08 data logger	A-0104-281	22/11/2024
TC-08 data logger	A-0085-107	09/04/2025
Multímetro digital	39236545LR	16/12/2024
Fuente de alimentación	20200518077	05/02/2025
Transformador variac	EVM1018	N/A

Solo queda realizar el ensayo y tomar nota de los resultados, los cuales se expresan de forma resumida a continuación:

- Temperatura de servicio: el incremento máximo registrado en la temperatura de servicio fue de 6.97K en la junta de la tapa sobre la fuente de alimentación. Este incremento, una vez corregido para una temperatura ambiente máxima de +45°C resulta en temperatura de servicio de 51.97°C.
- Temperatura superficial máxima: el incremento máximo registrado fue de 24.3K, medido en la superficie de la fuente de alimentación. Este incremento, una vez corregido para una temperatura ambiente máxima de +45°C resulta en temperatura superficial máxima de 69.3°C, que está dentro de los límites de la clasificación T4 del panel de interfaz.

#### 0.2.2.6.2 RESISTENCIA DIELECTRICA

La evaluación de la norma EN IEC 60079-7:2015+A1:2018 es la que nos lleva a tener que realizar este ensayo de resistencia dieléctrica. El objetivo es comprobar que el panel ha sido cableado de forma correcta y el equipo sea capaz de aguantar un voltaje determinado por la norma durante al menos 60 segundos sin que exista fallo eléctrico.

La tensión se debe aplicar a partes conductoras desnudas que estén a diferente potencial eléctrico.

La norma nos indica las siguientes tensiones:

- Para equipo y componentes eléctricos con tensión nominal que no exceda 90 V pico o en los que no se da un voltaje nominal de trabajo que exceda 90 V pico:  $500 V r. m. s. +5\%$  %.
- Para otros equipos y componentes eléctricos donde si se dé un voltaje nominal de trabajo que exceda 90 V pico:  $(1000 + 2U)V r. m. s. +5\%$  % o  $1500 V r. m. s. +5\%$  %, el que sea mayor, donde U es la tensión nominal de trabajo.

De acuerdo con estos puntos, las siguientes tensiones fueron aplicadas para los ensayos:

- 1500V entre “L” y “N”, “L” y “PE”, “N” y “PE” en los bornes de entrada de la fuente de alimentación.
- 500V entre “+” y “-”, “+” y “PE”, “-” y “PE” en los bornes de salida de la Fuente de alimentación.

El equipo usado para este ensayo es:

Equipo	Número de serie	Fecha de calibración
5kV high voltage tester	PE006791	02/10/2024

Se procede a realizar los ensayos y se observa que el panel supera los diferentes ensayos sin que se produzca fallo eléctrico.

#### 0.2.2.7 MANUAL

Es imprescindible redactar un manual, que debe acompañar a cada unidad que se fabrique. La norma EN IEC 60079-0 establece la información mínima que debe contener, con la norma EN IEC 60079-7 añadiendo algún requisito extra, en este caso referente a los bornes. El manual contiene la siguiente información:

- Descripción del producto.
- Especificaciones del producto: modelo, peso, tamaño, marcado ATEX, rango de temperatura y datos eléctricos.
- Una copia de la placa de marcado.
- Información sobre la instalación: método de fijación e información sobre la conexión a tierra.
- Información sobre el funcionamiento.

- Información de reparación y mantenimiento.
- Las condiciones especiales para la utilización segura:
  - Se deben tomar medidas, ya sea en el equipo o externamente a el, para proporcionar el dispositivo de protección transitoria a un nivel que no exceda el 140% del voltaje nominal máximo.
  - Solo se utilizarán fusibles de repuesto proporcionados por el fabricante. Póngase en contacto con el fabricante si es necesario reemplazar los fusibles.
  - Solo se deben utilizar prensaestopas y tapones con clasificación IP66 debidamente certificados.
- Se incluye un apartado con la lista de piezas que forman el panel.
- Se proporciona información adicional en la forma de los manuales de las diferentes partes utilizadas en el panel. Estos manuales no se incluyen ya que son extensos y no aportan información relevante al TFM.

El manual completo para el panel de control NICP se encuentra en el apartado 2.8.

#### 0.2.2.8 DECLARACIÓN UE DE CONFORMIDAD

El contenido de la declaración UE de conformidad se presenta íntegro a continuación:

1. Producto:

Network Interface Control Panel modelo NICP.

2. Nombre y dirección del fabricante:

COMPANY NAME  
 ADDRESS LINE 1  
 ADDRESS LINE 2  
 POST CODE  
 COUNTRY

3. La presente declaración de conformidad se expide bajo la exclusiva responsabilidad del fabricante.

4. Objeto de la declaración:

El panel de control de interfaz NICP está diseñado para ser instalado en un área clasificada como Zona 2 (ATEX Categoría 3) y está diseñado para interconectar cables Ethernet de cobre y datos en medios de fibra óptica. El panel NICP utiliza una envolvente certificada de acero inoxidable sin pintar, IP66, Ex eb (PTB 02 ATEX 1082 U) para instalar equipos y componentes eléctricos con certificación Ex. Dimensiones aproximadas son 600 mm (alto) x 780 mm (ancho) x 300 mm (fondo) con una sola puerta. El panel se suministra como una unidad completa, sin que el usuario final requiera ningún ensamblaje más que cablear el sistema. El NICP cuenta con 18 entradas M20 en la cara inferior de la envolvente.

5. El objeto de la declaración descrita anteriormente es conforme con la legislación de armonización pertinente de la Unión:

2014/34/EU (ATEX)	DIRECTIVA 2014/34/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO de 26 de febrero de 2014 sobre la armonización de las legislaciones de los Estados miembros en materia de aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas
2014/35/EU (LV)	DIRECTIVA 2014/35/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO de 26 de febrero de 2014 sobre la armonización de las legislaciones de los Estados miembros en materia de comercialización de material eléctrico destinado a utilizarse con determinados límites de tensión
2011/65/EU (RoHS)	DIRECTIVA 2011/65/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO de 8 de junio de 2011 sobre restricciones a la utilización de determinadas sustancias peligrosas en aparatos eléctricos y electrónicos

6. Referencias a las normas armonizadas pertinentes utilizadas, o referencias a las otras especificaciones técnicas respecto a las cuales se declara la conformidad:

Normas armonizadas ATEX aplicadas	
EN IEC 60079-0:2018	Atmósferas explosivas – Parte 0: Equipo – Requisitos generales
EN IEC 60079-7:2015+A1:2018	Atmósferas explosivas – Parte 7: Protección del equipo por seguridad aumentada "e"
EN IEC 60079-15:2019	Atmósferas explosivas – Parte 15: Protección del equipo por modo de protección "n"

7. Firmado

CIUDAD, 04/06/2024

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Director General en COMPANY NAME



## **0.3 DISEÑO DE UNA CAJA COMPONENTE ATEX CATEGORÍA 2 APLICANDO LOS MÉTODOS DE PROTECCIÓN DE SEGURIDAD AUMENTADA Y DE PROTECCIÓN DEL MATERIAL CONTRA LA INFLAMACIÓN DE POLVO POR ENVOLVENTE**

### **0.3.1 PLANTEAMIENTO**

El diseño y fabricación del panel de interfaz NICP ha evidenciado un problema común en el mundo de la fabricación de equipos para atmósferas explosivas, y es que debido a los grandes volúmenes de cajas certificadas que se requieren en el mercado, los fabricantes de estas cajas suelen tener plazos de entrega largos que normalmente oscilan entre las 12 y 18 semanas, pero que en ocasiones pueden llegar a ser cercanas al año.

Este problema pone en serios apuros a los fabricantes de equipos ATEX, ya que sus clientes no pueden permitirse esos largos tiempos de espera. Al final el cliente busca a la empresa que pueda fabricar el equipo en el menor tiempo posible.

Por este motivo, muchas empresas consideran diseñar y certificar sus propias cajas, consiguiendo de esta manera evitar este problema.

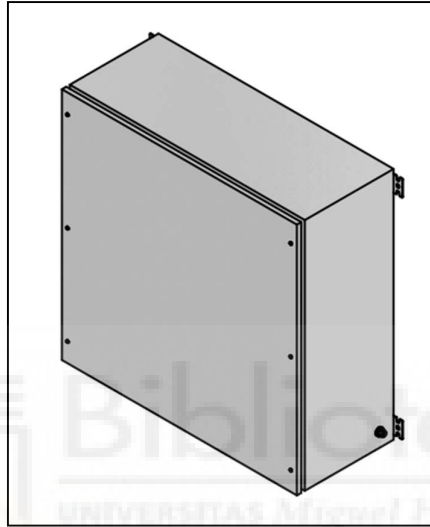
Hay que tener en cuenta que para que esta opción merezca la pena se deben vender un número relativamente elevado de cajas al año, especialmente si se quiere una caja para uso en zona 1, ya que para poder fabricarla también se requiere certificar el sistema de calidad de la empresa, lo que conlleva gastos adicionales asociados a las auditorías necesarias para la certificación del control de calidad y a las auditorías anuales necesarias para mantener la certificación.

En este caso, y basado en el trabajo realizado anteriormente y con pensamiento a ampliar la gama de paneles ofrecido, se decide diseñar una caja vacía para certificarla como un Componente EX, en conformidad con la Directiva 2014/34/UE y las normas EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 y EN 60079-31:2014, para uso en zona 1 (niveles de protección Gb y Db).

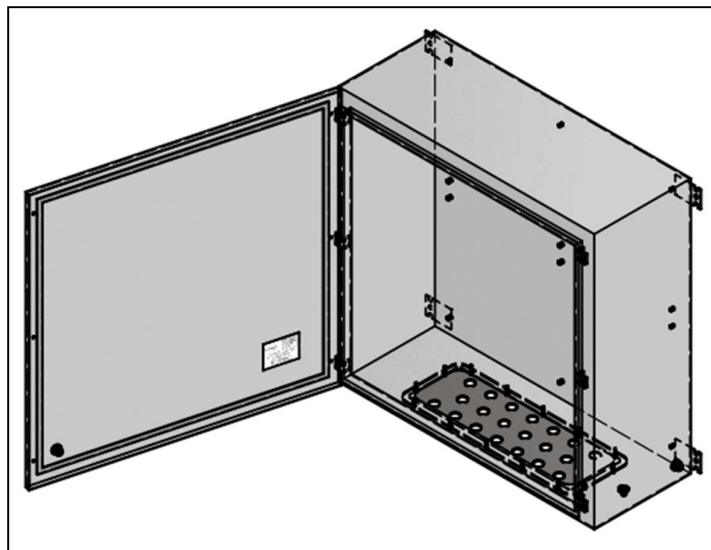
Puede observarse que se ha añadido la norma EN 60079-31:2014 (Parte 31: Protección del material contra la inflamación de polvo por envolverte "t"). Esta

es la norma con la que deben cumplir los equipos destinados a atmósferas explosivas de polvo. Es común que las cajas tengan la doble certificación para atmósferas de gas y polvo. Esta norma es relativamente corta y sencilla de aplicar, y solo introduce el requisito de que la caja debe ser IP6X, que se verifica por ensayo.

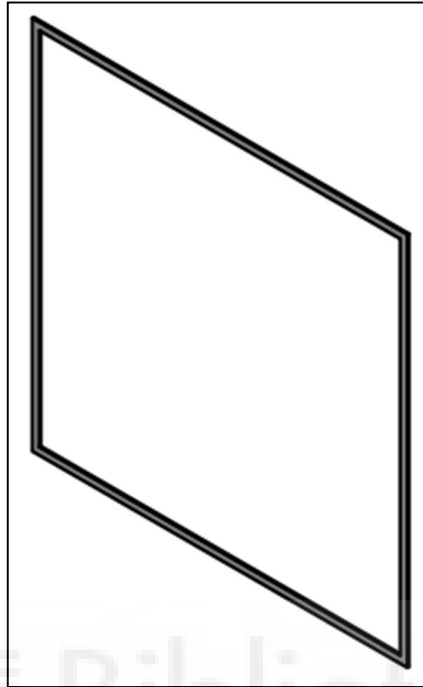
La caja será fabricada en acero inoxidable 316L, con dimensiones generales 800mm x 800mm x 330mm (H x L x D):



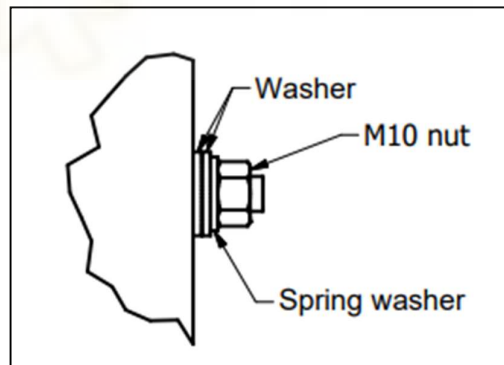
Constará de hasta 20 entradas para prensaestopas de tamaño M20 o M25, o una mezcla de ambos, a través de una tapa pasacables en la cara inferior de la caja:



Se usará una junta de silicona esponjosa HT-800 para sellar la puerta y la tapa pasacables, su adhesión al panel será por medio del adhesivo 'Sil-Poxy':



La caja contará con insertos de masa internos y externos para la conexión a tierra:



A continuación se resume el expediente técnico elaborado que se mandaría al Organismo Notificado elegido para su certificación, y se mencionan los aspectos importantes a tener en cuenta.



### 0.3.2 EXPEDIENTE TÉCNICO

El expediente técnico es ligeramente diferente en este caso, aunque sigue la misma estructura que en el caso anterior. Consta de un resumen de la información relevante para la certificación, planos de certificación, checklists de la Directiva y las normas (aunque incompletas, ya que los ensayos los realizará el Organismo Notificado), recopilación de datasheets de materiales, manual y certificado de conformidad (que no declaración UE de conformidad al ser un componente).

Una vez obtenida la certificación, tanto el certificado como el informe preparado por el Organismo Notificado formarán parte de este expediente técnico.

#### 0.3.2.1 DESCRIPCIÓN GENERAL DEL EXPEDIENTE TÉCNICO

Aquí se presenta la información destacada del equipo con respecto a la certificación del mismo:

- Se detalla el objeto de la certificación, que en este caso es la certificación de la caja vacía ENC\_V01 como Componente Ex de categoría 2 ATEX para uso en zona 1.
- Se dan los datos del fabricante:

COMPANY NAME

ADDRESS LINE 1

ADDRESS LINE 2

POST CODE

COUNTRY

- Se enumeran las normas aplicadas:

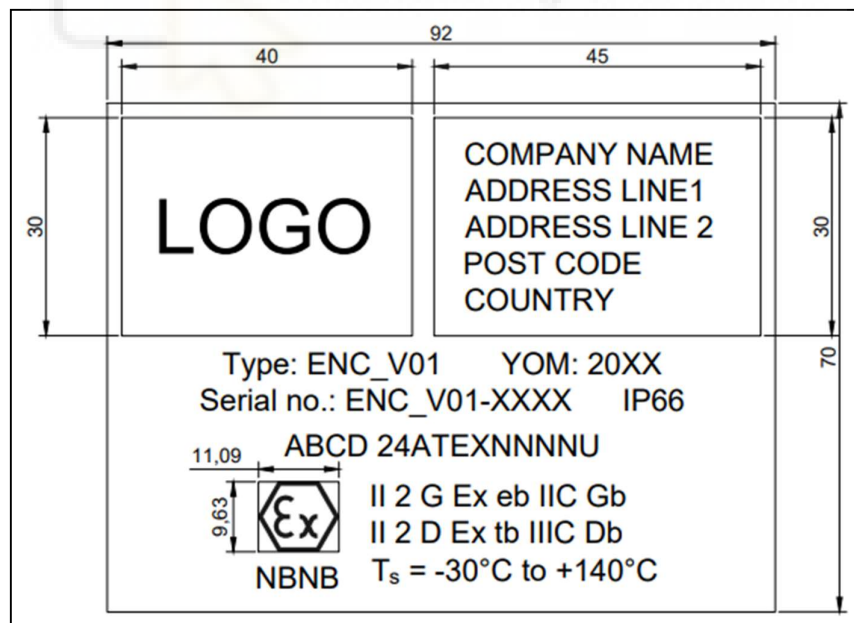
Directiva 2014/34/UE	Aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas
EN IEC 60079-0:2018	Atmósferas explosivas – Parte 0: Equipo – Requisitos generales
EN IEC 60079-7:2015+A1:2018	Atmósferas explosivas – Parte 7: Protección del equipo por seguridad aumentada "e"

EN 60079-31:2014	Atmósferas explosivas – Parte 31: Protección del material contra la inflamación de polvo por envolvente "t"
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- Se especifica el nombre del componente y su descripción: Caja vacía ENC\_V01.

La caja vacía ENC\_V01 es un Componente EX. Consiste de una caja con tapa con bisagras, construida enteramente de acero inoxidable 316L, que utiliza juntas de silicona esponjosa para mantener un nivel de protección de IP66. Sus dimensiones generales son 800mm x 800mm x 330mm (alto x ancho x profundo). Entrada a la caja es por medio de una tapa pasacables en la cara inferior de la caja, en la que pueden taladrarse hasta 20 agujeros para prensaestopas de tamaño M20 o M25, o una mezcla de ambos. La caja proporciona insertos de masa internos y externos en las paredes de la caja para conexión a tierra de tamaño M10. La caja tiene cuatro orejetas de fijación para montarla a la pared o estructura metálica.

- Se muestra el marcado que lleva el componente.



Al estar en la fase previa a la certificación por el Organismo Notificado, elementos como el número del certificado o el número identificativo del Organismo Notificado encargado de evaluar la calidad se dejan sin completar

(ABCD 24ATEXNNNU y NBNB). El número del certificado lleva la letra “U” al final, lo que indica que es un componente (no es un equipo terminado) y que requiere de más evaluación cuando vaya a ser usado en una aplicación.

- Se proporciona una lista de los planos de certificación.

Título	Número	Revisión	Fecha
ENC_V01 – GENERAL ARRANGEMENT	ENC_V01-GA-001	A	17.06.2024
ENC_V01 – OPEN ENCLOSURE	ENC_V01-OE-001	A	17.06.2024
ENC_V01 – ENCLOSURE BODY	ENC_V01-EB-001	A	17.06.2024
ENC_V01 – ENCLOSURE COVER	ENC_V01-EC-001	A	17.06.2024
ENC_V01 – GLAND PLATE	ENC_V01-GP-001	A	17.06.2024
ENC_V01 – COVER GASKET	ENC_V01-CG-001	A	17.06.2024
ENC_V01 – GLAND PLATE GASKET	ENC_V01-GG-001	A	17.06.2024
ENC_V01 – HINGE SUPPORT	ENC_V01-HS-001	A	17.06.2024
ENC_V01 – COVER HINGE	ENC_V01-CH-001	A	17.06.2024
ENC_V01 – MARKING LABEL	ENC_V01-ML-001	A	17.06.2024

- Limitaciones de certificación. Estas equivalen a las condiciones especiales para la utilización segura de los certificados de los equipos, pero se les llama limitaciones de certificación cuando se les aplica a un Componente Ex. En el caso de la caja vacía se prevé que sean:
  - La instalación de componentes eléctricos en la caja requiere de evaluación adicional por parte de un organismo notificado.
  - Sólo se deben utilizar prensaestopas y tapones ciegos debidamente certificados y con clasificación IP66.

Otras limitaciones pueden ser necesarias. La lista se actualizará en función de lo que determine la evaluación que realice el Organismo Notificado.

- Condiciones de fabricación. Estas son condiciones que solo atañen al fabricante. En este caso, al ser la caja un Componente, el marcado debe realizarse únicamente de forma interna. Esto queda reflejado en la siguiente condición de fabricación:
  - The ENC\_V01 empty enclosure shall only be marked internally.
- Conclusión en la que se establece que el panel de control NICKP cumple con la Directiva 2014/34/UE. La conclusión, en este caso, no se deja cerrada, ya que queda a expensas de que la certificación sea satisfactoria. Una vez obtenida la certificación se actualizará la conclusión.

### 0.3.2.2 PLANOS

Los planos elaborados contienen la información necesaria desde el punto de vista de la certificación. Cabe destacar que no son planos de fabricación, ya que los planos de fabricación contienen información innecesaria para la certificación.

Los planos muestran:

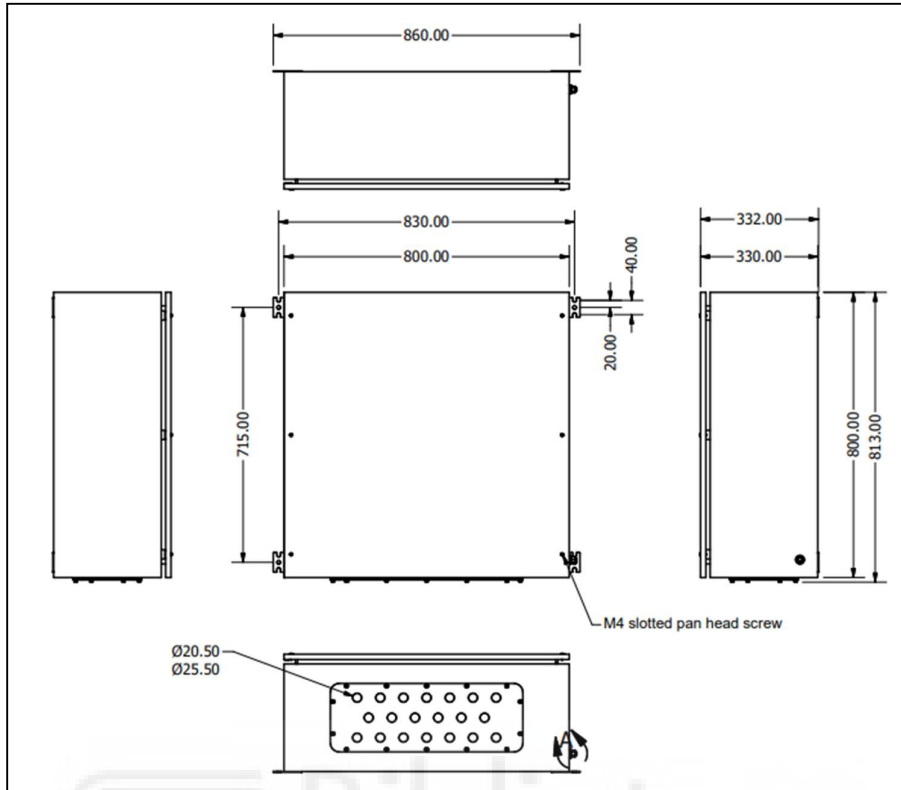
- Una vista general externa de la caja en la que se detallan medidas globales y detalle del inserto de masa externo.
- Una vista general interna donde se muestra la caja con la puerta abierta, se muestra el detalle del inserto de masa interno y la ubicación de la placa de marcado que para las cajas componentes debe ser fijada internamente.

- Planos más detallados de la caja, tapa y tapa pasacables con medidas.
- Planos de las juntas de silicona donde se establecen las medidas y las características del material.
- Planos de las bisagras de la puerta.
- Plano de la placa de marcado con la información necesaria e incluyendo un número de certificado y el número del Organismo Notificado con el cual se tiene el certificado de la calidad de la producción.

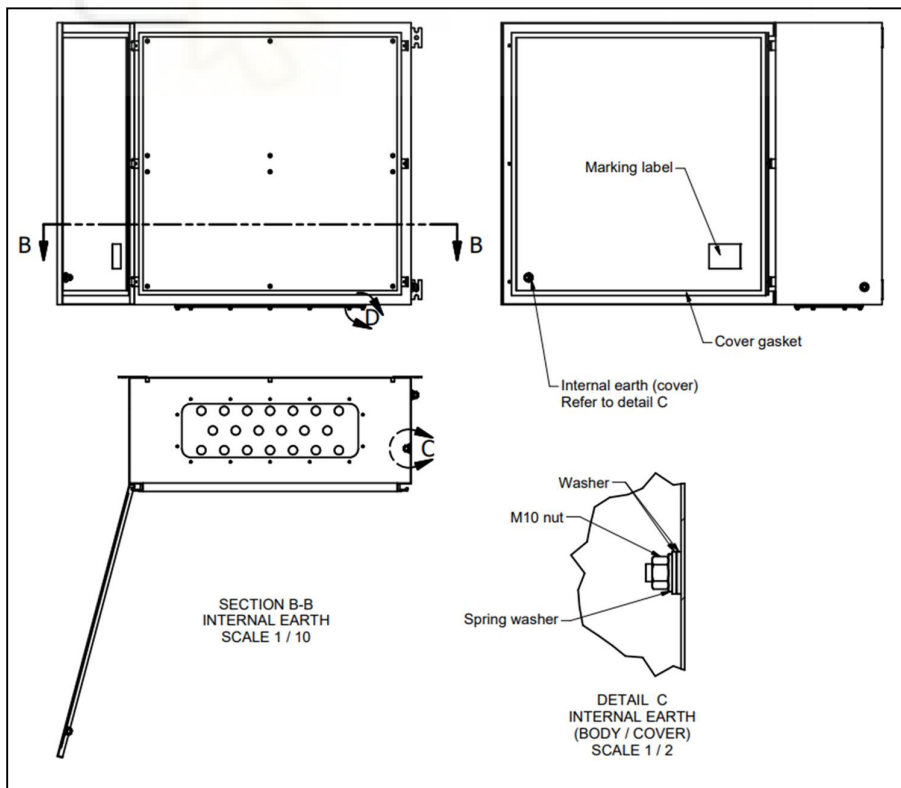
La lista de planos se muestra a continuación:

Title	Drawing	Rev.	Date
ENC_V01 – GENERAL ARRANGEMENT	ENC_V01-GA-001	A	17.06.2024
ENC_V01 – OPEN ENCLOSURE	ENC_V01-OE-001	A	17.06.2024
ENC_V01 – ENCLOSURE BODY	ENC_V01-EB-001	A	17.06.2024
ENC_V01 – ENCLOSURE COVER	ENC_V01-EC-001	A	17.06.2024
ENC_V01 – GLAND PLATE	ENC_V01-GP-001	A	17.06.2024
ENC_V01 – COVER GASKET	ENC_V01-CG-001	A	17.06.2024
ENC_V01 – GLAND PLATE GASKET	ENC_V01-GG-001	A	17.06.2024
ENC_V01 – HINGE SUPPORT	ENC_V01-HS-001	A	17.06.2024
ENC_V01 – COVER HINGE	ENC_V01-CH-001	A	17.06.2024
ENC_V01 – MARKING LABEL	ENC_V01-ML-001	A	17.06.2024

- El plano ENC\_V01-GA-001 proporciona una vista general externa de la caja en la que se detallan medidas globales y en que queda registrada información como el contenido máximo de metales ligeros, el número máximo de entradas, el acabado...

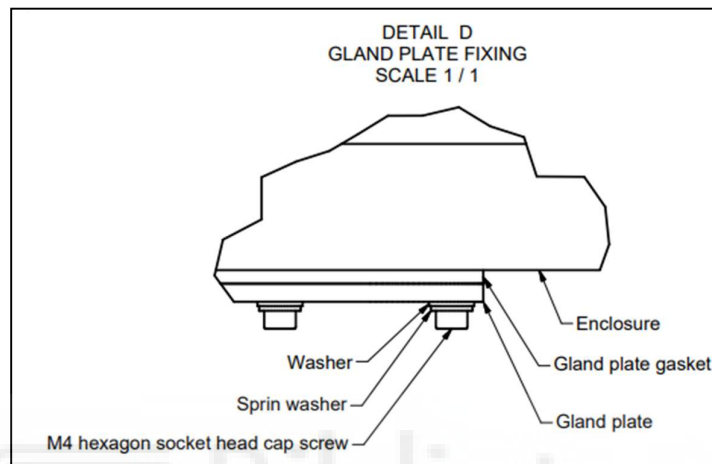


- El plano ENC\_V01-OE-001 proporciona vistas de la caja con la tapa abierta, para mostrar la ubicación de la toma de tierra y placa de marcado:

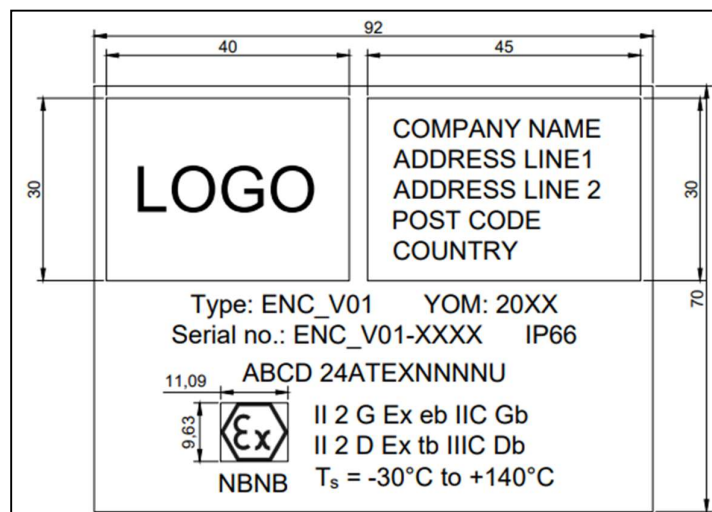


En este plano que constancia del adhesivo usado para la fijación de las juntas de silicona y de sus características relevantes para la certificación, y muestra el método de fijación de la tapa pasacables a la cara inferior de la caja:

2. The following adhesive is used to secure the gaskets to the cover and gland plate:  
 - Name or registered trademark: Smooth-On  
 - Identification: Sil-Poxy  
 - Continuous operating temperature: -41°C to +260°C



- Los planos ENC\_V01-EB-001, ENC\_V01-EC-001, ENC\_V01-GP-001, ENC\_V01-CG-001, ENC\_V01-GG-001, ENC\_V01-HS-001 y ENC\_V01-CH-001 muestran en detalle las dimensiones de las partes que forman la caja: base, tapa, tapa pasacables, juntas y bisagras.
- El plano ENC\_V01-ML-001 detalla la placa de marcado ATEX. Contiene la información requerida por las normas y la Directiva 2014/34/UE, y estipula el material y tamaño:



### 0.3.2.3 CHECKLISTS DE CONFORMIDAD

Para determinar si la caja ha sido diseñada en conformidad con la Directiva 2014/34/UE hay que evaluar el producto con respecto a los requisitos esenciales de salud y seguridad del anexo II de la Directiva. Estos requisitos están redactados de forma genérica, por lo que la práctica común es aplicar normas armonizadas ATEX que proporcionan presunción de conformidad con los requisitos de la Directiva.

En el caso de la caja hemos aplicado las siguientes normativas:

- EN IEC 60079-0:2018 – Atmósferas explosivas – Parte 0 – Requisitos generales.
- EN IEC 60079-7:2015+A1:2018 – Atmósferas explosivas – Parte 7: Protección del equipo por seguridad aumentada "e".
- EN 60079-31:2014 – Atmósferas explosivas – Parte 31: Protección del material contra la inflamación de polvo por envolvente "t".

En este caso se han elaborado checklists para las tres normas, y se han rellenado al máximo posible con la información de la que se dispone, intentando así evitar sorpresas cuando se proceda a la certificación con un Organismo Certificado. Hay que tener en cuenta que para algunas cláusulas no se puede proporcionar una justificación para la conformidad, ya que parte de la evaluación será realizada por el Organismo Notificado. El veredicto de estas cláusulas se ha dejado como **TBC** (To Be Confirmed). Es el caso, por ejemplo, de la cláusula 5.2.de EN IEC 60079-0:2018:

Cláusula	Requerimiento – Test	Resultado – Observación	Veredicto
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5.2	Service temperature (Temperatura de servicio)	<p>A service temperature range of -30°C to +140°C has been selected based on experience and on the COTs of the silicone gasket and adhesive.</p> <p>(Se ha elegido un rango de temperatura de servicio de -30°C to +140°C, basado en las temperaturas de funcionamiento continuo de los materiales no metálicos empleados y en la experiencia adquirida en otros proyectos).</p> <p>To be confirmed by test.</p>	TBT
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Para esta evaluación también se ha elaborado una checklist evaluando la conformidad con respecto a los requisitos esenciales de salud y seguridad del anexo II de la Directiva. Se ha completado considerando que la caja es certificada, y se usan las normas aplicadas como justificación de la conformidad. Si algún requisito no es cubierto por las normas, entonces se evalúa en esta checklist.

A continuación se muestra la evaluación de una cláusula de cada norma como ejemplo. La evaluación completa se encuentra en el apartado 3.4 de este documento.

La norma EN IEC 60079-0:2018, como su nombre indica, trata aspectos generales de cualquier tipo de producto. La cláusula que se muestra es la 6.5:

- Cláusula 6.5 – Retención de juntas:

Esta cláusula evalúa el método de fijación de una junta que va a ser abierta durante la instalación del equipo y sobre la que dependa el nivel de protección. Nos dice que deberá permanecer unida a una de las caras, y que esto se comprobará durante la realización de los ensayos. También indica que si se usa un adhesivo para la fijación, este debe cumplir los requisitos para cementos de

la cláusula 7.1.2.4 y ser usado dentro de los límites de su temperatura de funcionamiento continuo.

**6.5 Gasket retention**

Where the degree of protection provided by the enclosure depends on a gasketed joint which is intended to be opened during installation or in normal operation, gaskets shall be attached or secured to one of the mating faces to prevent loss, damage or incorrect assembly. The gasket material shall not itself adhere to the other joint face. When the joint is opened and re-closed prior to the tests for degree of protection by enclosure, it shall be verified that the gasket material remains attached or secured, and has not adhered to the other joint face. (See 26.4.1.2).

If an adhesive is used to secure the gasket, the adhesive shall comply with the requirements for cements given in 7.1.2.4 and used within its COT.

**7.1.2.4 Materials used for cementing**

The specification for cements shall include the following:

- a) the name or registered trademark of the cement manufacturer;
- b) the identification of the material, including its type designation;
- c) the continuous operating temperature (COT);

The source of the data for these characteristics shall be identified.

<b>EN IEC 60079-0:2018</b>			
<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
6.5	Retención de juntas	<p>El nivel de protección proporcionado por la caja depende de la correcta fijación de dos juntas de silicona, una en la tapa de la caja y otra en la tapa pasacables.</p> <p>Su fijación es mediante adhesivo. El adhesivo cumple con los requisitos de cementos de la cláusula 7.1.2.4 y es usado dentro de los límites de su temperatura de funcionamiento continuo.</p>	Pass

EN IEC 60079-0:2018			
Cláusula	Requerimiento – Test	Resultado – Observación	Veredicto
7.1.2.4	Cementos	<p>El adhesivo usado para fijar las juntas de silicona es evaluado como cemento.</p> <p>Queda constancia de la siguiente información en el plano ENC_V01-OE-001:</p> <p>a) Nombre o marca registrada: Smooth-On</p> <p>b) Identificación: Sil-Poxy</p> <p>c) Temperature de funcionamiento continuo: -41°C to +260°C</p> <p>Se ha guardado una copia de la datasheet del adhesivo de la cual se ha extraído esta información en el expediente técnico de la caja ENC_V01.</p>	Pass

La información del adhesivo se encuentra en la nota 2 del plano ENC\_V01:

NOTES:
1. Cover and gland plate gasket material is HT 800 silicone foam. Refer to drawings ENC_V01-CG-001 and ENC_V01-GG-001 for details.
2. The following adhesive is used to secure the gaskets to the cover and gland plate: - Name or registered trademark: Smooth-On - Identification: Sil-Poxy - Continuous operating temperature: -41°C to +260°C
3. Marking label shall only be fitted internally to the cover.

Para la evaluación completa de la norma EN IEC 60079-0:2018 diríjase a la sección 3.4.1.

La norma EN IEC 60079-7:2015+A1:2018, protección del equipo por seguridad aumentada “e”, se basa en dos principios fundamentales:

1. Arcos, chispas y superficies calientes se evitan a través del diseño del producto, y
2. La envolvente del producto tiene un nivel de protección mínimo de IP54.

A continuación se muestra un ejemplo de las cláusulas evaluadas:

- Cláusula 4.10 – Nivel de protección proporcionado por la envolvente:

Esta cláusula define los requisitos en cuanto al nivel de protección que debe de proporcionar la envolvente del producto en función de sus características. En el caso de la caja vacía, se requiere que la caja proporcione IP54 como mínimo aunque el objetivo es conseguir IP66:

<p><b>4.10 Degrees of protection provided by enclosures</b></p> <p><b>4.10.1</b> The degrees of protection as defined in tests of enclosures of IEC 60079-0 , as applicable, shall be as prescribed in a), b), or c) unless otherwise specified in 4.10.2, 4.10.3, or Clause 5. For Level of Protection "ec", the tests of enclosures requirements of IEC 60079-0 are modified for the thermal endurance to heat preconditioning test to replace the 20 K above the service temperature (<math>T_s + 20</math> K) with 10 K above the service temperature (<math>T_s + 10</math> K).</p> <p>a) Enclosures containing bare conductive live parts shall provide at least the degree of protection IP54.</p> <p>b) Enclosures containing only insulated conductive live parts as in 4.6 shall provide at least the degree of protection IP44.</p> <p>c) Enclosures for containing only insulated conductive live parts as in 4.6, can provide a reduced degree of protection of IP23 for Group I, or IP20 for Group II, if solid foreign bodies are prevented from falling vertically through any openings into the enclosure. For this equipment, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall detail the degree of protection provided by enclosure and provide guidance on the protection by location that is required. An example of an application where this reduced degree of protection could be suitable is a clean environment.</p> <p>For Level of Protection "ec", opening of the enclosure for maintenance purposes, is not considered normal operation, and the opening times requirement of IEC 60079-0 does not apply.</p>
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La conformidad con esta cláusula se demuestra a través de ensayo, que será llevado a cabo por el Organismo Notificado. Por lo tanto, se evalúa hasta donde se puede y se deja abierta:

EN IEC 60079-7:2015+A1:2018			
Cláusula	Requerimiento – Test	Resultado – Observación	Veredicto
4.10.1	Requisitos de la envolvente	<p>Los ensayos para determinar el nivel de protección por envolvente serán realizados por el Organismo Notificado encargado de realizar la certificación de la caja ENC_V01.</p> <p>El objetivo es conseguir IP66, aunque IP54 sería suficiente para cumplir los requisitos de esta norma.</p> <p>To be confirmed by test.</p>	TBT

La norma EN 60079-31:2014, protección del material contra la inflamación de polvo por envolvente "t", se basa en impedir que polvo potencialmente inflamable penetre en la envolvente en la que se encuentran instalados componentes eléctricos, evitando de esta manera el riesgo de ignición. Para ello se usa una envolvente herméticamente sellada.

A continuación se muestra un ejemplo de las cláusulas evaluadas:

- Cláusula 5.3.1 – Entradas simples:

Esta cláusula define los requisitos con los que deben cumplir las entradas simples al equipo. El diámetro de los agujeros para entradas simples no será más de 0.7 mm mayor que el diámetro nominal de las prensaestopas usadas.

<p><b>5.3.1 Plain entries</b></p> <p>The clearance holes for plain entries shall have a diameter not more than 0,7 mm greater than the nominal diameter of the entry thread gland or fitting. The inside of the enclosure shall be provided with sufficient room to attach a locknut to the gland or fitting.</p>
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<b>EN IEC 60079-7:2015+A1:2018</b>			
<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
5.3.1	Entradas simples	<p>Las entradas simples son a través de una placa en la cara inferior de la caja.</p> <p>El plano ENC_V01_GP-001 indica que el diámetro de los agujeros puede ser 20.5mm para prensaestopas tamaño M20 o 25.5 mm para prensaestopas tamaño M25, por lo que no son más de 0.7mm mayor que el diámetro nominal de las prensaestopas usadas.</p>	Pass

Al igual que con el panel de control NICP, conformidad con la Directiva 2014/34/UE se consigue aplicando las normas anteriores:

<b>DIRECTIVA 2014/34/EU – REQUISITOS ESENCIALES DE SEGURIDAD Y SALUD (ANEXO II)</b>			
<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
1	Requisitos comunes relativos a los aparatos y a los sistemas de protección		
1.0.1	Principios de integración de la seguridad frente a las explosiones	Cubierto por EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 y EN 60079-31:2014.	Pass

**DIRECTIVA 2014/34/EU – REQUISITOS ESENCIALES DE SEGURIDAD Y SALUD (ANEXO II)**

<b>Cláusula</b>	<b>Requerimiento – Test</b>	<b>Resultado – Observación</b>	<b>Veredicto</b>
1.2.4	Formación de polvo	Cubierto por EN IEC 60079-0:2018 y EN 60079-31:2014.	Pass

**0.3.2.4 DATASHEETS DE LOS MATERIALES**

Como parte del expediente técnico que se envíe al Organismo Notificado para la certificación de la caja, se deberán incluir las datasheets de los materiales empleados. En nuestro caso, los materiales críticos para la certificación son:

- Caja: acero inoxidable 316L.
- Juntas: silicona esponjosa HT-800. Para este material se dan dos opciones del mismo, pero de diferentes fabricantes.
- Adhesivo: Sil-Poxy Smooth-On.

Las normas nos indican que estos materiales deben estar controlados, y la manera de hacerlo es añadiendo la información a los planos. Lo ideal sería enumerar múltiples opciones de material para las juntas y el adhesivo, ya que puede darse el caso de que en algún momento alguno no esté disponible en el mercado. Pero hay que tener en cuenta que cada material que se especifique tendrá que ser sometido a los ensayos que correspondan, por lo que incluir muchas opciones puede dar flexibilidad a la hora de fabricar la caja, pero encarece de forma muy considerable el ejercicio de certificación.

Las copias de las datasheets se encuentran en el apartado 3.5 de este documento.

**0.3.2.5 ENSAYOS**

Aunque los ensayos en este caso sean responsabilidad del Organismo Notificado, es aconsejable considerar cuáles van a ser realizados y cuantas muestras harán falta.

La evaluación realizada en las checklists nos indica que para la certificación de la caja será necesario realizar los siguientes ensayos:

- Acondicionamiento térmico (calor y frío). Mínimo 2 muestras, recomendable 4 muestras.
- Impacto (calor y frío). Mínimo 2 muestras, recomendable 4 muestras.
- Presión positiva. 1 muestra.
- IP66. Mínimo 1 muestra.

Se decide preparar 4 muestras, que servirán para realizar todos los ensayos enumerados anteriormente.

Cabe destacar que aunque normativamente solo sea necesario el ensayo de IP6X, comercialmente es preferible tener IP66, ya que es la norma en este tipo de producto y no tenerla sería una desventaja comercial con respecto a los competidores.

#### 0.3.2.6 MANUAL

Al igual que para el panel de interfaz, los componentes también deben ir acompañados de un manual, aunque al no ser un producto terminado el contenido de estas es ligeramente diferente. En este caso también es la norma EN IEC 60079-0 la que establece la información mínima que debe contener, con la norma EN IEC 60079-7 añadiendo algún requisito extra. La norma EN 60079-31 no añade ningún requisito en cuanto al manual se refiere. La información requerida y contenida en el manual preparado es:

- Descripción del producto.
- Especificaciones del producto: modelo, peso, tamaño, marcado ATEX y rango de temperatura de servicio.
- Una copia de la placa de marcado.
- Información sobre la instalación: método de fijación e información sobre la conexión a tierra.
- Información de reparación y mantenimiento.
- Las limitaciones de certificación, que tras la evaluación realizada se anticipa que sean:
  - Installation of electrical components requires a further assessment by a Notified Body.



- Only suitably certified IP66 rated cable glands and blanking elements shall be used.

Estas pueden cambiar o alguna más ser añadida por el Organismo Notificado si lo creen necesario.

#### 0.3.2.7 CERTIFICADO DE CONFORMIDAD

Los componentes deben ir acompañados por un Certificado de Conformidad, no por una Declaración UE de Conformidad, ya que no son un producto acabado en el sentido expresado en la Directiva 2014/34/UE. A continuación se muestra el contenido del Certificado de Conformidad elaborado para la caja vacía ENC\_V01:

1. Producto:

Caja Vacía ENC\_V01.

2. Nombre y dirección del fabricante:

COMPANY NAME  
ADDRESS LINE 1  
ADDRESS LINE 2  
POST CODE  
COUNTRY

3. El presente certificado de conformidad se expide bajo la exclusiva responsabilidad del fabricante.

4. Objeto del certificado:

La caja vacía ENC\_V01 es un Componente EX. Consiste de una caja con tapa con bisagras, construida enteramente de acero inoxidable 316L, que utiliza juntas de silicona esponjosa para mantener un nivel de protección de IP66. Sus dimensiones generales son 800mm x 800mm x 330mm (alto x ancho x profundo). Entrada a la caja es por medio de una tapa pasacables en la cara inferior de la caja, en la que pueden taladrarse hasta 20 agujeros para prensaestopas de tamaño M20 o M25, o una mezcla de ambos. La caja proporciona insertos de masa internos y externos en las paredes de la caja para conexión a tierra de tamaño M10. La caja tiene cuatro orejetas de fijación para montarla a la pared o estructura metálica.

La instalación de componentes eléctricos requiere de evaluación adicional por un Organismo notificado.

5. El objeto del certificado de conformidad descrito anteriormente es conforme con la legislación de armonización pertinente de la Unión:

2014/34/UE (ATEX)	DIRECTIVA 2014/34/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO de 26 de febrero de 2014 sobre la armonización de las legislaciones de los Estados miembros en materia de aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas
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6. Referencias a las normas armonizadas pertinentes utilizadas, o referencias a las otras especificaciones técnicas respecto a las cuales se declara la conformidad:

Normas armonizadas ATEX aplicadas	
EN IEC 60079-0:2018	Atmósferas explosivas – Parte 0 – Requisitos generales
EN IEC 60079-7:2015+A1:2018	Atmósferas explosivas – Parte 7: Protección del equipo por seguridad aumentada "e"
EN 60079-31:2031	Atmósferas explosivas – Parte 31: Protección del material contra la inflamación de polvo por envoltente "t".

7. Certificado de tipo UE:

- Certificate: NoBo 24ATEXNNNNU
- QAN: NoBo 24ATEXQNNN
- Notified Body number: NBNB

8. Firmado

CIUDAD, 04/06/2024

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Director General en COMPANY NAME



# **1 INTRODUCTION TO EXPLOSIVE ATMOSPHERES** **(ATEX)**

## **1.1 EXPLOSIVE ATMOSPHERES – ATEX**

ATEX generally refers to the hazard of explosive atmospheres occurring in the workplace due to the presence of flammable gases or combustible dust mixed in air, which can give rise to the risk of explosion.

ATEX stands for ATmosphère EXplosibles and refers to two European Directives that relate to hazardous areas:

- Directive 99/92/EC, also known as 'ATEX 137' or the 'ATEX Workplace Directive'. This Directive covers the health and safety of workers.
- Directive 2014/34/EU (formerly 94/9/CE), also known as 'ATEX 114' or 'the ATEX Equipment Directive'. This Directive covers the manufacture of hazardous area equipment.



### **1.1.1 DIRECTIVE 1999/92/EC ('137') 'WORKER PROTECTION' DIRECTIVE**

This directive covers the health and safety of workers in their workplace. Each EU country is required to put this Directive into national law. For illustration purposes, Spanish law (REAL DECRETO 681/2003, de 12 de junio) will be used. This is a technical guide for the evaluation and prevention of the risks derived from explosive atmospheres in the workplace.

REAL DECRETO 681/2003, de 12 de junio, places responsibility with employers and the self-employed to carry out a risk assessment of their workplace to identify the risks from fires or explosions and to take preventive measures in an order of priority.

The articles of REAL DECRETO 681/2003, de 12 de junio, have been briefly summarised below:

- Article 1: object and scope of application. The object of this royal decree, within the framework of Law 31/1995 of prevention of occupational hazards, is to establish the minimum provisions for the health and safety of workers that could find themselves exposed to the risks derived from explosive atmospheres in the workplace.
- Article 2: definitions. This article provides definitions for terms used throughout the document. For example, it defines an explosive atmosphere as a mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture.
- Article 3: prevention and protection against explosions. The decree stipulates that the employer shall take technical and/or organisational measures appropriate to the nature of the operation, in order of priority and in accordance with the following principles:
  - The prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow that,
  - The avoidance of the ignition of the explosive atmosphere, and

- The mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers.
- Article 4: risk assessment of explosions. The employer shall assess the specific risks arising from explosive atmospheres, taking account at least of:
  - the likelihood that explosive atmospheres will occur and their persistence,
  - the likelihood that ignition sources, including electrostatic discharges, will be present and become active and effective,
  - the installations, substances used, processes, and their possible interactions,
  - the scale of the anticipated effects.

Explosion risks shall be assessed overall.

Places which are or can be connected via openings to places in which explosive atmospheres may occur shall be taken into account in assessing explosion risks.

- Article 5: general obligations. To ensure the safety and health of workers, and in accordance with the basic principles of risk assessment and those laid down in Articles 3 and 4, the employer shall take the necessary measures so that:
  - where explosive atmospheres may arise in such quantities as to endanger the health and safety of workers or others, the working environment is such that work can be performed safely,
  - in working environments where explosive atmospheres may arise in such quantities as to endanger the safety and health of workers, appropriate supervision during the presence of workers is ensured in accordance with the risk assessment by the use of appropriate technical means.

- Article 6: duty of coordination. Where workers from several undertakings are present at the same workplace, each employer shall be responsible for all matters coming under his control.

Without prejudice to the individual responsibility of each employer, the employer responsible for the workplace in accordance with national law and/or practice shall coordinate the implementation of all the measures concerning workers' health and safety and shall state, in the explosion protection document referred to in Article 8, the aim of that coordination and the measures and procedures for implementing it.

- Article 7: areas in which explosive atmospheres can form. The three points listed below are covered by the decree:
  1. The employer shall classify places where explosive atmospheres may occur into zones in accordance with Annex I.
  2. The employer shall ensure that the minimum requirements laid down in Annex II are applied to places covered by paragraph 1.
  3. Where necessary, places where explosive atmospheres may occur in such quantities as to endanger the health and safety of workers shall be marked with signs at their points of entry in accordance with Annex III.
- Article 8: explosion protection document (DPCE). In carrying out the obligations laid down in Article 4, the employer shall ensure that a document, hereinafter referred to as the 'explosion protection document', is drawn up and kept up to date. The explosion protection document shall demonstrate in particular:
  - that the explosion risks have been determined and assessed,
  - that adequate measures will be taken to attain the aims of this Directive,
  - those places which have been classified into zones in accordance with Annex I,
  - those places where the minimum requirements set out in Annex II will apply,

- that the workplace and work equipment, including warning devices, are designed, operated and maintained with due regard for safety,
- that in accordance with Council Directive 89/655/EEC (1), arrangements have been made for the safe use of work equipment.

The explosion protection document shall be drawn up prior to the commencement of work and be revised when the workplace, work equipment or organisation of the work undergoes significant changes, extensions or conversions.

The employer may combine existing explosion risk assessments, documents or other equivalent reports produced under other Community acts.

Documentation can be used to ensure a plant runs safely and to demonstrate compliance with the health and safety requirements.

Documentation should include at least:

- area classification of site
- location of all certified equipment
- marking of all certified equipment
- special conditions of certification (if any), Inspection frequency
- maintenance requirements and records
- justification for deviations from Code of Practice



### **1.1.2 DIRECTIVE 2014/34/EU ('114') 'PRODUCT' DIRECTIVE**

Spanish law adopted the requirements of Directive 2014/34/EU by means of the publication of Real Decreto 144/2016, de 8 de abril, which establishes the essential health and safety requirements demanded of equipment and protective systems intended for use in potentially explosive atmospheres.

This Directive applies to:

- equipment and protective systems intended for use in potentially explosive atmospheres;
- safety devices, controlling devices and regulating devices intended for use outside potentially explosive atmospheres but required for or contributing to the safe functioning of equipment and protective systems with respect to the risks of explosion;
- components intended to be incorporated into equipment and protective systems referred to in point (a)

The different parts of Directive 23014/34/EU are touched upon throughout the document, so a summary has not been considered necessary in this section.

## 1.2 PROPERTIES OF FLAMMABLE MATERIALS

### 1.2.1 COMBUSTION

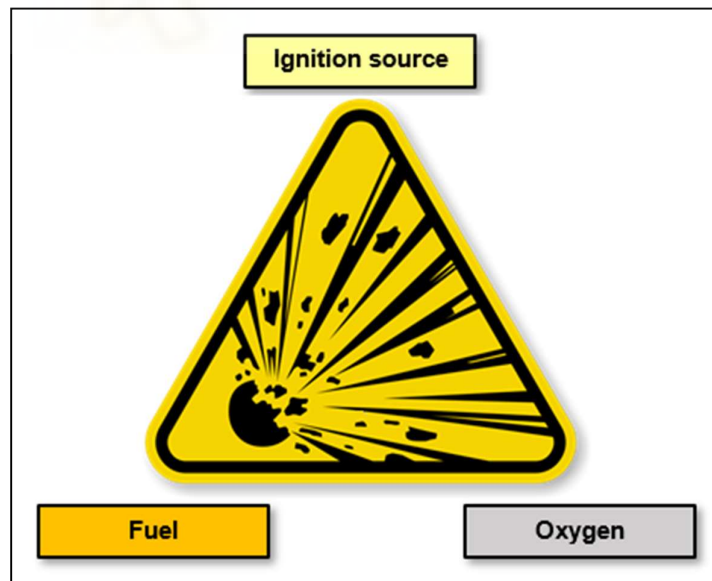
Combustion ('burning') does not take place unless sufficient energy is supplied to start the reaction. An ignition source such as a spark, flame or hot surface can provide this energy.

Combustion is an exothermic ('heat-producing') reaction between a substance and an 'oxidising agent'. The only 'oxidising agent' considered for equipment is the oxygen in air under normal atmospheric conditions:

- 20.9% vol./vol. oxygen in air
- -20°C to +60°C (although temperatures outside this range are frequently quoted, subject to assessment)
- 0.8 bar to 1.1 bar

If the fuel particles are finely divided, then they are able to mingle very intimately with oxygen and, if an energy source is supplied, then any reaction between the fuel and oxygen could be extremely rapid.

### 1.2.2 FIRE TRIANGLE



The three requirements for a fire are often represented by the fire triangle:

- Fuel

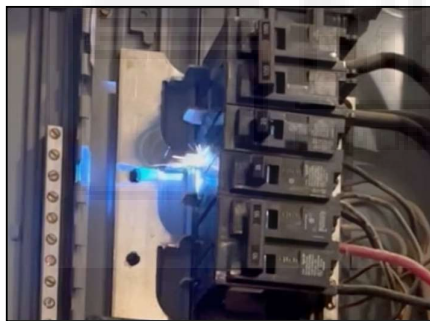
- Air
- ignition source

A number of protection methods used for 'Ex' equipment relies on removing one of the three. Equipment must be able to operate safely in the presence of a flammable fuel/air mixture, which may be inside the equipment, without igniting it. Intrinsic safety and increased safety use this principle, for example.

Very rarely, normal ambient temperature, without further heating, supplies sufficient heating to start the ignition process. Phosphorus is an example. Such materials are known as 'pyrophoric' and require special measures, so are not considered further.

### 1.2.3 SOURCES OF IGNITION

To ignite a fuel/air mixture, energy must be added. The two most common ignition mechanisms are sparks and hot surfaces.



European standard EN 1127-1 lists the following potential ignition sources:

1. Hot surfaces
2. Flames
3. Mechanically generated sparks
4. Electrical equipment
5. Stray electric currents, cathodic corrosion protection
6. Static electricity
7. Lightning
8. Radio frequency (RF) electromagnetic waves from 104 - 3 x 10<sup>12</sup> Hz

9. Electromagnetic waves from  $3 \times 10^{11}$  Hz to  $3 \times 10^{15}$  Hz (e.g. lasers)
10. Ionizing radiation
11. Ultrasonic radiation
12. Adiabatic compression and shock waves
13. Exothermic reactions, including self-ignition of dusts

Some are obvious and some are rare but need to be considered, even if only so that they can be eliminated as an ignition hazard.

However, for most situations, the list of 13 reduces to just two 'enemies': sparks and hot surfaces.

#### **1.2.4 FLASHPOINT**

At absolute zero ( $-273^{\circ}\text{C}$ ), nothing moves! As the temperature increases, solids melt and a liquid forms. As it rises further, the liquids give off more and more vapour. Eventually, there is enough vapour to form a flammable mixture with air, this is the "flashpoint".

The flashpoint of a liquid is the minimum temperature, under standard test conditions, at which a liquid produces enough vapour to form a flammable mixture with air.

Not all liquids vaporise enough to form a flammable mixture at ambient temperature, so flashpoint is a useful guide to the liquid's volatility (how easily a liquid vaporises).

The term 'flashpoint' is applied specifically to flammable liquids. A material which is handled, stored or processed at temperatures below the flashpoint will apparently be non-flammable because not enough vapour is produced to form a flammable mixture with air. However, if the liquid passes through a jet, a flammable mist could be formed even if the temperature is below the flashpoint, so care is required when using flashpoints.

Thus, the vapour from diesel, with a flashpoint of about  $55^{\circ}\text{C}$ , would not form a flammable mixture if it were to spill, whereas a pool of gasoline (petrol), with a flashpoint of around  $-45^{\circ}\text{C}$  will invariably be at a temperature where it produces enough vapour to form a flammable mixture.

Some alcoholic beverages, such as brandy, contain too much water to be ignitable at room temperature, but heat it and apply a match.... and it ignites!

Note also that a liquid with a flashpoint above the ambient temperature absorbed onto clothing or lagging that has a wicking effect could catch fire if ignited.

The flashpoint is only a guide to how liquids behave in actual situations. The values quoted below are measured by the 'closed cup' non-equilibrium method. In general, though, if a source of ignition is supplied to a liquid fuel significantly above its flashpoint, it is likely to catch fire.

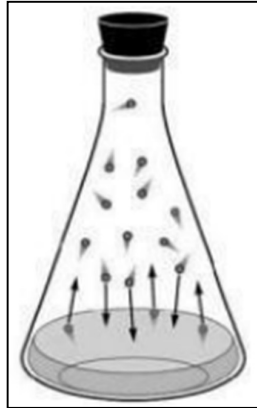
Flammable liquid	Flashpoint (°C)
Acetone	-20
Diesel*	55
Ethanol	12
Ethylene glycol	110
Iso-propyl alcohol, IPA, propane-2-ol	12
Kerosene (paraffin)*	38
Methanol	11
Methyl ethyl ketone, MEK	-4
Toluene	4
Xyklene*	30

\*These materials are mixtures, and the flashpoint varies with composition.

### 1.2.5 GASES, VAPOURS AND MISTS

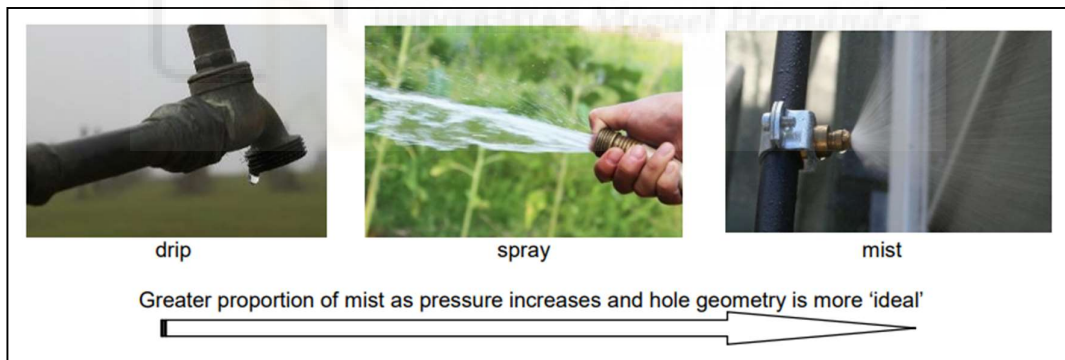
Hydrogen, methane, propane and many others are referred to as gases because this is their state at normal temperature and pressure.

When a liquid evaporates, what is given off is usually referred to as 'vapour' rather than 'gas'.



However, there is little to distinguish them on a molecular scale, as both vapours and gases are capable of mixing with air to form an explosive atmosphere. However, the concentration of vapour given off from a liquid cannot be 100% (unless the liquid is actually boiling), whereas a leak of gas is likely to be, initially, at 100%.

Mists/aerosols are small droplets of liquid, usually caused by ejecting a liquid under pressure through a small hole. The danger is that, even if the liquid is moderately high flashpoint, the mist can still catch fire.



Also, the lower the viscosity of the liquid, the easier it is to generate a mist.

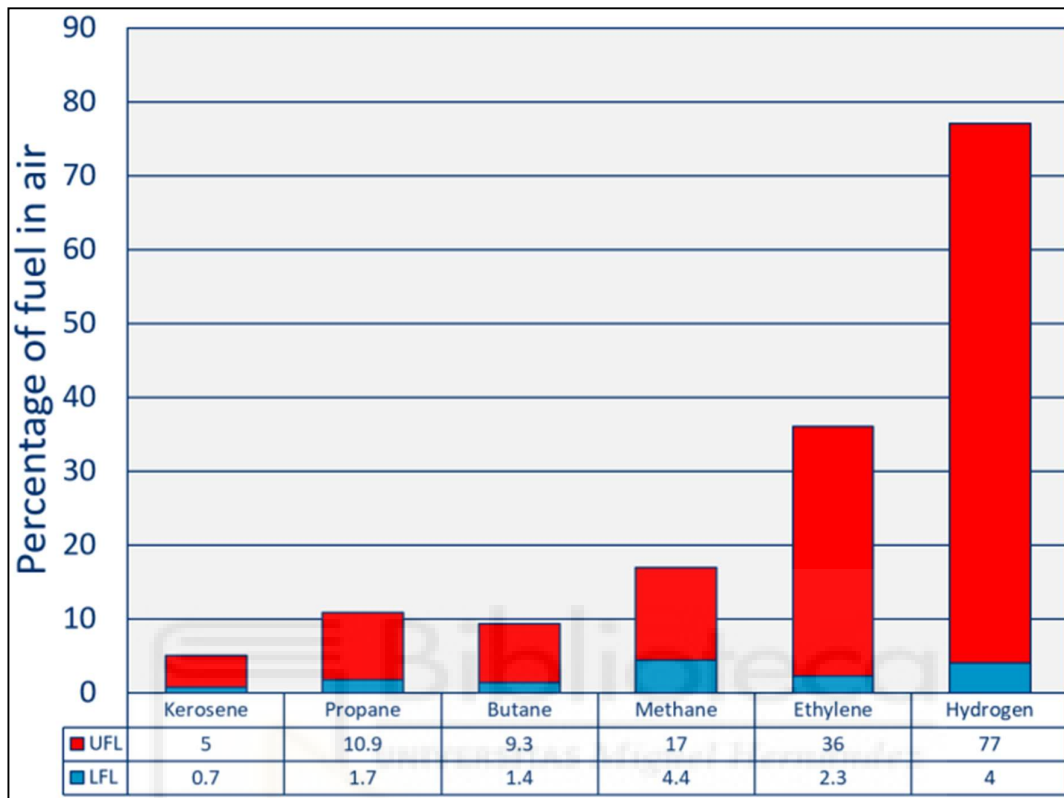
### 1.2.6 FLAMMABLE RANGES FOR GASES AND VAPOURS

The limits of the flammable range of gases and vapours are:

- LFL: Lower Flammable Limit, also known as LEL (Lower Explosive Limit).
- UFL: Upper Flammable Limit, also known as UEL (Upper Explosive Limit).

The LFL and UFL for some common materials are given below. EN 60079-20-1 (Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour

classification – Test methods and data) tabulates the properties of a wide range of flammable materials, but the usual place to find relevant information is to refer to their material safety data sheet (MSDS).



LFL and UFL are self-explanatory in that they refer to the limits of a mixture with air outside which combustion cannot take place. Below the LFL, the mixture is considered as 'fuel lean' and above the UFL as 'fuel rich'. The figure is of considerable importance as it is only between the upper and lower flammable limits that a flammable atmosphere can exist.

### 1.2.7 FLAMMABLE RANGES FOR DUSTS

The LEL and UEL cannot be accurately determined for dusts, on account of the variation in particle size, moisture content and composition. For the LEL, typical values are between 10 mg/m<sup>3</sup> and 100 mg/m<sup>3</sup>, which represents a 'dust storm' with limited visibility. In an unscientific attempt to give an idea of what a flammable dust concentration would look like, imagine being unable to see your hand at arm's length in front of your face.



### 1.2.8 AUTO IGNITION TEMPERATURE OF DUSTS (AIT)

The auto-ignition temperature is the minimum temperature under standard conditions at which a flammable mixture will ignite due to heat alone.

'Auto-ignition temperature' is often abbreviated to simply 'ignition temperature'.

AIT values must be treated with care as the actual ignition temperature will depend upon many factors such as the heat source geometry and size. It is interesting to note that hydrogen, which is very sensitive to spark ignition, is relatively insensitive to this type of ignition. It is worth stressing that there is no simple relationship between the auto-ignition temperature and the minimum spark ignition energy. One consequence of this is that equipment must be selected both by apparatus group and also by temperature.

The compression of a vapour/air mixture also causes a rise in temperature – this is the basis of the diesel engine in which the compression is sufficient to exceed the AIT.

The AIT is most commonly found from the material safety data sheet, but EN 60079-20-1 also lists the AIT. The temperature marking of 'Ex' equipment must indicate a temperature below the AIT of the hazard material. If the equipment is certified for gases and vapours, the safety factor has already been added. For



dust-certified equipment, no safety factor has been added and the end user must ensure the surface temperature is at least 75 K below the layer AIT and no more than two-thirds of the cloud AIT.

Ignition temperatures for some common dusts are shown below:

Dust	5mm layer ignition temperature (°C)	Cloud ignition temperature (°C)
Coal	225	380
Flour	340	490
Sugar	460	490
Sawdust	340	490
Aluminium	450	590
Bronze	260	390
Zinc	440	570

### 1.2.9 DENSITY

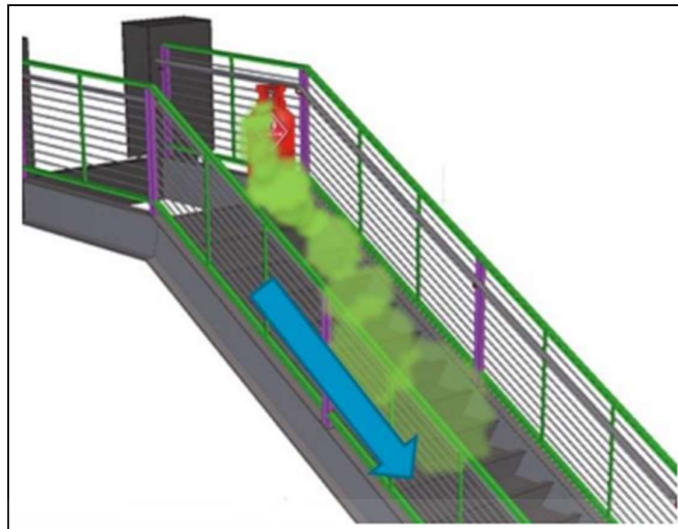
When a flammable material escapes, either deliberately or, more likely, as a result of an accidental leak, it is useful to know whether it goes up or down.

Some gases, notably hydrogen (relative density 0.07), methane (0.55) and ammonia (0.59) are significantly lighter than air and are likely to rise if released in bulk. Note that the relative density values depend on the gases being at the same temperature; ammonia is often stored under refrigeration.

As a gas rises through air, it will mix and rapidly assume close to neutral buoyancy. Eddy currents may cause the gas to swirl to ground level, so density itself is never an absolute predictor of where the gas will go.

Acetylene (0.90), ethylene (0.97) and carbon monoxide (0.97) have densities so close to air that their densities do not give any useful prediction of their movement.

Some gases, notably propane (1.52) and butane (2.00) are denser than air, and so, too, are all flammable vapours, without exception. This means that vapours released from a liquid spill will be ground-hugging and pour invisibly into drains and pits:



### 1.2.10 FLAME PROPAGATION

Propagation is the process by which a combustion reaction spreads throughout the available explosive atmosphere. It can be considered as a chain reaction where unburned mixture is ignited by the mixture that is burning. Propagation will only take place if the concentration of the combustible mixture is within its flammable range. Beware secondary ignitions! These are a particular danger when the pressure wave from an explosion turns dust layers into dust clouds that are then ignited.



If the ignition occurs in an outdoor location, the most likely consequence is a fire rather than an explosion, since the pressure wave resulting from the flame propagating through the explosive atmosphere can readily dissipate. However, where the flame propagates inside an enclosed area, then the resulting and rapid increase in pressure is held in by the enclosure or building and a much larger pressure rise is observed. Those inside a building are much more likely to be injured. If an explosion occurs inside an enclosure and the enclosure cannot withstand the pressure, then there is a hazard from flying fragments.

Area classification should always take particular note of possible flammable releases into enclosed areas.

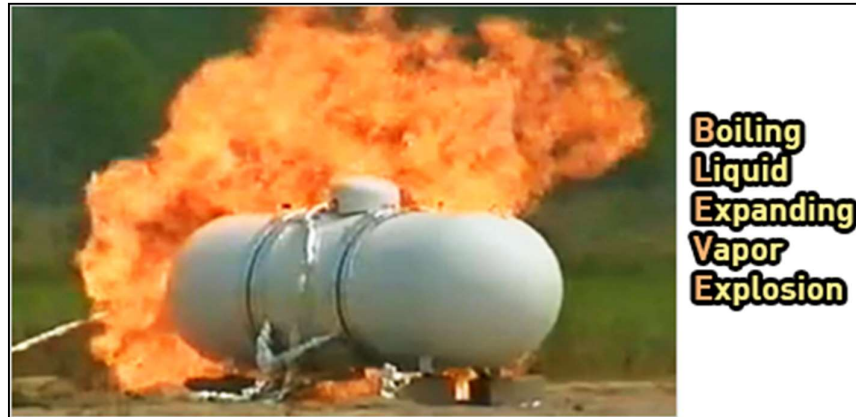
### **1.2.11 DETONATION**

Detonation is sometimes associated with explosions in pipelines. These are normally fairly safe against ignition, because there is not sufficient air inside them to support combustion; the mixture is too rich. If the pipeline is opened up for maintenance, or through a fault, then air can enter, which, if ignited, can detonate all the way along the pipeline. Robust procedures should be in place to prevent a flammable fuel/air mixture inside a pipeline, since, if ignited, the flame front accelerated along the pipe, compressing the unburnt gas ahead of itself. This has a two-fold effect:

- the flame burns faster through the pressurised mixture because the molecules are closer and this facilitates the chain reaction;
- the fuel/air concentration is higher, so more heat is liberated by unit volume and more heat equals more pressure.

Eventually, the gas/air mixture ahead of the flame is compressed so much that it reaches its auto-ignition temperature. The pipeline will probably rupture but the flame will continue.

### **1.2.12 BOILING LIQUID EXPANDING VAPOUR EXPLOSION (BLEVE)**



If a flammable liquid is stored in a sealed vessel, which is exposed to fire, it will try to expand. Since it cannot, the pressure inside the vessel will increase. The fire may well weaken the casing. If the casing bursts, most of the contents will be released as a gas cloud, which will immediately ignite. The resultant fireball may be such that a free air or fuel-air explosion results; this is known as a thermobaric explosion. Most LPG vessels have a coolant deluge system around them to prevent the casing being weakened by a fire.

### 1.2.13 MINIMUM IGNITION ENERGY

The MIE is the energy of a spark that can ignite a fuel/air mixture in the middle of its flammable range, under standard conditions. The only protection method for which this is relevant is intrinsic safety, as this relies on the concept of a 'safe spark'.

The MIE for the four gases that are used as representative of gas groups I, IIA, IIB and IIC are given below:

	Minimum Ignition Energy MIE ( $\mu\text{J}$ )
Methane	525
Propane	320
Ethylene	160
Hydrogen	40

These are the values used for intrinsic safety certification – lower values can be achieved under different test conditions.

At higher pressures gas/air mixtures become easier to ignite, mainly because the molecules are closer together, which facilitates the chain reaction. This is one reason why 'Ex' equipment is only certified for use at ambient pressure. Equipment that requires connection to a high process pressure, such as a pressure sensor, is protected.

Dusts have a much higher ignition energy, typically thousands of microjoules.



## **1.3 AREA CLASSIFICATION**

### **1.3.1 WHAT IS AREA CLASSIFICATION AND WHY IT IS NECESSARY**

The dangers of installing electrical apparatus in areas where explosive mixtures of gases and air could occur was first recognised in the mining industry early in the 20th century. Awareness spread quickly to the chemical and petrochemical industries who recognised that, unlike the coal mining situation where the release of firedamp is unpredictable in quantity and duration, the occurrence of flammable atmospheres was due to mechanical and process failures or to deliberate situations created by personnel. This meant that the presence and persistence of such situations could be predicted to a level much higher than was the case in mining. For an ignition to take place, a source of ignition must coincide with an explosive atmosphere.

Zoning therefore applies to non-mining situations only. Industrial sites handling flammable materials are divided up according to the probability of a flammable atmosphere occurring into zones of risk, based upon frequency and persistence. There are three zones for gases, vapours and mists (0, 1, 2) and three for flammable dusts & powders (20, 21, 22).

It is important to understand that zones are based on the probability of an explosive atmosphere being present.

Gases, vapours, mists and dusts can, under ideal conditions, mix intimately with the oxygen molecules in air and, if the mixture is within the flammable range, introducing an ignition source will cause the entire mixture to burn rapidly, usually within a fraction of a second. If this occurs outdoors, the result is likely to be a flash fire. If indoors, an explosion could result. Anyone undertaking an area classification exercise should take particular care to identify and deal with any areas where an explosion risk is present.

Area classification does not deal with explosives (i.e. materials where the oxygen is not in gaseous form but is held chemically combined in the explosive, along with the fuel). Likewise, the toxic nature of the flammable materials is not considered. Some flammable materials are very toxic (hydrogen sulphide and carbon monoxide are examples) and typically pose a toxic risk at concentrations far below the level at which they become flammable.

Area classification is part of the risk assessment of a site, and is used to identify those areas that may contain flammable mixtures.

There are several outcomes from the area classification process:

- It enables suitable equipment to be selected, according to the severity of the risk (see table 1 below);
- It prohibits uncertified equipment from being brought into the zone;
- It ensures that the ignition risk is identified before ignition sources are used under permit

Ideally, electrical and non-electrical equipment would not be installed in a hazardous area. Where this is inevitable, the designer should consider how to install the equipment in the zone of lowest risk. Very occasionally, it will be necessary to install equipment in a zone 0. In this case, because the probability of an explosive atmosphere being present is very high, only equipment with an extremely low probability of causing ignition can be used.

Area classification for flammable substances is intended to define the extent and type of hazardous zones, such that precautions can be taken to prevent ignitions from being caused by electrical or mechanical equipment. It is not used for any hazards other than flammable and it is not intended for toxic risks or corrosive risks, because formalised rules exist for relating area classification to the electrical and mechanical risks only.

### **1.3.2 ZONES**

Flammable atmospheres are classified zone 0, 1 or 2 for gas, and 20, 21, and 22 for dust, on the basis of the probability or likelihood of the presence of an explosive atmosphere.

#### **1.3.2.1 ZONE FOR GASES, VAPOURS AND MISTS**

- Zone 0: A flammable atmosphere is present continuously, or for long periods, or frequently.
- Zone 1: A flammable atmosphere is likely in normal operation, occasionally.

- Zone 2: A flammable atmosphere is unlikely in normal operation and, if it occurs, will exist only for a short time.

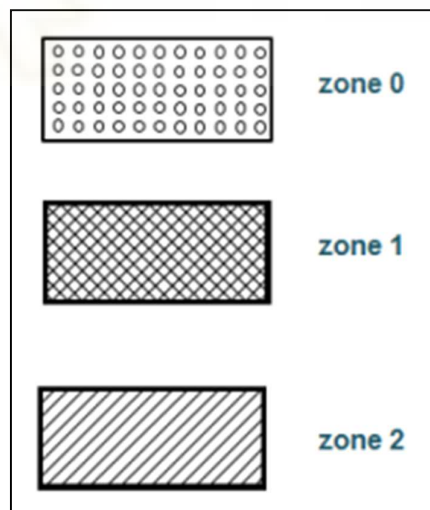
Secondary guidance comes from the following rule, taken from the Energy Institute Model code of safe practice, Part 15, section 1.5.4 and also quoted in other publications:

- Zone 0: explosive atmosphere present more than 1000 hours/year
- Zone 1: explosive atmosphere present between 10 and 1000 hours/year
- Zone 2: explosive atmosphere present less than 10 hours/year

[Note: strictly speaking, the 10 and 1000 hour breakpoints apply to “grades of release”, and are not in the definitions of zones].

There are 8760 hours in a year, so 10 hours is about 0.11% of the time and 1000 hours is about 11%. However, determining which zone is applicable is firstly done based on the definitions of the zones; the number of hours of exposure is secondary guidance.

The recommended shading is shown below. Colours can also be used for additional clarity.

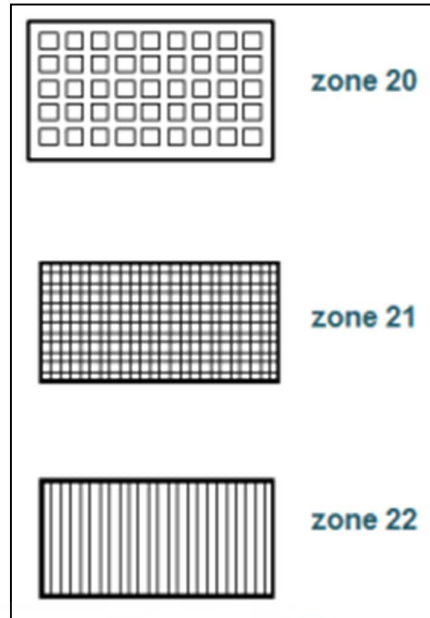


### 1.3.2.2 ZONES FOR DUSTS

EN 60079-10-2 defines dust zones in an analogous way to the gas/vapour zones defined in EN 60079-10-1, i.e. 20 is the high probability zone, 22 is the lowest



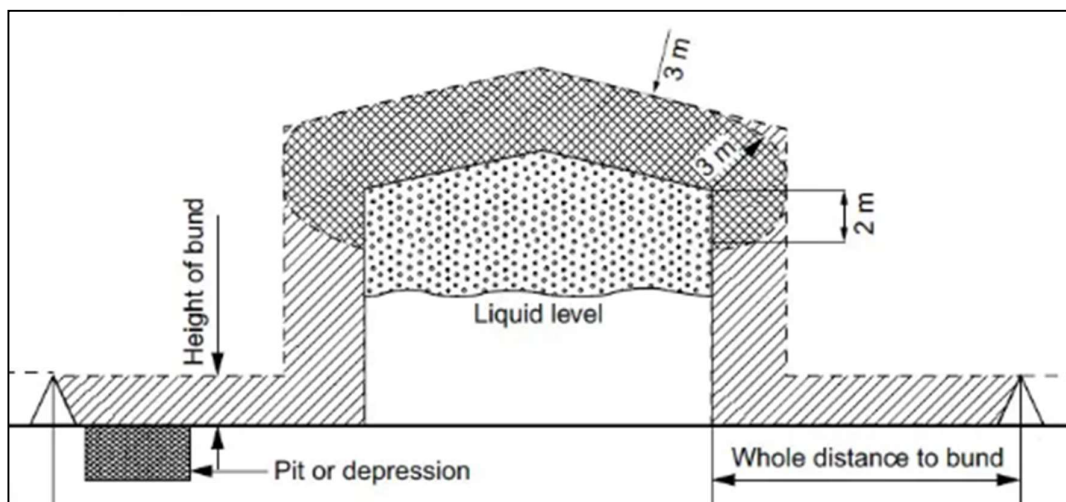
probability. The recommended shadings are also given and are shown below. Colours can also be used for additional clarity.



### 1.3.2.3 EXAMPLES OF ZONING

#### 1.3.2.3.1 TYPICAL EXAMPLE OF ZONING FOR FLAMMABLE VAPOUR

The diagram below is based on Figure D.4(a) of the Energy Institute Model Code of Safe Practice, Part 15 (known as “EI15” for brevity). It demonstrates how zoning is applied in a standard situation in which a highly flammable liquid (for example cyclohexane) is stored in a tank.



Where possible, area classification should be done by example, if one exists in a code of practice. However, it is most important to stress that the actual plant must

be equivalent to the example in the important aspects. Certain assumptions are made in generating the generic examples as shown in codes of practice and these assumptions must be matched against the actual operating conditions. For example, the zoning in the above example assumes a maximum pumping rate – a larger rate may give a larger zone around the vent.

A slightly different drawing applies if EN 60079-10-1 is referenced. Different codes give varying answers for apparently identical situations. There are a number of reasons for this:

- Scope: a code written for a particular industry, e.g. the IGE/SR/25 Code (Institute of Gas Engineers) for the natural gas industry, will give zone extents for specific flammable releases (e.g. methane).
- Age: it is a fair generalisation that older codes of practice are more conservative. This is borne out by the current and original editions (1990) of the 'EI15' code, where some classifications are reduced in the current version. However, there are many examples where the newer classification is more severe.
- Engineering standards: an area classification code of practice that cannot assume or cannot specify design and construction standards or operating conditions is necessarily based on the worst case. This inevitably produces a conservative area classification. This can be seen by comparing the classification of a flanged joint on a natural gas line in EI15 and guidance for natural gas boiler houses (e.g. from the Institute of Gas Engineers, IGE). EI15 gives 1 m, 2 m or even 5 m (depending on the 'Level') whereas the IGE allows no hazard radius. However, the IGE is basing its guidance for boiler houses on:
  - Design and construction standards,
  - Trained installers,
  - Low operating pressure.

It is clear that the differences between codes of practice are not only acceptable but are to be expected. This does not normally produce any difficulty for the user because it is generally evident which code of practice should be used. Other more

specific codes, therefore, have a proper place in dealing with specific situations or industry sectors.

To acquire a better understanding of such definitions, it is helpful to look at a typical item of a process plant and see what hazardous areas it creates.

#### 1.3.2.3.1.1 ZONE 0

Considering the definition of zone 0, it is clear that such a zone would not generally be acceptable in parts of a plant where people habitually work and it follows that such a zone would usually be contained within a process in a plant or be extremely small in extent. It is also likely that if such a zone of significant size were not contained it would almost certainly be an unacceptable loss of process material.

Typical of a zone 0 is the interior of a fixed-roof vented tank, where the source of release is the liquid surface and an explosive atmosphere is almost always present. As the tank fills and empties, air is constantly being drawn in and expelled. Thus, it is almost certain to form a flammable mixture with the vapour from the flammable liquid in the tank, and a potentially explosive atmosphere is likely to exist in the vapour space for much or all of the time, depending mainly on the vapour pressure and explosive limits of the liquid, and the temperature.

Various figures have been used for the length of time for which a potentially explosive atmosphere needs to exist before Zone 0 classification is awarded, but, as stated above, EI15 suggests that, if it exists for more than 1000 hours/year (there are some 8760 hours in a year), then the area should be classified as Zone 0.

In summary, zone 0 areas are generally easy to define in area classification, usually being inside vessels. There is a high probability of an explosive gas/air mixture being present.

#### 1.3.2.3.1.2 ZONE 1

Releases causing flammable atmospheres that are part of the normal running of the plant may occur with some regularity. Examples would be releases as a result of:

- decanting;

- some sampling operations;
- opening of the hatch on a reactor to allow more reagent to be added to a process.

Zones 1 may occur on parts of plants where people may work, but are associated with smaller releases that create only small localised areas, so it is less likely that personnel will have significant exposure to them. [Although the toxic nature of chemicals is completely unrelated to area classification, it is true that exposure to many flammables also has health implications].

An example of Zone 1 is the tank which was used as the Zone 0 example. When this tank is filling, the atmosphere in its vapour space will be expelled. The zone extent, typically 2 m to 3 m from the vent, represents the distance for the vapour (already partly mixed with air inside the tank) to dilute to a fraction of its LEL.

If a potentially explosive atmosphere is present for between 10 and 1000 hours a year, the area is classified Zone 1.

As a result of the difficulty of adequately assessing the effectiveness of ventilation in indoor plant areas, many of these are given a blanket zone 1 classification, even when only secondary grade releases are present. This is generally unacceptable and the ventilation should be improved if this is found to be the case during an area classification review. Large zones 1 in outdoor plants should normally be avoided.

In summary:

- Outdoor zones 1 are relatively rare compared to zones 2 and usually small, particularly where people are present;
- Indoor process areas with poor ventilation may be zone 1 throughout (although better ventilation should be considered).

#### 1.3.2.3.1.3 ZONE 2

By definition this is the least hazardous of zoned areas. On a normal outdoor process plant handling flammables it is usually the case that the great majority of areas will be zone 2. Because of its very nature, zone 2 is the zone created by unlikely conditions. It is not intended to cover conditions of catastrophic process failure which are so unlikely as to be almost unforeseeable. Because it is the

abnormal occurrence that results in zone 2, it is also likely to involve the largest quantity of flammable material released and thus the largest hazardous area results. Typical of the zone 2 situation is the area in the bund of the vented tank. This takes account of possible over-filling of the tank (an abnormal situation), resulting in a small quantity of liquid running down the side of the tank and collecting in the bund. Note that the example in this particular code of practice does not cover the situation where the entire contents of the tank are emptied into the bund as this is considered a 'catastrophic' failure.

The figure normally attributed to zone 2 is a maximum of 10 hours/year, but this is not expected to occur as the result of one leak and, typically, the persistence time of a flammable mixture should not exceed 1 hour in any one incident for a zone 2 to be appropriate. Where the ventilation is inadequate to limit the persistence time, a zone 1 is appropriate (EN 60079-10-1 provides a method for calculating persistence times.).

In summary:

- Most outdoor hazardous areas are predominantly zone 2 with zone 1 areas defined where there are deliberate releases (decanting) or poor ventilation (like trenches).
- Indoors, zone 2 should again predominate provided there is adequate ventilation.

#### 1.3.2.3.2 TYPICAL EXAMPLE OF ZONING FOR FLAMMABLE DUST

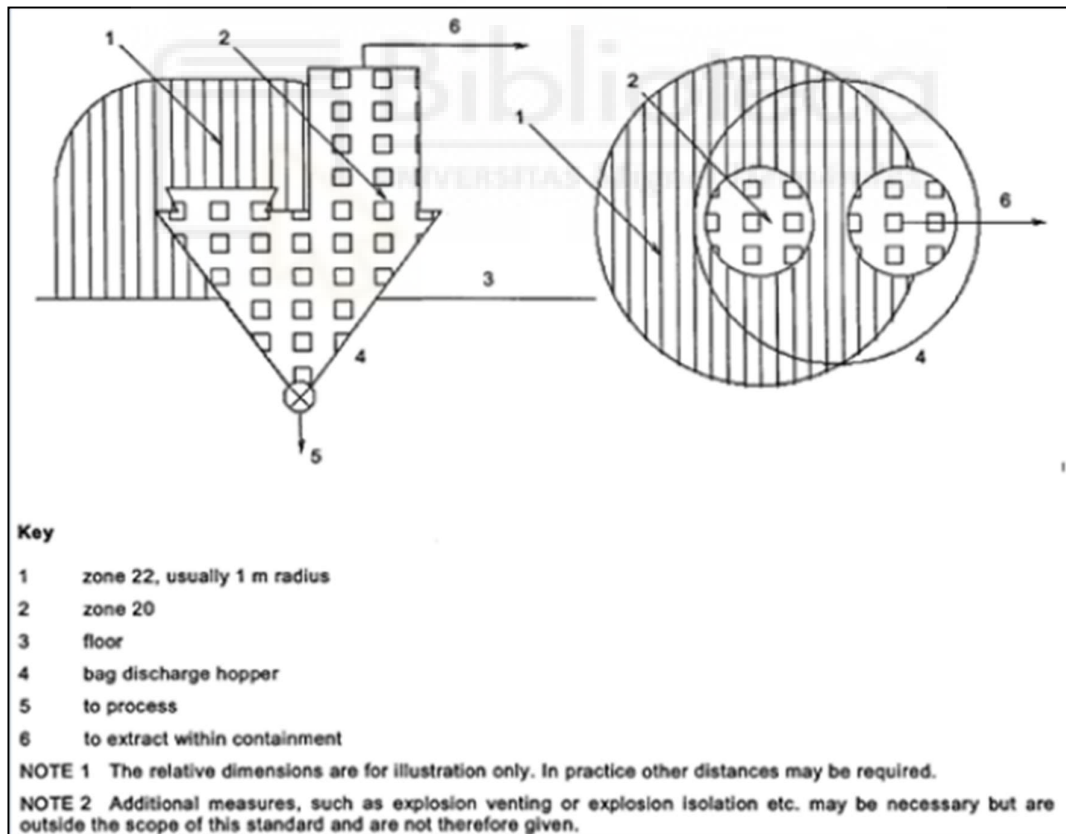
Dust zoning is much simpler than zoning for gases and vapours, partly because the dust rarely moves more than a metre or so from the source of release, due to its tendency to settle to the ground. Whereas guidance in EN 60079-10-1 for gases and vapours is supplemented by a variety of industry codes, dust zoning is usually done according to EN 60079-10-2 without the benefit of additional industry guidance. This is a pity, since the tendency is to assign a more onerous zone than is, perhaps, strictly necessary, particularly inside the dust containment system; industry research is needed to produce more realistic zoning, backed up by good science. It is very difficult to predict whether the dust will be within its flammable range during processing operations, so the normal approach will be to

assume that the dust/air mixture is within the flammable range, whereas, depending on the operation, this may only be true occasionally.

Zoning outside the dust containment system is usually relatively straightforward, based on judgement about likelihood of releases.

EN 60079-10-2 gives a fairly conservative approach. In the example shown below, which describes a hopper filling operation, with extraction from within the hopper, a zone 20 is assigned inside the hopper itself, extending into the extraction duct. This may be reduced to a zone 21 if addition of powder is relatively infrequent.

The zone 22 outside the hopper, typically for 1 m horizontally and down to the solid floor, is to take account of accidental spillage or failure of the extraction system. The 1 m may be reduced if the dust is relatively dense or even regarded as 'negligible extent' (NE) – effectively unclassified.



EN 60079-10-2 gives a number of examples of zoning and is generally an easy code to apply. The problem comes in dealing with the results of the zoning, particularly those zones within the dust containment system. This is because

energetic mechanical equipment, such as grinders, mixers and mills, may create their own zone 21 or even a zone 20. Consideration always needs to be given to whether the probability of an ignition is sufficiently low: if not, then further measures, such as explosion containment or suppression, should be considered. This can be extremely expensive to retrofit to older equipment.

#### 1.3.2.3.3 ASSIGNING A ZONE

- Decanting: during decanting, there will be a modest release of vapour. Assuming the ventilation is at least adequate to prevent undue persistence of the explosive atmosphere when the tap is closed, this will result in a small zone 1. However, abnormal conditions should be considered. If liquid is spilled into the drip tray (not shown) or the tap fails to close properly, a pool will form in the drip tray and a larger zone 2 will result.



- Leaking flange: A leak is an unintentional event, so fits in with the definition of a zone 2.



- Paint spraying: many paints contain flammable solvents. The release of the paint as a flammable aerosol is normal procedure, so this cannot be a zone 2. Is it a zone 1 or a zone 0? This depends on the frequency of the spraying. If the activity is for a short duration, a zone 1 would be more appropriate. If the spraying is done by a robot, then a zone 0 might apply.



#### 1.3.2.4 THE EFFECT OF POOR VENTILATION

The above treatment is a somewhat simplified version of the area classification process. Although it works in many cases, the zone number (0, 1, 2, 20, 21, 22) should not be assigned directly for a piece of equipment handling a flammable material until ventilation has been considered. In practice, each item of equipment is assigned a 'grade of release' (continuous, primary or secondary) and this, combined with a consideration of ventilation, gives the zone number. However, this more advanced (and accurate!) approach is not covered in this chapter, which is an overview only.

A flanged joint will not necessarily result in a zone 2: if it is in a poorly ventilated area, close to many other similar joints, a zone 1 might be more appropriate.

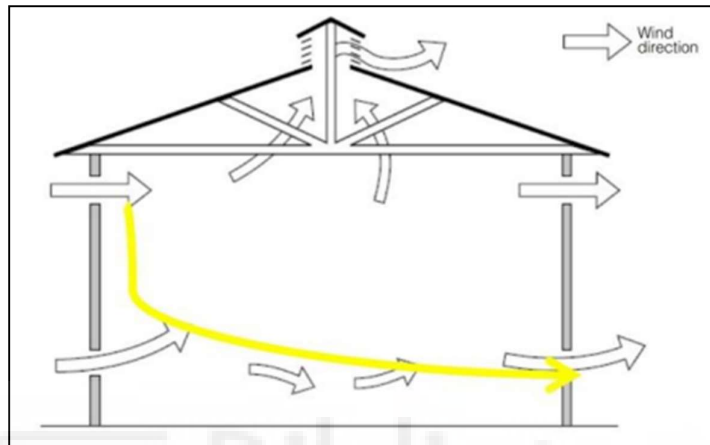
In open, outdoor locations, the ventilation is able to satisfactorily dilute and disperse releases. If a zone is assigned around a flange located in such an area, it will be a zone 2. This may also be true indoors, but the zone radius is likely to be larger, as the ventilation in a naturally ventilated room is never as good as an open, outdoor location.

Rooms may have one or more doors, windows, ventilators and gaps in the structure. However, area classification should not rely on openings being open if they can be left in the closed position. Roller-shutter doors in production areas are often closed in cold weather, resulting in much reduced ventilation. Some rooms have almost no ventilation and it is difficult to quantify the air change rate.



### 1.3.2.5 THE IMPORTANCE OF VENTILATION IN DISPERSING GASES AND VAPOURS

Ventilation in buildings is rarely ideal, but where it can be designed in from the start, effective sweeping of the enclosed space is facilitated by a number of high-level vents on one of the long walls, with corresponding low-level vents on the facing wall, possibly fitted with extract fans:



Vapours and denser-than-air gas will be effectively swept out, the effect enhanced by the air movement outside the building, even where fans are not fitted.

This arrangement also works for lighter-than-air gases (such as hydrogen, methane, ammonia), but beware of pockets forming in the roof spaces if the ventilators are not at the highest point. For such gases, the extract fans should be at high level.

### 1.3.2.6 CATASTROPHIC FAILURES

It is important to note that area classification only deals with reasonably foreseeable abnormal events and does not consider highly improbable ('catastrophic') events. EN 60079-10-1 defines 'catastrophic' failures as "beyond the concept of abnormality dealt with in the standard" and lists as examples "the rupture of a process vessel or pipeline and events that are not predictable".

Releases caused by rare catastrophic failures, such as, say, fracture of an all-welded pipe or rupture of a process vessel, are of extremely low probability, so the area will be classified as non-hazardous. The basis of safety is the risk assessment carried out by the operator.

It is the employer's responsibility to minimise releases where reasonably practicable. Often, existing operating procedures can be improved to reduce still further the probability of accidental spillages. Such a measure could be as simple as using a 'kettle' with a sprung-loaded cover for transferring solvents, rather than an open bucket. If the kettle is used, a spill becomes highly improbable and may (subject to a risk assessment) be regarded as not requiring a zone.



## 1.4 EQUIPMENT GROUPING, TEMPERATURE CLASS AND IP

### 1.4.1 EQUIPMENT GROUPING

The three equipment groups are as follows:

- Group I: equipment for use in mines, no subgrouping.
- Group II: non-mining equipment for flammable gases and vapours, subgroups IIA, IIB, IIC
- Group III: non-mining equipment for flammable dusts, subgroups IIIA, IIIB and IIIC. Subgroups were introduced in 2007, older equipment does not have the subgroup marked.

Typical explosive atmospheres for each group/subgroup are shown in the table below:

Group	Subgroup	Typical explosive atmosphere
I	N/A	Firedamp / coal dust
II	IIA	Propane
	IIB	Ethylene
	IIC	Hydrogen
III	IIIA	Combustible flyings
	IIIB	Non-conductive dust
	IIIC	Conductive dust

Grouping of the hundreds of flammable gases, liquids and dusts into just three sub-groups is done for the benefit of manufacturers: it gives them just three targets to aim for, rather than designing equipment for a specific material.

For equipment designed for use with flammable gases and vapours, manufacturers will usually want to aim for equipment that is suitable for IIC gases, since these are the most sensitive. If equipment is IIC, then it is automatically acceptable for IIB and IIA materials (provided other factors, such as the protection method and temperature classification are also suitable). Most equipment on the market for gas/vapour hazards is marked IIC or IIB, with little IIA equipment,

usually for specialist areas, like the natural gas industry. On the other hand, the majority of gases and vapours are IIA, with a much smaller number of IIB materials. There are only five IIC gases, hydrogen, acetylene, carbon disulphide dichlorodiethylsilane and ethyl nitrate. Coke oven gas and water gas may also be classified as IIC depending on their hydrogen content and are rarely encountered.

Dusts grouping (IIIA, IIIB, IIIC) is on the basis of particle size and conductivity and the supplier's material safety data sheet should be consulted. However, it is unlikely to contain this information, since the grouping only dates from 2007. In reality, virtually all equipment for flammable dusts is certified 'IIIC', so can be used with IIIB and IIIA dusts anyway.

For gases and liquids, the sub-group is given in EN 60079-20-1 and also the Material Safety Data Sheet (MSDS). It is based on two properties of the material:

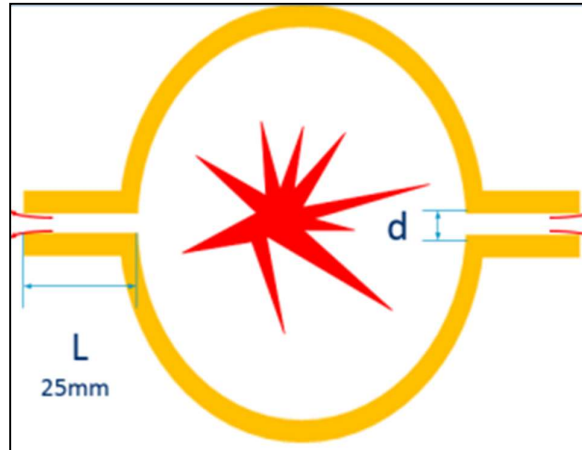
- minimum ignition current (i.e. how easily a fuel/air mixture is ignited by a spark, this affects intrinsic safety certification).
- maximum experimental safe gap (i.e. how easily a flame burns through an enclosure joint, this affects flameproof certification).

It is not necessary to know the details of the methods for measuring these two parameters, but these are given for reference in the following sections.

#### 1.4.1.1 SUBGROUPING BY MAXIMUM EXPERIMENTAL SAFE GAP (MESG)

The MESG is a measure of the ability of a flame to burn through a gap and is particularly relevant to flameproof apparatus. MESG is measured with standardised apparatus as represented below and allows the flame transmission abilities of different gases to be compared. The maximum gap that will still prevent the flame burning from the inside of the enclosure through the gap to the outside is the MESG for that gas.

Under these standardised conditions, hydrogen has the smallest MESG (0.28 mm) whereas propane, for example, has an MESG of 0.99 mm.



The equipment in the diagram is a bronze sphere with a machined joint between the lid and the base that is 25mm long (L). The MESG (d), the gap between the lid and the base is variable. The most sensitive gas/air mixture is chosen and fills the enclosure and the surrounding volume. The gas/air mixture is ignited internally and the gap (d) reduced such that flame transmission to the outer enclosure no longer occurs.

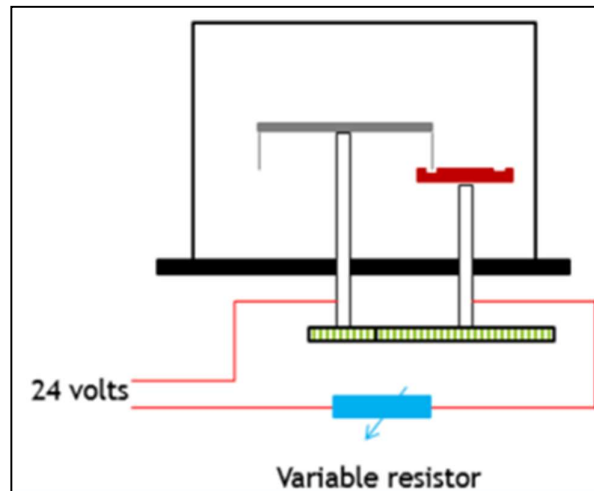
Gases and vapours are already assigned to sub-groups on the basis of this test, as well as the MIC test detailed in the following section.

Maximum Experimental Safe Gap values are shown in the table below:

d (mm)	Group	Typical working gap (mm)
> 0.9	I, IIA	0.4
0.5 – 0.9	IIB	0.2
< 0.5	IIC	0.1

#### 1.4.1.2 SUBGROUPING BY MINIMUM IGNITION CURRENT (MIC)

The MIC is the minimum current at a test voltage of 24 Vdc that ignites the most sensitive gas/air mixture, using the standard test apparatus.



The two discs (grey and red) rotate in opposite directions and the tungsten wires attached to the upper disc cause sparks when they make contact with the lower, cadmium disc, which is grooved. The enclosure is filled with the gas/air mixture under test.

Gases and vapours are put into the various sub-groups, IIA, IIB and IIC based on MIC.

Minimum Ignition Current MIC (A)	Group	Energy ( $\mu\text{J}$ )
> 0.8	I, IIA	160
0.45 – 0.8	IIB	80
< 0.45	IIC	20

Note that MESG is also considered when putting a gas into a sub-group. The more onerous sub-group is chosen.

Each sub-group is assigned a test gas (two for IIC), which is the worst-case gas in the sub-group and can be used for testing.

Group	Test gas	MIC (mA)	MIE ( $\mu\text{J}$ )	MESG (mm)	Comment
I	Methane	85	525	1.14	Firedamp is mainly methane
IIA	Propane	70	320		The majority of gases and vapours are IIA

Group	Test gas	MIC (mA)	MIE ( $\mu$ J)	MESG (mm)	Comment
IIB	Ethylene	45	160	IIB	Significant number of IIB materials
IIC	Hydrogen	21	40	IIC	Three main IIC gases: H <sub>2</sub> , C <sub>2</sub> H <sub>2</sub> & CS <sub>2</sub>
	Acetylene	24			
II	All gases	-	-	-	Some older equipment is marked "II" if the protection method does not depend on MESG/MIC. It is now marked "IIC", so "II" and "IIC" are effectively the same

For example, a piece of flameproof equipment that is intended to be certified IIB will typically be tested with an ethylene/air mixture to determine the internal explosion pressure (the "reference pressure") and with an ethylene/oxygen mixture to test for flame transmission.

#### 1.4.2 TEMPERATURE CLASS (T-CLASS)

The T-class is the maximum surface temperature of the equipment:

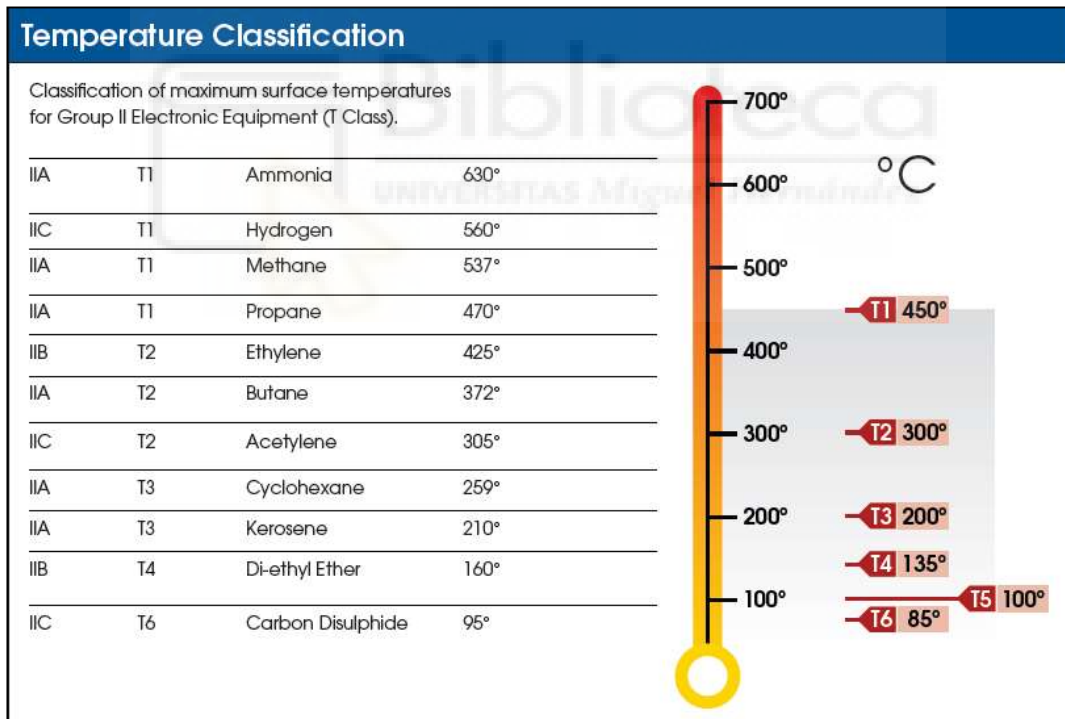
T-Class	Surface Temperature (°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

The temperature of the equipment is usually measured under fault conditions, although equipment for zones 2 and 22 (i.e. the zones with lowest probability of an explosive atmosphere)) is permitted to be tested under worst-case normal

operation. The temperature is measured internally or externally, depending on the protection concept. For flameproof, encapsulated and pressurised equipment for example, the internal temperature is not relevant, so the temperature class is based on the external temperature. By contrast, increased safety and intrinsically safe equipment, for example, have temperature classes based on the internal temperature.

Ambient temperature and temperature class are not the same: the ambient temperature is the maximum temperature of the location, whereas the temperature class is the limiting temperature of the equipment. The ambient temperature is almost always written on the equipment, but, if not, the default value is -20°C to +40°C.

The six temperature classes are shown below, along with the auto-ignition temperatures of some common substances:



There is a modest safety factor built into the temperature class, so, for gases and vapours, provided the auto ignition temperature is above the temperature class limit of the equipment, the equipment will not ignite the explosive atmosphere due to excessive temperature. Most equipment is T6, T5 and T4, with a small amount of T3. T2 and T1 which are mainly for special applications. By contract, most



gases and vapours are T1, T2 and T3, with a handful requiring T4 equipment. There are no materials currently listed in EN 60079-20-1 that require T5 and only one, carbon disulphide, that requires T6.

Dust-protected equipment is not marked with a temperature class but with the actual external surface temperature, in degrees Celsius (e.g. “T90°C”). Dusts have both a layer and a cloud auto-ignition temperature (AIT):

Dusts Typical Ignition Temperatures (°C)		
Dusts	Cloud	Layer
Aluminium	590 °C	>450 °C
Coal dust (lignite)	380 °C	225 °C
Flour	490 °C	340 °C
Grain dust	510 °C	300 °C
Methyl cellulose	420 °C	320 °C
Phenolic resin	530 °C	>450 °C
Polythene	420 °C	(melts) °C
PVC	700 °C	>450 °C
Soot	810 °C	570 °C
Starch	460 °C	435 °C
Sugar	490 °C	460 °C

In contrast to equipment certified for gases and vapours, the user is required to add a safety factor. As an example, a flammable dust has the following properties:

- Layer AIT = 200°C
- Cloud AIT = 450°C

The user needs to make two calculations and pick the lower temperature:

- Layer AIT: subtract 75 K, so  $(200 - 75) = 125^{\circ}\text{C}$
- Cloud AIT: multiply by 2/3, so  $450 \times 2/3 = 300^{\circ}\text{C}$
- The lower of the two is 125°C – the maximum surface temperature of the equipment must be below this value.

It is almost invariably that it is the layer AIT that determines the permitted maximum surface temperature of dust-protected equipment – this is usually below 100°C, though can, of course, be higher. Some intrinsically safe equipment that is also dust protected is marked “T135°C”.

### 1.4.3 INGRESS PROTECTION (IP)

Ingress Protection is not a method of explosion protection in its own right. The IP code comprises two digits describing the protection an enclosure provides against:

- Ingress of solid objects including dust;
- Ingress of liquid.

Ingress of solid object is denoted by the first digit of the IP code:

First digit	Protection against ingress of solid material	Protection against access to live parts
0	No protection	No protection
1	$\varnothing \geq 50 \text{ mm}$	Back of hand
2	$\varnothing \geq 12.5 \text{ mm}$	Finger
3	$\varnothing \geq 2.5 \text{ mm}$	Tool
4	$\varnothing \geq 1.0 \text{ mm}$	Wire
5	$\varnothing \geq \text{Dust-protected}$	Wire
6	Dust-tight	Wire
X	Not relevant	Not relevant

Ingress of liquid is denoted by the second digit of the IP code:

Second digit	Protection against ingress of liquid
0	No protection
1	Vertical drips
2	Drips with 15° tilt
3	Splashes
4	Sprays, 5 – 10 min
5	Jets, 12.5 l/min, 30 kPa, 3 min

Second digit	Protection against ingress of liquid
6	Powerful jets, 100 l/min, 100 kPa, 3 min
7	30 min immersion, 1 m
8	Submersion
9K	30 lit/min, 80°C

Up to IPX6, the higher the number, the higher the protection level. The photograph below shows an IPX6 test in progress:



However, it is not necessarily the case that IPX7 and IPX8 are better than IPX6, since the test is different. Therefore, it is common to see equipment marked “IP66/IP67”, for example. Most equipment for outdoor use is specified as IP65 or better.

The test conditions for IPX8 are determined by the manufacturer, who specifies the depth of submersion and the duration.

IP9K tests the protection against close-range, high pressure, high temperature spray-downs.

## **1.5 ELECTRICAL EQUIPMENT PROTECTION METHODS**

### **1.5.1 PREVENTATIVE MEASURES FOR AVOIDING AN IGNITION**

The priority order for measures to be taken to avoid an ignition are as follows:

1. Reduce quantity of flammable material to a minimum, or zero, e.g. substitute material;
2. Avoid release;
3. Control release at source;
4. Prevent formation of explosive atmosphere;
5. Collect and render safe;
6. Avoid ignition sources;
7. Mitigate the effect of a fire or explosion.

These are taken from European and National legislations (ATEX 1999/92/EC 'Worker Protection' Directive and Real Decreto 681/2003, de 12 de junio), but are generally applicable. Note that the priority is to reduce the amount of flammable material used, preferably to zero (e.g. by substitution of a flammable ink with a water-based ink). Where this is not practical, consider reducing the amount of material held indoors and make more use of outdoor stores, where the risk to workers is less.

The probability of release of gas or vapour is reduced by good engineering:

- design sampling to be closed-loop
- consider double-skinned pipework for sensitive areas

Good working practices also avoid releases, for example:

- interlock on a hatch to prevent opening while reactor is charged
- transfer liquids in closed containers only

Where releases are possible, orifice plates and other flow restrictors can control the amount released. Measures such as local extract ventilation should be considered for high-risk areas to control the release at source and prevent the formation of an explosive atmosphere.

Drip trays with drains and level sensors deal with accidental releases. This allows liquids to be collected and rendered safe within the shortest possible time.

Coalescing guards around flange joints might be considered where there is a mist hazard, for example, but this is too awkward a method for general use and is usually confined to sensitive areas only, that is, where workers are very likely to be present.

It is significant that “avoid ignition sources”, i.e. the fitting of ‘Ex’ equipment, is well down the list.

In some cases, it is not possible to reduce the probability of an ignition to a low enough level. An example would be a mill or grinder used to grind a flammable material, inevitably producing a dust cloud inside the enclosure. The introduction of tramp metal could cause a spark. Therefore, additional measures should be considered to mitigate the effect of the resulting ignition and, possibly, explosion.

### **1.5.2 BASIC TECHNIQUES USED FOR EQUIPMENT PROTECTION**

It may be helpful to generalise the various protection methods and group them into the following:

- containment
- energy limitation
- avoidance of ignition sources
- exclusion

Dilution can also be included, but is not really a protection method in its own right, since it is more often associated with measures such as extract ventilation. However, it is a feature of some pressurised equipment that contains an internal release of gas, such as a gas analyser.

#### **1.5.2.1 CONTAINMENT**

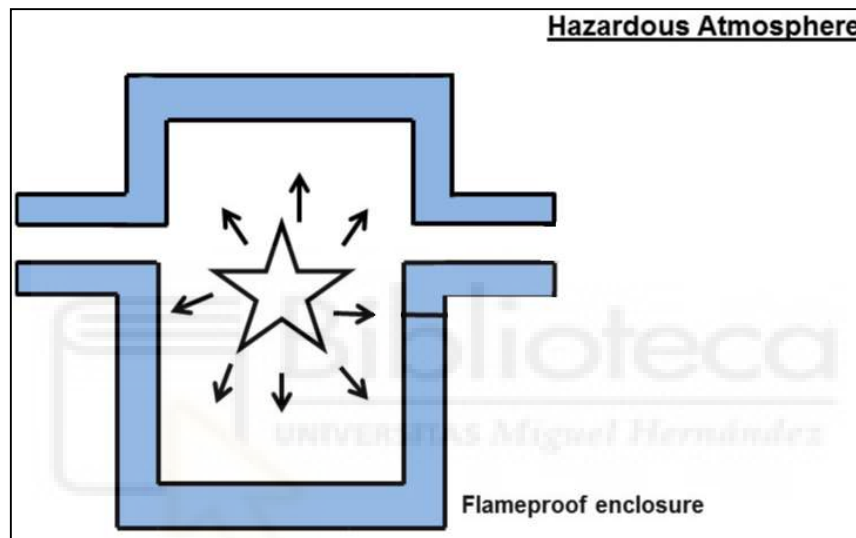
An explosion inside the equipment is contained within the equipment:

- The enclosure is strong enough to withstand the pressure of an internal explosion

- Any joints or gaps in the enclosure quench the flames, the explosion is prevented from escaping outside the equipment
- Flameproof (Ex d) is now the only method (enclosed break, Ex nC, is now replaced by Ex dc)

#### 1.5.2.1.1 FLAMEPROOF, EX D

The principle of the flameproof type of protection is that the enclosure is built strongly enough to withstand the explosion pressure and joints are made narrow enough to quench flames.



The flameproof enclosure is not gas-tight and the equipment inside may well spark incendively and contain hot surfaces. Protection is provided by the enclosure. This is the oldest method of 'Ex' protection, but is still popular.

#### 1.5.2.2 ENERGY LIMITATION

The basis of safety of energy limitation is that sparks are "safe" and there is insufficient power to cause an excessive temperature rise. Intrinsic safety (Ex i) is now the only method of protection based on energy limitation.

##### 1.5.2.2.1 INTRINSIC SAFETY, EX I

By its very nature, the intrinsic safety method of protection can only be used for low power equipment, which limits it to instrumentation and a range of other low power devices, such as gas detectors, torches, etc.



Energy limitation, Ex nL, for zone 2 was a simplified version of intrinsic safety, but this is now superseded by Ex ic for new equipment. Ex ic imposes additional requirements (such as the need for a certified power supply) that were not present in Ex nL, so the two concepts are similar but not completely interchangeable.

#### 1.5.2.3 AVOIDANCE OF IGNITION SOURCES

The basis of safety of avoidance of ignition sources is that the design eliminates arcs, sparks and hot surfaces and that the enclosure prevents ingress of water and dust that might cause sparking.

For electrical equipment the method of protection is increased safety (Ex e). Historically, also non-sparking (Ex nA) falls under this category. But since the principles of non-sparking are the same as increased safety they have recently been incorporated into the increased safety type of protection, meaning that Ex nA has been superseded by Ex ec.

##### 1.5.2.3.1 INCREASED SAFETY, EX E

Increased safety is widely used for luminaires, junction boxes, motors (especially larger frame sizes) and heat-trace tape.



There are no sources of ignition in the enclosure.

The minimum ingress protection requirement is IP54, but, for anything other than indoor use, a higher level of protection is required.

#### 1.5.2.3.2 NON-SPARKING, EX NA

Type of protection non-sparking (Ex nA) for zone 2 uses the same approach and is a simplified version of Ex e. The concept has now been transferred into the increased safety standard and is known as “Ex ec”, whereas what is currently known as “Ex e” is now “Ex eb”.

#### 1.5.2.4 EXCLUSION

The basis of the exclusion method is, as indicated by its name, to exclude the explosive atmosphere from coming into contact with hot surfaces or arcs and sparks. The exclusion of the explosive atmosphere may be achieved in a number of ways:

- By maintaining the pressure of the internal atmosphere above the surrounding atmosphere (Ex p)
- By filling the equipment with oil (Ex o)
- By encapsulation in solid material (Ex m)
- By restricted Breathing (Ex nR)
- By sealing the enclosure (Ex nC)



- By dust-tightness (Ex t)

#### 1.5.2.4.1 PRESSURIZATION, EX P

Type of protection pressurization (Ex p) works by slightly pressurising the enclosure, usually with air or an inert gas, such that an explosive atmosphere on the outside cannot get inside.



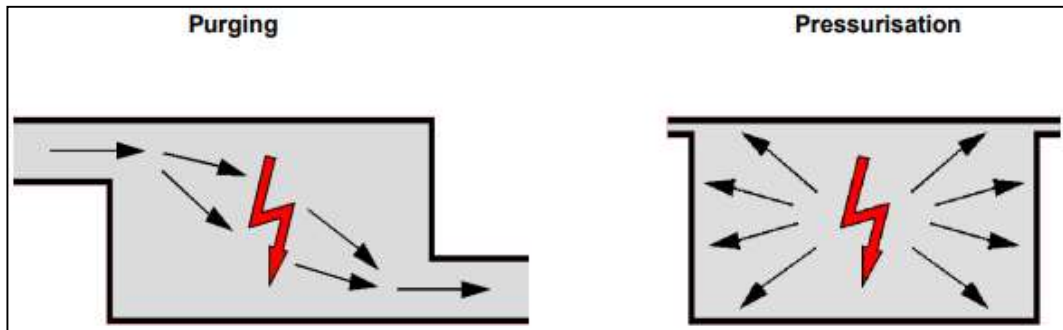
If there is an internal release of a flammable material, as may happen in a gas analyser, for example, then nitrogen rather than air is the protective gas of choice.

The current standard for pressurised equipment gives the following three options: pxb, pyb and pzc.

Dilution is not a method of explosion protection in its own right, but may be used within a pressurised enclosure, for example, to dilute an internal source of release.

Purging – Isolating the ignition source from the explosive atmosphere by purging the enclosure interior of the explosive mixture before powering equipment and during equipment operation.

Static pressurization – Protection against ingress of the external atmosphere into an enclosure by maintaining a protective gas therein at a positive pressure without the addition of a protective gas.



#### 1.5.2.4.2 OIL IMMERSION, EX O

Oil immersion is a type of protection in which the electrical equipment, or parts of the electrical equipment, are immersed in a protective liquid in such a way that an explosive gas atmosphere which may be above the liquid or outside the enclosure cannot be ignited.

By comparison with most other methods, oil-filled equipment is very rare. However, for a device such as a large transformer, oil immersion may be the most practical solution, since the oil is already required for cooling purposes.

Ex o equipment may be used in zones 1 and 2 and is suitable for all gases and vapours, provided the temperature class is appropriate.

#### 1.5.2.4.3 ENCAPSULATION, EX M

The method is simple in principle: the electrical equipment is completely surrounded by a casting compound, so the flammable gas, vapour or dust cannot come in contact with it. This means that sparks are not a problem and the only hot surface to worry about is on the outside surface.

#### 1.5.2.4.4 RESTRICTED BREATHING, Ex nR

The basis of safety is that the flammable gas is excluded by means of well-fitting covers and gaskets. It is only permitted in zone 2 for gases.

#### 1.5.2.4.5 HERMETICALLY SEALED, Ex nC

The basis of safety of this type of device is that the flammable gas is excluded by effective sealing such that the device cannot be opened during normal operation and dust cannot penetrate.

#### 1.5.2.4.6 DUST IGNITION PROTECTION BY ENCLOSURE, Ex t

Type of protection dust ignition protection by enclosure (Ex t) uses a rugged, dust-tight enclosure to exclude dust; the temperature marking is based on the outer surface temperature of the enclosure. This is the predominant method of protection for flammable dusts.

The enclosure is subjected to a range of tests to prove it is suitably robust, concluding with a dust tightness test in almost all cases, giving an ingress protection of IP6X, where X is any value, indicating the level of protection against water ingress. Preventing water ingress is not, however, a requirement for protection type Ex t.

Where the equipment is already certified as intrinsically safe, encapsulated or pressurised, lesser requirements for the enclosure may apply.



## 1.6 NON-ELECTRICAL TYPES OF PROTECTION

Non-electrical protection was initiated by Europe's ATEX Directives and standards published in 2003. The IECEx scheme had not addressed non-electrical protection until 2016 when two ISO standards were issued that can be used for IECEx certification:

- ISO 80079-36:2016 - Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements
- ISO 80079-37:2016 - Explosive atmospheres - Part 37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"

These replace the EN 13463 series of standards, which have been used for ATEX certification. The method of protection that is not in the ISO standards is protection "fr" (flow restriction, EN 13463-2), which has not been widely adopted and is likely to be discontinued.

The full list of non-electrical protection methods is as follows:

- Constructional safety "c"
- Liquid immersion "k"
- Control of ignition sources "b"
- Flameproof "d"
- Pressurisation "p"
- Dust ignition protection by enclosure "t"

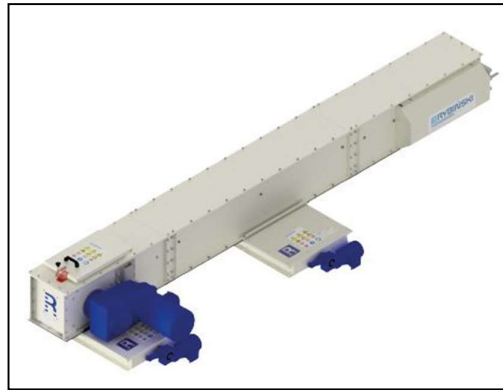
Note that under the 80079 series of non-electrical standards, non-electrical equipment will be marked "Ex h" in any case.

### 1.6.1 CONSTRUCTIONAL SAFETY, EX H (FORMERLY EX C)

Constructional safety, Ex h, is perhaps the mainstay of non-electrical protection. This method employs good engineering practice to achieve the required level of security against unwanted sparks and hot surfaces. It can be applied to:

- Seals for moving parts

- Lubricants
- Moving parts
- Bearings
- Power transmission systems
  - Gear drives
  - Belt drives
  - Chain drives
- Clutches and couplings
- Brakes and braking systems
- Springs and absorbing elements
- Conveyor belts



From the list of mechanical items that are addressed by type of protection constructional safety, it can be seen that it is a very versatile method and can be used for almost all non-electrical ignition hazards. However, it may not always be the most cost effective solution, which is why the other methods provide alternative ways of achieving safety

### **1.6.2 LIQUID IMMERSION, EX H (FORMERLY EX K)**

Liquid immersion is probably the next most commonly used method after constructional safety. The letter 'k' does not give much away, but, in fact, stands for liquid immersion, similar in concept to 'Ex o' for electrical equipment.

In liquid immersion, the liquid in question is usually an oil. This method is a practical alternative to constructional safety for devices such as gearboxes and some types of bearings where the oil is already present for lubrication purposes.



### 1.6.3 CONTROL OF IGNITION SOURCES, EX H (FORMERLY EX B)

Ex b uses electrical instruments to monitor non-electrical equipment. For example, if a bearing condition is monitored using an electrical temperature sensor, then this is protection by control of ignition sources. Clearly, the electrical sensor needs to be suitably protected and also initiate an alarm if the bearing's temperature passes a safe threshold.



Other types of sensors might be used to monitor vibration, temperature or lubricant flow.

### 1.6.4 EX D, EX P AND EX T

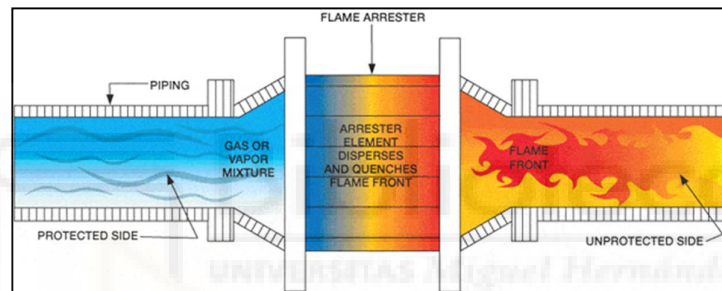
Types of protection Ex d, Ex p and Ex t can be applied to non-electrical equipment. If used, the same principles and standards as for electrical protection apply, and supplement or modify the non-electrical standards.

## 1.7 PROTECTIVE SYSTEMS

Protective systems are devices other than components of equipment which are intended to halt incipient explosions immediately and/or to limit the effective range of an explosion and which are separately made available on the market for use as autonomous systems. It is worth noting that protective systems do not prevent explosions, but mitigate their consequences.

Examples of autonomous protective systems are:

- flame arresters. Flame arresters are intended to stop the propagation of an explosion. An example of their use can be found on vapour recovery lines on petrol filling stations to prevent the propagation of an explosion due to the underground storage tank or the vehicle.



- explosion relief systems (using e.g. bursting discs, vent panels, explosion doors, etc.). A typical example is a vent panel, which provides a one-time use of overpressure protection and has the function of protecting an installation against overpressure and/or underpressure. These panels are used in a closed system to acutely create an opening when a preset pressure occurs, so the pressure can be released.

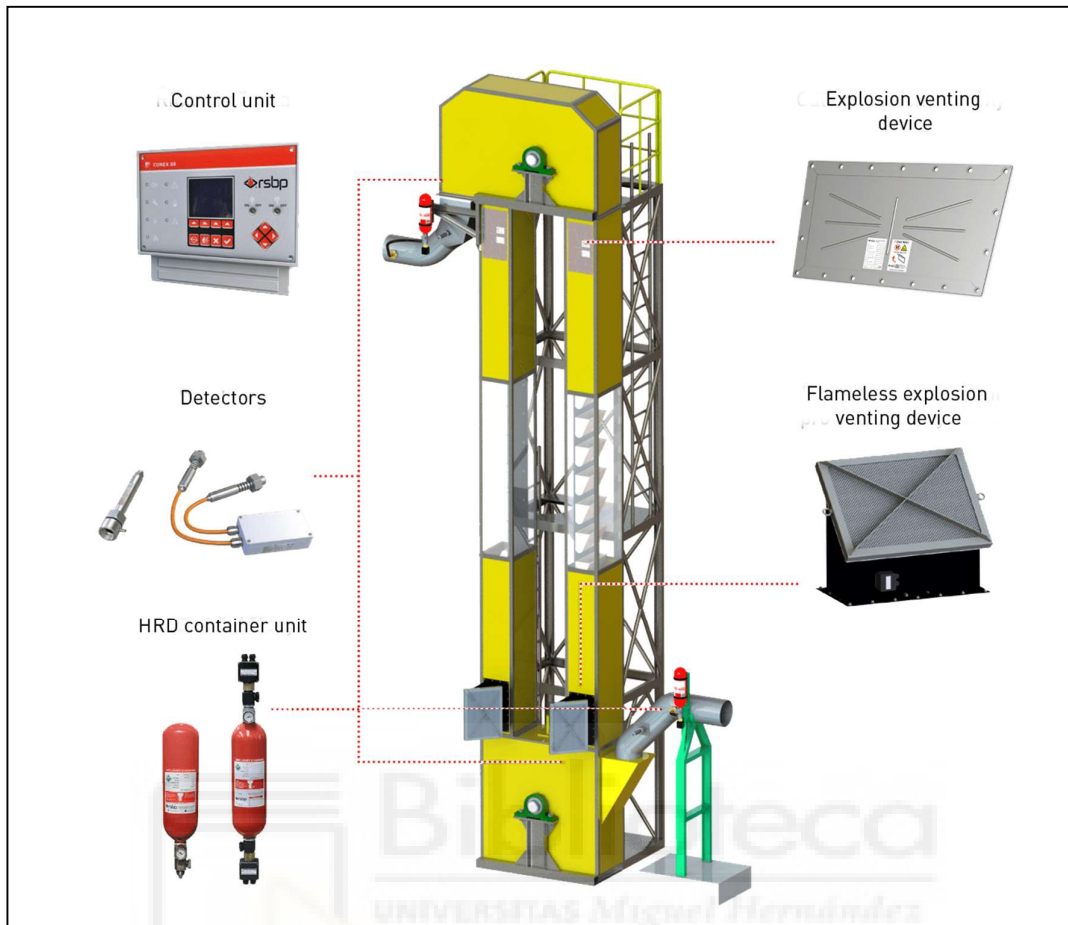


- extinguishing barriers. These are connected to pipelines or vessels through which an explosion can occur or transmit. The cylinders (containers) are fitted with a special geometry nozzle that distributes the extinguishing agent in a flat plume (fan). This forms a barrier of explosive suppressant across the entire cross-section of the pipeline halting the propagation of the explosion.



- explosion suppression systems. Explosion suppression systems are special technical devices which prevent the development of destructive maximum pressure by quickly introducing extinguishing agents. When an explosion is suppressed, explosion products do not spread outside the equipment or the protected area. As a result, structural integrity is not compromised and people are not harmed.





From its intended function it is obvious that a protective system will, at least partially, be installed and used in a potentially explosive atmosphere.

Because a protective system has the function to eliminate or reduce the dangerous effects of an explosion (a safety function) it is subject to the Directive regardless as to whether it has its own potential source of ignition or not. In this first case it would have to comply with the specific essential health and safety requirements for equipment as well.


## 1.8 EQUIPMENT MARKING (include combined types of protection here?)

### 1.8.1 MARKING REQUIREMENTS

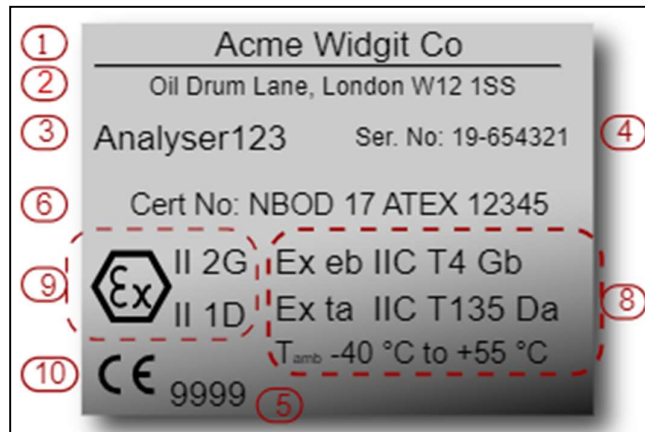
It is the manufacturer's responsibility to affix the marking, which can be regarded rather like a contract between the manufacturer and the end user.

Where the certification plate or markings on explosion protected equipment is missing or illegible, alternative methods may be used to determine traceability to the certification details of the specific equipment. The method used could include additional identification labels which incorporate unique tag numbers, serial numbers or reference to the installation databases. The method of attaching or fixing the labelling must not reduce the integrity of the equipment.

For ATEX, the marking should normally include the following:

1. The name of the manufacturer or the registered trademark.
2. The manufacturer's address.
3. The equipment type identification.
4. A serial number (or batch number).
5. Notified body reference number (if applicable).
6. The certificate number.
7. Specific conditions of use when not covered in the 'X' type certificate and/or warnings
8. The specific Ex marking code, including ambient temperature range when applicable.
9. Cenelec "Explosion Protected" mark () and ATEX directive marking.
10. CE mark.
11. An 'X' or 'U' suffix if applicable

See example marking label below:



### 1.8.2 PROTECTION CONCEPTS AND EX SYMBOLS

The table below summarises the relationship between protection concepts, Ex symbols and EN/IEC standards of electrical and non-electrical equipment:

Protection concept	Ex symbol	Standards
Flameproof	Ex da	EN/IEC 60079-0
	Ex db	EN/IEC 60079-1
	Ex dc	
Purged	Ex pxb	EN/IEC 60079-0
	Ex pyb	EN/IEC 60079-2
	Ex pzc	
Powder filled	Ex q	EN/IEC 60079-0
		EN/IEC 60079-5
Oil immersion	Ex o	EN/IEC 60079-0
		EN/IEC 60079-6
Increased safety	Ex eb	EN/IEC 60079-0
	Ex ec	EN/IEC 60079-7
Intrinsic safety	Ex ia	EN/IEC 60079-0
	Ex ib	EN/IEC 60079-11
	Ex ic	

Protection concept	Ex symbol	Standards
Type of protection "n"	Ex nC (protected sparking)	EN/IEC 60079-0
	Ex nR (restricted breathing)	EN/IEC 60079-15
Encapsulation	Ex ma	EN/IEC 60079-0
	Ex mb	EN/IEC 60079-18
	Ex mc	
Optical radiation	Ex op is	EN/IEC 60079-0
	Ex op pr	EN/IEC 60079-28
	Ex op sh	
Dust	Ex ta	EN/IEC 60079-0
	Ex tb	EN/IEC 60079-31
	Ex tc	
Special	Ex sa	IEC 60079-0
	Ex sb	IEC 60079-33
	Ex sc	
Non-electrical	Ex h	EN/ISO 80079-36
		EN/ISO 80079-37

### 1.8.3 EQUIPMENT PROTECTION LEVEL AND ATEX EQUIPMENT CATEGORIES

In 2007, the IECEx scheme introduced the concept of Equipment Protection Level (EPL). This is the Level of Protection assigned to equipment based on its likelihood of becoming a source of ignition. It distinguishes the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres in mines susceptible to firedamp. The EPLs are as follows:

- EPL Ma: equipment for installation in a mine susceptible to firedamp, having a "very high" Level of Protection, which has sufficient security that it is unlikely to become an ignition source in normal operation, during

expected malfunctions or during rare malfunctions, even when left energized in the presence of an outbreak of gas.

- EPL Mb: equipment for installation in a mine susceptible to firedamp, having a "high" Level of Protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
- EPL Ga: equipment for explosive gas atmospheres, having a "very high" Level of Protection, which is not a source of ignition in normal operation, during expected malfunctions or during rare malfunctions.
- EPL Gb: equipment for explosive gas atmospheres, having a "high" Level of Protection, which is not a source of ignition in normal operation or during expected malfunctions.
- EPL Gc: equipment for explosive gas atmospheres, having an "enhanced" Level of Protection, which is not a source of ignition in normal operation and which may have some additional protection to ensure that it remains inactive as an ignition source in the case of regular expected occurrences (for example failure of a lamp).
- EPL Da: equipment for explosive dust atmospheres, having a "very high" Level of Protection, which is not a source of ignition in normal operation, during expected malfunctions, or during rare malfunctions.
- EPL Db: equipment for explosive dust atmospheres, having a "high" Level of Protection, which is not a source of ignition in normal operation or during expected malfunctions.
- EPL Dc: equipment for explosive dust atmospheres, having an "enhanced" level of protection, which is not a source of ignition in normal operation and which may have some additional protection to ensure that it remains inactive as an ignition source in the case of regular expected occurrences (for example failure of a lamp).

ATEX had been doing this since its inception in 1994, by means of 'Categories'.

The ATEX categories are as follows:

- Equipment Group I (mines):
  - Category M 1: Equipment category M 1 comprises equipment designed and, where necessary, equipped with additional special means of protection to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection.

Equipment in this category is intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

Equipment in this category is required to remain functional, even in the event of rare incidents relating to equipment, with an explosive atmosphere present, and is characterised by means of protection such that:

- either, in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection,
- or the requisite level of protection is assured in the event of two faults occurring independently of each other.

- Category M 2: Equipment category M 2 comprises equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a high level of protection.

Equipment in this category is intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust.

This equipment is intended to be de-energised in the event of an explosive atmosphere.

The means of protection relating to equipment in this category assure the requisite level of protection during normal operation and also in the case of more severe operating conditions, in particular those arising from rough handling and changing environmental conditions.

- Equipment Group II (other places except mines):
  - Category 1: Equipment category 1 comprises equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring a very high level of protection.

Equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dust mixtures are present continuously, for long periods or frequently.

Equipment in this category must ensure the requisite level of protection, even in the event of rare incidents relating to equipment, and is characterised by means of protection such that:

- either, in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection,
- or the requisite level of protection is assured in the event of two faults occurring independently of each other.

- Category 2: Equipment category 2 comprises equipment designed to be capable of functioning in conformity with the operational parameters established by the manufacturer and of ensuring a high level of protection.

Equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.

The means of protection relating to equipment in this category ensure the requisite level of protection, even in the event of frequently occurring disturbances or equipment faults which normally have to be taken into account.

- Equipment category 3 comprises equipment designed to be capable of functioning in conformity with the operating parameters established by the manufacturer and ensuring a normal level of protection.

Equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists, or air/dust mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.

Equipment in this category ensures the requisite level of protection during normal operation.

The equivalence between EPLs and Categories is summarised below:

Zone	EPL	Category
-	Ma	M1
-	Mb	M2
0	Ga	1G
1	Gb	2G
2	Gc	3G
20	Da	1D
21	Db	2D
22	Dc	3D

The EPLs and Categories can be used to determine into which zone the equipment can be installed. Note, however, that there are no zones down mines and the meanings of the EPLs and Categories for mining are as follows:

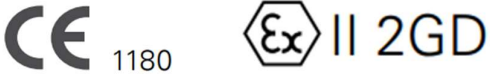

- M1/Ma: very high level of protection, safe with two independent faults, for equipment that can remain energised in the presence of flammable atmosphere – firedamp.
- M2/Mb: high level of protection, safe with one fault, for equipment that must be de-energised when flammable atmosphere is present – firedamp.

ATEX equipment must also include the EPL in its marking, so the indication of zone is, in effect, given twice.

#### **1.8.4 ATEX MARKINGS – EXAMPLES AND BREAKDOWN**



- ATEX Directive marking:

	
CE	Denotes that a product complies with all the relevant
1180	Notified Body identification number
	Specific marking for explosion protection
II	Equipment group (I – mining, II – non-mining)
GD	Type of flammable atmosphere (G – Gas, D – Dust, M1 – equipment remains energised, M2 equipment is de-energised)

- Standards marking – Gas

<b>Ex db IIC T4 Gb</b>	
Ex	Denotes explosion protection
db	Denotes type of protection
IIC	Denotes gas group
T4	Denotes temperature classification
Gb	Denotes Equipment Protection Level

- Standards marking – Dust

<b>Ex tb IIIC T135°C Db</b>	
Ex	Denotes explosion protection
db	Denotes type of protection
IIIC	Denotes dust group

T4	Denotes temperature classification
Db	Denotes Equipment Protection Level

### **1.8.5 CERTIFICATE NUMBER “X” SUFFIX**

Many equipment certificate numbers have an ‘X’ suffix. This indicates that there is important information in the certificate that is not on the equipment marking. This information is known as “Specific Conditions of Use” under ATEX.

Wherever possible, the manufacturer should aim to include all the required information and, especially, warnings on the marking. This means that this important information is readily available to the installer and also the person who inspects the equipment. However, sometimes this is not feasible, due to lack of space or because the amount of information is too much and would make the marking confusing.

### **1.8.6 CERTIFICATE NUMBER “U” SUFFIX**

The “U” suffix at the end of the certificate number indicates that the equipment is a “component”. The word “component” has a very specific meaning in this context and does not mean simply an electronic component such as a resistor or integrated circuit. The definition, taken from EN IEC 60079-0:2018 clause 3.36, is as follows:

“Ex Component: equipment intended to be part of Ex Equipment, marked with the symbol “U”, which is not intended to be used alone, and requires additional consideration when incorporated into Ex Equipment.”

Component certification is used when a manufacturer wants to sell a device that cannot be installed and used on its own (it has no “autonomous function”) but which can be incorporated into an item of equipment without the need to repeat the assessments and tests on the component.

An empty flameproof enclosure is a good example:

The construction meets the flameproof requirements and the relevant tests have been performed (reference pressure, overpressure, impact, flame transmission,

thermal rise in this case), but an empty enclosure is clearly no use on its own. However, the component certificate allows the enclosure to be sold to any manufacturer who wants to market, for example, a control station containing a power supply, some galvanic isolators and some PLCs (programmable logic controllers). Rather than repeat all the flameproof tests, the final manufacturer only needs to do the following:

- generate a drawing showing what is to be installed inside the enclosure
- apply to a Certification Body
- generate a marking drawing (usually the Certification Body will inform the manufacturer what needs to be included)

The Certification Body will assess whether the installed devices are in accordance with the component certificate and issue a certificate. This process often requires no further testing, so is very low cost compared to the certification of the complete equipment, including the enclosure.

Other common components are Ex eb terminals, Ex db eb micro-switches, Ex db gas sensing heads...

## 1.9 EQUIPMENT SELECTION / CATEGORIES

### 1.9.1 INFORMATION REQUIREMENTS

In order to select the appropriate electrical equipment for hazardous areas, the following information is required:

- classification of the hazardous area including the equipment protection level requirements where applicable;
- where applicable, gas, vapour or dust classification in relation to the group or subgroup of the electrical equipment;
- temperature class or ignition temperature of the gas or vapour involved;
- minimum ignition temperature of the dust cloud and minimum ignition temperature of the dust layer;
- intended application of the equipment;
- external influences and ambient temperature.

It is recommended that the equipment protection level (EPL) requirements are recorded on the area classification drawing. This should also apply even if consequences have not been subjected to risk assessment.

### 1.9.2 SELECTION BY ZONE / EPL

Where only the zones are identified in the area classification documentation, then the relationship between EPLs and zones from Table 1 of EN/IEC 60079-14 shall be followed:

Zone	Equipment protection levels (EPLs)
0	“Ga”
1	“Ga” or “Gb”
2	“Ga” or “Gb” or “Gc”
20	“Da”
21	“Da” or “Db”
22	“Da” or “Db” or “Dc”

Where the EPLs are identified in the area classification documentation, those requirements for selection of the equipment shall be followed.

### 1.9.3 SELECTION BY TYPE OF PROTECTION

The recognised types of protection according to IEC standards have been allocated default EPLs according to Table 2 of EN/IEC 60079-14. Where the equipment is marked with a type of protection code and an EPL that differs from Table 2 then the equipment EPL marking shall take precedence.

EPL	Type of protection	Code	According to
"Ga"	Intrinsically safe	"ia"	IEC 60079-11
	Encapsulation	"ma"	IEC 60079-18
	Two independent types of protection each meeting EPL "Gb"		IEC 60079-26
	Protection of equipment and transmission systems using optical radiation	"op is"	IEC 60079-28
	Special protection	"sa"	IEC 60079-33
"Gb"	Flameproof enclosures	"d"	IEC 60079-1
	Increased safety	"e"	IEC 60079-7
	Intrinsically safe	"ib"	IEC 60079-11
	Encapsulation	"mb"	IEC 60079-18
	Oil immersion	"o"	IEC 60079-6
	Pressurized enclosures	"p", "px", "py", "pxb" or "pyb"	IEC 60079-2
	Powder filling	"q"	IEC 60079-5
Fieldbus intrinsically safe concept (FISCO)		IEC 60079-27	

	Protection of equipment and transmission systems using optical radiation	“op is” “op sh” “op pr”	IEC 60079-28
	Special protection	“sb”	IEC 60079-33
“Gc”	Intrinsically safe	“ic”	IEC 60079-11
	Encapsulation	“mc”	IEC 60079-18
	Non-sparking	“n” or “nA”	IEC 60079-15
	Restricted breathing	“nR”	IEC 60079-15
	Energy limitation	“nL”	IEC 60079-15
	Sparking equipment	“nC”	IEC 60079-15
	Pressurized enclosures	“pz” or “pzc”	IEC 60079-2
	Protection of equipment and transmission systems using optical radiation	“op is” “op sh” “op pr”	IEC 60079-28
	Special protection	“sc”	IEC 60079-33
“Da”	Encapsulation	“ma”	IEC 60079-18
	Protection by enclosure	“ta”	IEC 60079-31
	Intrinsically safe	“ia” or “iaD”	IEC 60079-11 or IEC 61241-11
	Special protection	“sa”	IEC 60079-33
“Db”	Encapsulation	“mb”	IEC 60079-18
	Protection by enclosure	“tb” or “tD”	IEC 60079-31
	Pressurized enclosures	“pD”	IEC 61241-4

	Intrinsically safe	“ib” or “ibD”	IEC 60079-11 or IEC 61241-11
	Special protection	“sb”	IEC 60079-33
“Dc”	Encapsulation	“mc”	IEC 60079-18
	Protection by enclosure	“tc” or “tD”	IEC 60079-31
	Pressurized enclosures	“pD”	IEC 61241-4
	Intrinsically safe	“ic” or “icD”	IEC 60079-11 or IEC 61241-11
	Special protection	“sc”	IEC 60079-33
New protection marking codes with identification of EPLs may be introduced in the future.			

#### 1.9.4 SELECTION BY CATEGORIES

The ATEX Directive 2014/34/EU gives equipment Categories that correspond to the IECEx Equipment Protection Levels (EPLs). The relationship between ATEX Categories and IECEx EPLs is as follows:

Category	EPLs	Zone
1G	Ga	0
2G	Gb or Ga	1
3G	Gc, or Gb or Ga	2
1D	Da	20
2D	Db or Da	21
3D	Dc or Db or Da	22

#### 1.9.5 SELECTION BY EQUIPMENT GROUPING

Electrical equipment shall be selected in accordance with Table 3 of EN/IEC 60079-14 shall be followed:

Location gas/vapour or dust	Permitted equipment group
IIA	II or IIA or IIB or IIC
IIB	II or IIB or IIC
IIC	II or IIC
IIIA	III or IIIA or IIIB or IIIC
IIIB	III or IIIB or IIIC
IIIC	III or IIIC

### 1.9.6 SELECTION BY IGNITION TEMPERATURE OF THE GAS, VAPOUR OR DUST AND AMBIENT TEMPERATURE

The electrical equipment shall be so selected that its maximum surface temperature will not reach the ignition temperature of any gas, vapour or dust which may be present.

#### 1.9.6.1 GAS OR VAPOUR

Symbols for the temperature classes marked on the electrical equipment have the meaning indicated in Table 4 of EN/IEC 60079-14. The relationship between gas or vapour ignition temperature and temperature class of equipment shown in Table 4 of EN/IEC 60079-14 is as follows:

Temperature class required by the area classification	Ignition temperature of gas or vapour in °C	Allowable temperature classes of equipment
T1	> 450	T1 to T6
T2	> 300	T2 to T6
T3	> 200	T3 to T6
T4	> 135	T4 to T6
T5	> 100	T5 and T6



Temperature class required by the area classification	Ignition temperature of gas or vapour in °C	Allowable temperature classes of equipment
T6	> 85	T6

#### 1.9.6.2 DUST

##### 1.9.6.2.1 DUST CLOUD

The maximum surface temperature of equipment when tested in the dust-free test method in accordance with IEC 60079-0 shall not exceed two-thirds of the minimum ignition temperature in degrees Celsius of the dust/air mixture concerned:

$$T_{\max} \leq 2/3 T_{CL}$$

##### 1.9.6.2.2 DUST LAYERS

Where the equipment is not marked with a dust layer thickness as part of the T rating, a safety factor shall be applied taking the dust layer thickness into account as follows:

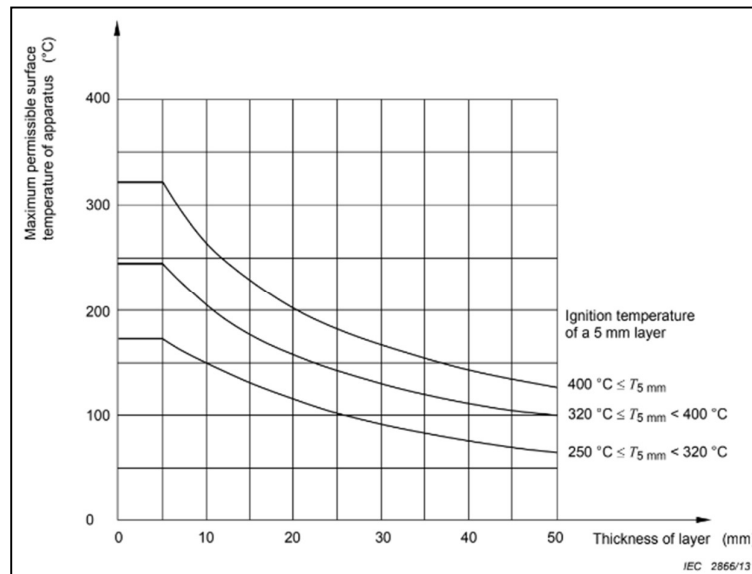
- up to 5 mm thickness: The maximum surface temperature of the equipment when tested in the dust-free test method in accordance with IEC 60079-0 shall not exceed a value of 75 °C below the minimum ignition temperature for the 5 mm layer thickness of the dust concerned:

$$T_{\max} \leq T_{5\text{ mm}} - 75\text{ °C}$$

where  $T_{5\text{ mm}}$  is the minimum ignition temperature of the 5 mm layer of dust.

- above 5 mm up to 50 mm thickness: Where there is a possibility that dust layers in excess of 5 mm may be formed on equipment, the maximum permissible surface temperature shall be reduced. For guidance, examples of the reduction in maximum permissible surface temperature of equipment used in the presence of dust having

minimum ignition temperatures in excess of 250 °C for a 5 mm layer are shown in the graph below for increasing depth of layers:



- For dust layers above 50 mm thickness special measures apply, refer to EN/IEC 60079-14 for details.

up to 5 mm thickness: The maximum surface temperature of the equipment when tested in the dust-free test method in accordance with

### 1.9.7 SELECTION TO COVER EXTERNAL INFLUENCES

Electrical equipment shall be selected and/or installed so that it is protected against external influences which could adversely affect the explosion protection. Some examples are:

- extremely low or high temperatures;
- solar radiation;
- pressure conditions;
- corrosive atmosphere;
- vibrations, mechanical impacts, friction or abrasion;
- wind;
- painting processes;
- chemicals;

- water and moisture;
- dust;
- plants, animals, insects.

External influences shall be identified as part of the installation design and selection of equipment for the installation and measures applied for control shall be documented and included in the verification dossier.

### **1.9.8 OTHER REQUIREMENTS**

Additional requirements apply to:

- Rotating electrical machines
- Environmental factors for “Ex” machine installation
- Luminaires
- Plugs and socket outlets
- Specific requirements for explosive dust atmospheres
- Cells and batteries
- Gas detection equipment

### **1.9.9 EXAMPLES OF SUITABILITY OF EQUIPMENT**

#### **1.9.9.1 EXAMPLE 1:**

Requirement: zone 1, gas Group IIC, temperature class T3

Installed equipment marking label information: Ex db IIB T3

Verdict: not acceptable

Ex db equipment is suitable for zone 1 applications, and the equipment meets the T3 temperature class requirement. However, the equipment is for use with gas Group IIB gases, and the installation requires for gas Group IIC equipment.

#### **1.9.9.2 EXAMPLE 2:**

Requirement: zone 0, gas Group IIB, temperature class T4

Installed equipment marking label information: Ex ma IIC T6

Verdict: acceptable

Ex ma equipment is suitable for zone 0 applications, the equipment's temperature class is T6, which meets the T3 temperature class requirement, and the equipment is for use with gas Group IIC gases, and the installation only requires gas Group IIB equipment.

#### 1.9.9.3 EXAMPLE 3:

Requirement: zone 20, dust Group IIIB, maximum surface temperature 90°C

Installed equipment marking label information: Ex ia IIC T6

Verdict: not acceptable

Ex ia equipment may be suitable for zone 0/20 applications, however, the equipment is intended for gas applications (Group IIC), not dust applications (IIIB). A T6 temperature class equates to a maximum surface temperature of +85°C, so the maximum surface temperature requirement would have been met.

#### 1.9.9.4 EXAMPLE 4:

Requirement: zone 21, dust Group IIIC, maximum surface temperature 85°C

Installed equipment marking label information: Ex tb IIIC T80°C

Verdict: acceptable

Ex tb equipment is suitable for zone 21 applications, the equipment is for use in dust Group IIIC and its maximum surface temperature, +80°C, is below the maximum allowable surface temperature of the installation, +85°C.

## 1.10 MOST APPLIED PROTECTION CONCEPTS FOR ELECTRICAL EQUIPMENT

### 1.10.1 EQUIPMENT PROTECTION BY FLAMEPROOF ENCLOSURES "D"

#### 1.10.1.1 FLAMEPROOF PROTECTION, EX D

En/IEC 60079-1 addresses flameproof type of protection, along with EN/IEC 60079-0 which contains the general requirements applicable to all hazardous area electrical equipment.

The two main features of a flameproof enclosure are:

- That it is strong enough to contain an explosion
- That its gaps are narrow enough to quench the flame generated by the explosion

A cross section of a typical flameproof enclosure is shown below:



Flameproof equipment has historically been used in zone 1, considering also the apparatus group and temperature class. This continued under ATEX, so Ex d equipment was invariably Category 2G.

Under IECEx, Ex d has been EPL Gb only. IEC 60079-1:2014 introduced the following options:

- Ex da: EPL Ga, certified for zone 0 – but only applies to catalytic gas sensors, not general equipment

- Ex db, EPL Gb, certified for zone 1 – this is the new marking for Ex d and will remain the commonest flameproof version by far.
- Ex dc, EPL Gc, certified for zone 2 – this replaces ‘enclosed break’ devices, previously certified Ex nC. However, Ex dc (and nC) devices are limited to a free internal volume of 20 cm<sup>3</sup>, so have limited application. The commonest device with such a small internal volume is the micro-switch, but, for commercial reasons, this is much more likely to be certified “db”.

Note that flameproof equipment is not ‘fireproof’: Ex d equipment is able to cope with an internal flame

lasting just a few milliseconds but is not designed to withstand an external fire.

The letter ‘d’ in the abbreviation for flameproof comes from the German ‘druckfeste Kapsulung’ (pressure-resistant encapsulation). In North America, the concept is known as ‘explosionproof’.

#### 1.10.1.2 APPLICATIONS

Ex d is a versatile method with a wide range of applications, for example:

- Motors
- Junction boxes
- Luminaires
- Instruments

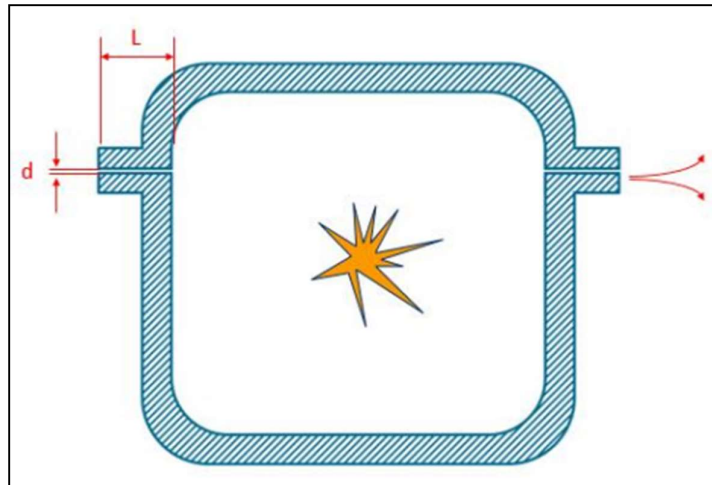
Flameproof (Ex d) and increased safety (Ex e) are often alternative methods of protection for many items of equipment, though Ex e cannot include switches and instrumentation, so flameproof is more versatile. The method of protection chosen depends on design and cost considerations, but Ex e is probably favoured for junction boxes, luminaires and larger-frame motors.

Flameproof is protection by enclosure, so the electrical equipment inside is less significant. The temperature class is measured on the outside of the enclosure.

#### 1.10.1.3 HOW FLAMEPROOF WORKS

The electrical equipment is housed in a specially constructed enclosure which does not permit an internal explosion to ignite the surrounding atmosphere. A

flameproof enclosure is built strong enough to resist the internal forces of an exploding gas, and with gaps narrow enough to cool (reduce the energy) of the exploding gases so that they cannot ignite a flammable gas outside the enclosure.



Tests show that if a small gap is present between the cover and lid, the internal flame is quenched provided the gap is not too wide. Thus, a gap is allowed between mating surfaces up to a specified maximum. Flameproof enclosures do not rely on the maintenance of a gap to relieve the pressure - no gap at all gives the biggest safety margin.

Flamepaths rely on at least three mechanisms to prevent flame transmission to the outside:

- Expanding and cooling - as the hot gases decompress, they cool. This is least significant with IIC gases
- Mixing ('entrainment') and cooling - as the hot gases escape from the flamepath they rapidly mix with the unburned gas and cool. This is most significant for IIC gases
- The flamepath gap is less than the 'flame diameter' – flames cannot propagate if the diameter of the kernel of burning gas is too small. This is the Davy Lamp principle and is most significant for firedamp. In this case the flame diameter is about 1 mm, so a mesh with a hole size of less than this prevents the flame transmission of burning methane

From point 2 above, it follows that obstructing the flamepath (with paint, tape or other obstructions) could make the flame quenching less effective, particularly with IIC gases. In practice, this is only a significant risk with flanged joints.

It is important to maintain the width of gaps below the maximum permissible as, for example, in a Zone 1 area gas may be entering the enclosure and be ignited and expelled at various times in its life. No intentional gap has to be left and joints should be fitted as close as possible. No intervening loose or perishable packing is allowed in gaps except permitted greases or gaskets/O-rings supplied by the manufacturer.

When inspecting flameproof equipment, the condition of flamepaths is an important check. Minor damage is acceptable but there is no specific guidance on what level of damage would cause equipment to fail; an engineering judgement is required. If the surface is deeply pitted with rust or has a deep scratch across the entire flamepath, then replacing the equipment should be considered. For larger, more expensive items, repair may be a cheaper option (EN/IEC 60079-19 applies in this scenario).

Corrosion of the mating surfaces, and physical damage through careless handling when the housing is opened for inspection and repair, can increase the gap dimensions of jointed surfaces above the maximum safe gap and destroy the flameproof characteristics.

When designing flameproof equipment, there is a trade-off between the flamepath length (L) and the gap (d). A longer flamepath sometimes allows a slightly wider maximum gap.

Apart from the value of 'L', the other factors determining flamepath gap are:

- the volume of the enclosure
- the gas group, IIA, IIB or IIC
- the type of joint

#### 1.10.1.4 FLAMEPATHS

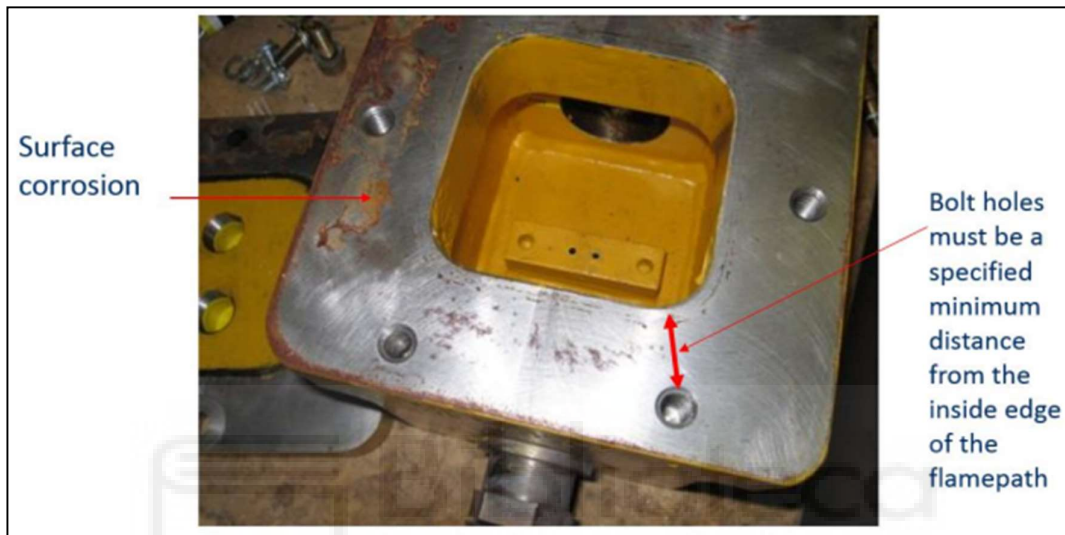
##### 1.10.1.4.1 FLAMEPATH: FLANGED JOINT

In a flanged joint, the cover and base must be in direct contact, forming a flamepath.



The design gap is zero, but, to allow for slight distortion of the metal and surface roughness, the standard allows a maximum gap. In practice, no gap, or a negligible gap, should be detected when inspecting a flanged joint.

The photograph below shows a flanged joint with no weatherproof protection. A gasket covering all or part of the face of the flange is out of the question, as this would move apart the metal parts of the joint. However, it is permissible for the manufacturer to incorporate a groove for an O-ring at the outer edge, provided the O-ring compresses enough so as not to prevent metal-to-metal contact.



When installing Ex d equipment with flanged joints, care shall be exercised to prevent the flameproof flange joint approaching nearer than the distance specified to any solid obstacle which is not part of the equipment, such as steelwork, walls, weather guards, mounting brackets, pipes or other electrical equipment. It is possible, though unlikely, that the equipment could be tested at a smaller distance of separation, but this would be documented in the certificate.

Gas Group	Minimum distance (mm)
IIA	10
IIB	30
IIC	40

This restriction does not apply to other types of joint.

#### 1.10.1.4.2 FLAMEPATH: SPIGOT JOINT

Generally, only the inner face is considered as the flamepath, so it is effectively a cylindrical joint. It is common to fit an O-ring into a groove at the end of the flamepath (though this is not present in the design shown).



#### 1.10.1.4.3 FLAMEPATH: THREADED JOINT

Threaded joints are very efficient at preventing flame transmission, so are the joint design of choice for IIC enclosures. The thread form is required to have a minimum quality of fit and at least 5 threads (if parallel), with at least 8 mm engagement depth.



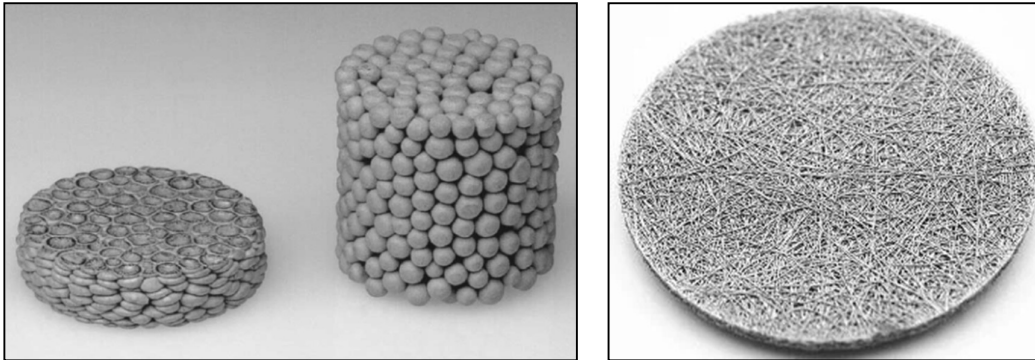
#### 1.10.1.4.4 FLAMEPATH: CYLINDRICAL JOINT (SHAFT)

Shaft joints may be rotating or associated with actuator rods, for example in micro-switches.



The sinter is porous, which allows gas to pass through it, but, provided the pore size is sufficiently small, a flame caused by an internal ignition is quenched – the sinter acts as a flame arrestor.

Examples of metal sphere and metal fibre sinters are shown below:



#### 1.10.1.4.7 FLAMEPATH DIMENSIONS

Tables 2 and 3 of EN/IEC 60079-1 specify the minimum width of joint and gap for enclosures of Groups I, IIA, IIB and IIC as shown below:

Type of joint		Minimum width of joint <i>L</i> mm	Maximum gap mm														
			For a volume $V \leq 100$ cm <sup>3</sup>			For a volume $100 < V \leq 500$ cm <sup>3</sup>			For a volume $500 < V \leq 2\,000$ cm <sup>3</sup>			For a volume $2\,000 < V \leq 5\,750$ cm <sup>3</sup>			For a volume $V > 5\,750$ cm <sup>3</sup>		
			I	IIA	IIB	I	IIA	IIB	I	IIA	IIB	I	IIA	IIB	I	IIA	IIB
Flanged, cylindrical or spigot joints		6	0,30	0,30	0,20	–	–	–	–	–	–	–	–	–	–	–	–
		9,5	0,35	0,30	0,20	0,35	0,30	0,20	0,08	0,08	0,08	–	0,08	0,08	–	0,08	–
		12,5	0,40	0,30	0,20	0,40	0,30	0,20	0,40	0,30	0,20	0,40	0,20	0,15	0,40	0,20	0,15
		25	0,50	0,40	0,20	0,50	0,40	0,20	0,50	0,40	0,20	0,50	0,40	0,20	0,50	0,40	0,20
Cylindrical joints for shaft glands of rotating electrical machines with:	Sleeve bearings	6	0,30	0,30	0,20	–	–	–	–	–	–	–	–	–	–	–	–
		9,5	0,35	0,30	0,20	0,35	0,30	0,20	–	–	–	–	–	–	–	–	–
		12,5	0,40	0,35	0,25	0,40	0,30	0,20	0,40	0,30	0,20	0,40	0,20	–	0,40	0,20	–
		25	0,50	0,40	0,30	0,50	0,40	0,25	0,50	0,40	0,25	0,50	0,40	0,20	0,50	0,40	0,20
		40	0,60	0,50	0,40	0,60	0,50	0,30	0,60	0,50	0,30	0,60	0,50	0,25	0,60	0,50	0,25
	Rolling-element bearings	6	0,45	0,45	0,30	–	–	–	–	–	–	–	–	–	–	–	–
		9,5	0,50	0,45	0,35	0,50	0,40	0,25	–	–	–	–	–	–	–	–	–
		12,5	0,60	0,50	0,40	0,60	0,45	0,30	0,60	0,45	0,30	0,60	0,30	0,20	0,60	0,30	0,20
		25	0,75	0,60	0,45	0,75	0,60	0,40	0,75	0,60	0,40	0,75	0,60	0,30	0,75	0,60	0,30
		40	0,80	0,75	0,60	0,80	0,75	0,45	0,80	0,75	0,45	0,80	0,75	0,40	0,80	0,75	0,40

Constructional values rounded according to ISO 80000-1 [3] should be taken into consideration when determining the maximum gap.

NOTE In this edition of IEC 60079-1, two new columns were introduced into Table 2 that subdivided the previous single " $V > 2\,000$ " column into a " $2\,000 < V < 5\,750$ " column and a " $V > 5\,750$ " column. This subdivision was made to introduce maximum gap dimensions for flanged, cylindrical or spigot joints with minimum width of joint *L* of 9,5 mm where none existed previously. Specifically, it introduced the values "0,08" for Groups IIA and IIB when volume is " $2\,000 < V < 5\,750$ " and "0,08" for Group IIA when volume is " $V > 5\,750$ ". These maximum gap values and the associated volume subdivisions are based on historic US Class I, Division 1 explosion-proof gap dimensions documented in ANSI/UL 1203 [4].

Type of joint		Minimum width of joint $L$ mm	Maximum gap mm			
			For a volume $V \leq 100$ $\text{cm}^3$	For a volume $100 < V \leq 500$ $\text{cm}^3$	For a volume $500 < V \leq 2\,000$ $\text{cm}^3$	For a volume $V > 2\,000$ $\text{cm}^3$
Flanged joints <sup>a</sup>		6	0,10	–	–	–
		9,5	0,10	0,10	–	–
		15,8	0,10	0,10	0,04	–
		25	0,10	0,10	0,04	0,04
Spigot joints (Figure 2a)	$c \geq 6$ mm	12,5	0,15	0,15	0,15	–
	$d \geq 0,5 L$	25	0,18 <sup>b</sup>	0,18 <sup>b</sup>	0,18 <sup>b</sup>	0,18 <sup>b</sup>
	$L = c + d$	40	0,20 <sup>c</sup>	0,20 <sup>c</sup>	0,20 <sup>c</sup>	0,20 <sup>c</sup>
	$f \leq 1$ mm					
Cylindrical joints Spigot joints (Figure 2b)		6	0,10	–	–	–
		9,5	0,10	0,10	–	–
		12,5	0,15	0,15	0,15	–
		25	0,15	0,15	0,15	0,15
Cylindrical joints for shaft glands of rotating electrical machines with rolling element bearings		6	0,15	–	–	–
		9,5	0,15	0,15	–	–
		12,5	0,25	0,25	0,25	–
		25	0,25	0,25	0,25	0,25
		40	0,30	0,30	0,30	0,30
<sup>a</sup> Flanged joints are permitted for explosive mixtures of acetylene and air only in accordance with 5.2.7. <sup>b</sup> Maximum gap of cylindrical part increased to 0,20 mm if $f < 0,5$ mm. <sup>c</sup> Maximum gap of cylindrical part increased to 0,25 mm if $f < 0,5$ mm.						
The constructional values rounded according to ISO 80000-1 should be taken into consideration when determining the maximum gap.						

Tables 4 and 5 of EN/IEC 60079-1 specify the minimum requirements for cylindrical and tapered threaded joints dimensions for enclosures of Groups I, IIA, IIB and IIC as shown below:

Pitch	$\geq 0,7$ mm <sup>a</sup>
Thread form and quality of fit	Medium or fine tolerance quality according to ISO 965-1 and ISO 965-3 <sup>b</sup>
Threads engaged	$\geq 5$
Depth of engagement	
Volume $\leq 100$ $\text{cm}^3$	$\geq 5$ mm
Volume $>100$ $\text{cm}^3$	$\geq 8$ mm
<sup>a</sup> Where the pitch exceeds 2 mm, special manufacturing precautions may be necessary (for example, more threads engaged) to ensure that the electrical equipment can pass the test for non-transmission of an internal ignition which is prescribed in 15.3. <sup>b</sup> Cylindrical threaded joints which do not conform with ISO 965-1 and ISO 965-3 in respect of thread form or quality of fit are permitted if the test for non-transmission of an internal ignition, prescribed in 15.3, is passed, when the width of the threaded joint specified by the manufacturer is reduced by the amount specified in Table 9.	



<b>Table 5 – Taper threaded joints <sup>a, c</sup></b>	
Threads provided on each part	$\geq 5$ <sup>b</sup>
<p><sup>a</sup> Internal and external thread shall have the same nominal size.</p> <p><sup>b</sup> Threads shall conform to the NPT requirements of ANSI/ASME B1.20.1 and shall be made-up wrench tight. External threaded parts shall be provided with:</p> <ol style="list-style-type: none"> <li>1) an effective thread length not less than the "L2" dimension; and</li> <li>2) if a shoulder is provided, a length not less than the "L4" dimension between the face of the shoulder and end of the thread.</li> </ol> <p>Internal threads shall gauge at "flush" to "2 turns large" using an L1 plug-gauge.</p> <p><sup>c</sup> Where the tapered threaded joint consists of both the internal and external threaded parts with at least 4,5 fully engaged threads, the requirements of footnote b in this table need not be applied.</p>	
<p><b>NOTE</b> See Annex C for tapered thread requirements applicable to flameproof entry devices.</p>	

#### 1.10.1.4.8 OTHER CONSIDERATIONS RELATING TO FLAMEPROOF JOINTS

- Protection of flameproof joints: Tape around the flamepath has been shown by test to reduce the effectiveness of the flamepath's quenching action. This effect applies most to IIC gases, least to IIA gases. The use of an approved non-hardening tape (e.g. 'Denso' tape) around a flanged joint may be used in certain conditions: EN/IEC 60079-14 recommends one layer only where IIA gases are involved, otherwise tape is not permitted (although there is a relaxation for some enclosures used with IIB gases). [Note that it is the apparatus group of the gas that is considered, not that of the apparatus itself.] This restriction does not apply to other types of joint.
- Grease on flameproof joints: Greasing of all flameproof joints is recommended but the grease, if applied, shall be of a type that does not harden because of ageing, does not contain an evaporating solvent, and does not cause corrosion of the joint surfaces as per EN/IEC 60079-14.
- Greasing of bolts: Care must be exercised when applying grease to bolts to ensure that excessive grease inside a blind bolt hole does not lead to an enclosure cover not being tightened fully.
- Painting of flamepaths: Flameproof joints and faces must not be painted. Painting of the enclosure after assembly is permitted.

#### 1.10.1.5 FLAMEPROOF TYPE TESTS

EN/IEC 60079-1 stipulates that the following type tests shall be carried out:

- Determination of explosion pressure (reference pressure)
- Overpressure
- Non-transmission of an internal ignition

The object of these tests is to verify that the enclosure can withstand the pressure of an internal explosion and that the flame caused by the explosion does not reach the external explosive atmosphere. Details of each test are provided below:

#### 1.10.1.5.1 REFERENCE PRESSURE TEST

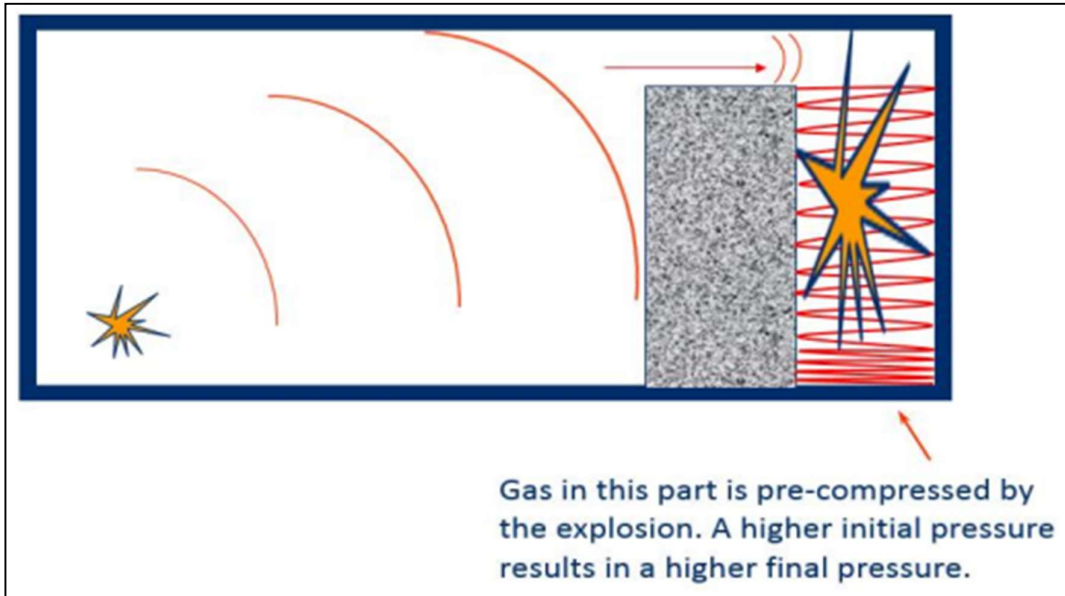
The reference pressure is the highest value of the maximum smoothed pressure, relative to atmospheric pressure, observed inside the enclosure during these tests.

Each test consists of igniting an explosive mixture inside the enclosure and measuring the pressure developed by the explosion. The number of tests and the explosive gas mixture used, in volumetric ratio with air and at atmospheric pressure, is as follows:

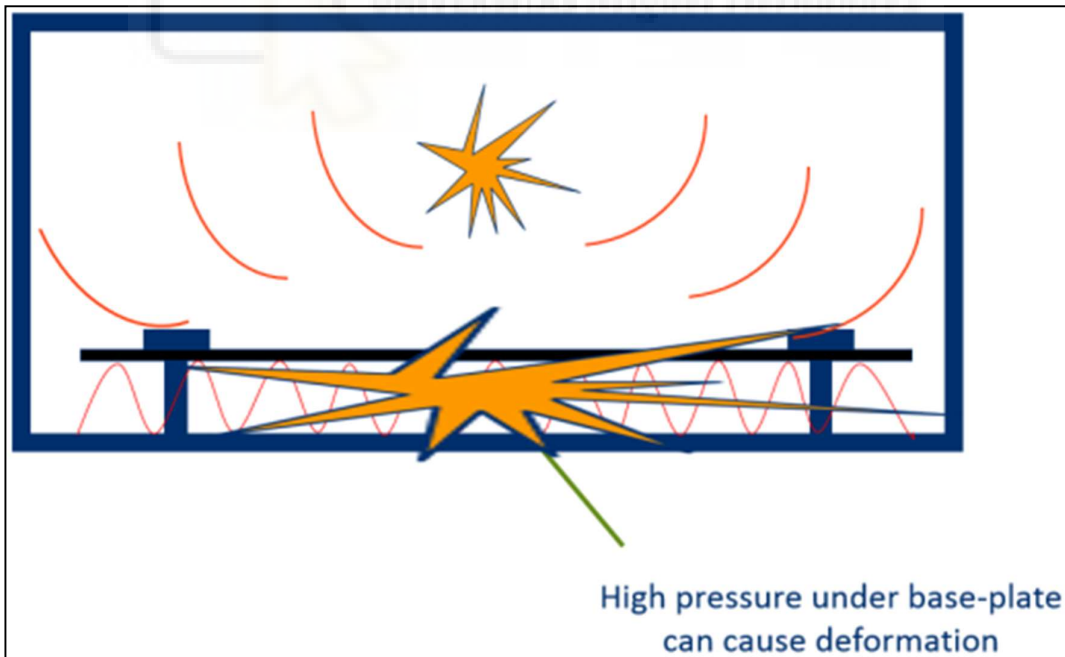
- Electrical equipment of Group I: three tests with  $(9,8 \pm 0,5)$  % methane
- Electrical equipment of Group IIA: three tests with  $(4,6 \pm 0,3)$  % propane
- Electrical equipment of Group IIB: three tests with  $(8 \pm 0,5)$  % ethylene
- Electrical equipment of Group IIC: five tests with  $(14 \pm 1)$  % acetylene and five tests with  $(31 \pm 1)$  % hydrogen

During reference testing, sensors are installed in the enclosure walls and an internal gas/air (sometimes oxygen-enriched) test mixture is ignited to establish the enclosure's peak pressure, known as the 'reference pressure'.

It is important to note that the reference pressure determined on an empty enclosure is likely to be lower than when the enclosure is populated with components, even though there is a smaller free volume for the explosive atmosphere to fill. This is because unburned gas may be pushed into the cavities created by the internal components creating a highly pressurised pocket of explosive mixture in the cavity, resulting in a more severe explosion as the flame burns more quickly through the compressed explosive mixture. This phenomena is known as "pressure piling":



A good example of pressure piling can be observed around base plates in enclosures, such as a printed circuit board. The initial explosion compresses the gas under the circuit board, so by the time the flame front comes in contact with the pre-compressed gas under the base plate, the explosion pressure will be much larger:



It is important to consider this when deciding the location of the pressure sensors.



#### 1.10.1.5.2 OVERPRESSURE TEST

Once the reference pressure has been determined, an over pressure test is performed. The test sample is subjected to an over pressure of 1,5 and 4 times the reference pressure. A non-compressible hydraulic media is normally used for these tests, usually water.

If an enclosure passes 4 times the reference pressure, the manufacturer is exempt from routine testing each piece of equipment manufactured. If an enclosure fails 4x reference pressure but passes at 1.5 times, the manufacturer must subject every enclosure to a routine overpressure test at 1.5 times the reference pressure.

Welded enclosures are subject to the 1,5 times overpressure test in all cases.

The overpressure test shall be considered satisfactory if the enclosure suffers no permanent deformation or damage invalidating the type of protection, the joints have in no place been permanently enlarged and if there is no leakage through the walls of the enclosure.

#### 1.10.1.5.3 NON-TRANSMISSION OF AN INTERNAL IGNITION TEST

An enclosure must also pass flame transmission testing, comprising 5 successive tests without allowing the explosion to escape to the outside atmosphere. As for the reference pressure tests, the explosive gas mixture varies depending on the gas group:

- electrical equipment of Group I: (12,5 ± 0,5) % methane-hydrogen [(58 ± 1) % methane and (42 ± 1) % hydrogen]
- electrical equipment of Group IIA: (55 ± 0,5) % hydrogen
- electrical equipment of Group IIB: (37 ± 0,5) % hydrogen
- electrical equipment of Group IIC: (27,5 ± 1,5) % hydrogen and (7,5 ± 1) % acetylene

Typically, the enclosure under test is surrounded by a polythene bag, which is also filled with the test gas:



The test result is considered satisfactory if the ignition is not transmitted to the test chamber, meaning that the test is successful if the outer bag remains intact.

## **1.10.2 EQUIPMENT PROTECTION BY INCREASED SAFETY "e"**

### 1.10.2.1 INCREASED SAFETY PROTECTION, EX e

The two fundamental principles of increased safety are:

- arcs, sparks and hot surfaces are avoided by design, and
- enclosures are weatherproof to a minimum ingress protection of IP54

Ex e equipment is certified against EN/IEC 60079-7. From the 2015 edition onwards, increased safety equipment may be either:

- Level of Protection "eb", previously "e" (EPL Gb) for zone 1, or
- Level of Protection "ec" (EPL Gc) for zone 2, introduced in EN/IEC 60079-7:2015

Level of Protection "eb" applies to equipment or Ex Components, including their connections, conductors, windings, lamps, and batteries; but not including semiconductors or electrolytic capacitors. For Level of Protection "eb", EN/IEC 60079-7 applies to electrical equipment where the rated voltage does not exceed 11 kV r.m.s., a.c. or d.c.

Level of Protection "ec" applies to equipment or Ex Components, including their connections, conductors, windings, lamps, and batteries; and also including

semiconductors and electrolytic capacitors. For Level of Protection “ec”, EN/IEC 60079-7 applies to electrical equipment where the rated voltage does not exceed 15 kV r.m.s., a.c. or d.c.

The method of protection is not affected by the apparatus group of the gas or vapour so all equipment is marked ‘IIC’.

The letter ‘e’ that is used to indicate increased safety comes from the German (“erhöhte Sicherheit” or “enhanced safety”). Compared to flameproof equipment, Ex e enclosures are usually lighter, cheaper to manufacture and, possibly, easier to maintain, although, unlike Ex d, it is essential to Ex e protection that water is excluded, so the condition of the sealing gasket (or equivalent) is of great importance.

#### 1.10.2.2 HOW INCREASED SAFETY WORKS

As mentioned above, the objective of the increased safety type of protection is to avoid arcs, sparks and hot surfaces in the equipment, and for the enclosure to maintain as a minimum an ingress protection rating of IP54. The minimum requirements to achieve this are stipulated in EN/IEC 60079-7.

There are common requirements to all types of equipment with type of protection Ex e, known as constructional requirements, and then there are supplementary requirements for specific types of electrical equipment, such as electrical machines, luminaires, junction boxes, resistance heating equipment...

The general constructional requirements address common design features of all equipment, such as electrical connections, creepage and clearances, temperature limitations, ingress protection... A summary of these constructional requirements is provided below to give an idea of how arcs, sparks and hot surfaces are mitigated:

- Electrical connections: Electrical connections intended to be terminated internal to the equipment enclosures are subdivided into those for field-wiring, for factory wiring, and into permanent types and reconnectable/rewireable types.

External earthing and equipotential bonding connections shall comply with the requirements for field wiring connections.

Each type shall, as applicable:

- be constructed in such a way that the conductors cannot slip out from their intended location during tightening of a screw or after insertion.
- provide a means to avoid loosening of the connection in service.
- be such that contact is assured without damage to the conductors such that would impair the ability of the conductors to fulfil their function, even if multi-stranded conductors are used in connections intended for direct clamping of a single conductor.
- provide a positive compression force to assure contact pressure in service.
- be constructed in such a way that the contact they assure is not appreciably impaired by temperature changes occurring in normal service.
- except as permitted by the earth continuity test of IEC 60079-0, provide contact pressure that does not depend on the structural integrity of insulating materials.
- not be specified to accommodate more than one individual conductor in a clamping point unless specifically designed and assessed for doing so.
- if intended for stranded conductors, employ a means to protect the conductors and distribute the contact pressure evenly. The method of applying contact pressure shall be capable, on installation, of reliably forming the stranded conductor into an effectively solid shape that does not subsequently change in service. Alternatively, the method of applying the contact pressure should be such that it is designed to accommodate any settlement of the strands in service.
- for screw connections, have a torque value specified by the manufacturer.

- for screwless connections intended for class 5 and/or class 6 fine-stranded conductors according to IEC 60228, the fine-stranded conductor shall be equipped with a ferrule or the termination shall have a method to open the clamping mechanism so that the conductors are not damaged during the installation of the conductor.
- Clearances: clearance is the shortest distance in air between two conductive parts. Clearances between bare conductive parts at different potentials shall be as given in Table 2 of EN/IEC 60079-7 with a minimum value for field wiring connections of 3 mm for Level of Protection “eb” or 1,5 mm for Level of Protection “ec”. Clearances shall be determined as a function of the working voltage, the higher the working voltage the greater the required clearance is. Table 2 of EN/IEC is shown below.
- Creepage distances: creepage distance is the shortest distance along the surface of a solid insulating material, in contact with air, between two conductive parts. The required values of creepage distance are dependent on the working voltage, the resistance to tracking of the electrical insulating material and its surface profile. Creepage distances between bare conductive parts at different potentials shall be as given in Table 2 of EN/IEC 60079-7, with a minimum value for field wiring connections of 3 mm for Level of Protection “eb” or 1,5 mm for Level of Protection “ec”, and shall be determined as a function of the rated voltage specified by the manufacturer of the equipment. Table 2 of EN/IEC is shown below.

Table 2 – Minimum Creepage distances, clearances and separations											
Voltage (see a and b) $U_{r.m.s.}$ a.c. or d.c. V	Minimum creepage distance mm								Minimum clearances and separations mm		
	Material group								Clearance	Distance under coating <sup>d</sup>	
	I		II		IIIa		IIIb				
	"eb"	"ec"	"eb"	"ec"	"eb"	"ec"	"eb"	"ec"	"eb"	"ec"	"ec"
≤10 (see c)	1,6	1	1,6	1	1,6	1	-	1	1,6	0,4	0,3
≤ 12,5	1,6	1,05	1,6	1,05	1,6	1,05	-	1,05	1,6	0,4	0,3
≤ 16	1,6	1,1	1,6	1,1	1,6	1,1	-	1,1	1,6	0,8	0,3
≤ 20	1,6	1,2	1,6	1,2	1,6	1,2	-	1,2	1,6	0,8	0,3
≤ 25	1,7	1,25	1,7	1,25	1,7	1,25	-	1,25	1,7	0,8	0,3
≤ 32	1,8	1,3	1,8	1,3	1,8	1,3	-	1,3	1,8	0,8	0,3
≤ 40	1,9	1,4	2,4	1,6	3,0	1,8	-	1,8	1,9	0,8	0,6
≤ 50	2,1	1,5	2,6	1,7	3,4	1,9	-	1,9	2,1	0,8	0,6
≤ 63	2,1	1,6	2,6	1,8	3,4	2	-	2	2,1	0,8	0,6
≤ 80	2,2	1,7	2,8	1,9	3,6	2,1	-	2,1	2,2	0,8	0,8
≤ 100	2,4	1,8	3,0	2	3,8	2,2	-	2,2	2,4	0,8	0,8
≤ 125	2,5	1,9	3,2	2,1	4,0	2,4	-	2,4	2,5	1	0,8
≤ 160	3,2	2	4,0	2,2	5,0	2,5	-	2,5	3,2	1,5	1,1
≤ 200	4,0	2,5	5,0	2,8	6,3	3,2	-	3,2	4,0	2	1,7
≤ 250	5,0	3,2	6,3	3,6	8,0	4	-	4	5,0	2,5	1,7
≤ 320	6,3	4	8,0	4,5	10,0	5	-	5	6,0	3	2,4
≤ 400	8,0	5	10,0	5,6	12,5	6,3	-	6,3	6,0	4	2,4
≤ 500	10	6,3	12,5	7,1	16	8	-	8	8,0	5	2,4
≤ 630	12	8	16	9	20	10	-	10	10	5,5	2,9
≤ 800	16	10	20	11	25	12,5	-	-	12	7	4
≤ 1 000	20	11	25	11	32	13	-	-	14	8	5,8
≤ 1 250	22	12	26	12	32	15	-	-	18	10	-
≤ 1600	23	13	27	13	32	17	-	-	20	12	-
≤ 2 000	25	14	28	14	32	20	-	-	23	14	-
≤ 2 500	32	18	36	18	40	25	-	-	29	18	-
≤ 3 200	40	22	45	22	50	32	-	-	36	22	-
≤ 4 000	50	28	56	28	63	40	-	-	44	28	-
≤ 5 000	63	36	71	36	80	50	-	-	50	36	-
≤ 6 300	80	45	90	45	100	63	-	-	60	45	-
≤ 8 000	100	56	110	56	125	80	-	-	80	56	-
≤ 10 000	125	71	140	71	160	100	-	-	100	70	-
≤ 12 500	-	90	-	90	-	125	-	-	-	89	-
≤ 13 640	-	98	-	98	-	138	-	-	-	97	-

<sup>a</sup> When determining the required values for creepage and clearance, the working voltage may be higher than the voltage in the table by a factor of 1,1.

NOTE The factor of 1,1 recognizes that at many places in a circuit, the working voltage equals the rated voltage and that there are a number of rated voltages in common use that can be accommodated by the 1,1 factor.

<sup>b</sup> The creepage distance and clearance values shown already take into account a maximum supply voltage tolerance of ±10 %. Therefore it is not necessary to further consider supply voltage fluctuations when determining which voltage value from the Table to use.

<sup>c</sup> At 10 V and below, the value of CTI is not relevant and materials not meeting the requirement for material group IIIb may be acceptable.

<sup>d</sup> The distances under coating shown are permitted for printed wiring boards in Level of Protection "ec" as described in 4.5.

- Temperature limitations: No solid electrical insulating material shall attain a temperature in excess of:

- 20K above the material's maximum service temperature for level of protection "eb", and at least 80°C.
- the material's maximum service temperature for level of protection "eb".

Determination shall be in accordance with the procedure for the determination of Service Temperature in EN/IEC 60079-0.

Furthermore, no surface of any part of electrical equipment, including the surface of internal parts to which the explosive gas atmosphere might have access, shall attain a temperature in excess of the maximum surface temperature prescribed in EN/IEC 60079-0, except for lamps in luminaires for which the requirement is given in 5.3.7.2. The determination of the maximum surface temperature specified in EN/IEC 60079-0 shall consider the additional overload or malfunction conditions as required by EN/IEC 60079-7.

- Wiring internal to the equipment: Wiring which might come into contact with a conductive part shall be mechanically protected, secured, or routed to avoid insulation damage.
- Degrees of protection provided by enclosure: The degrees of protection as defined in tests of enclosures of EN/IEC 60079-0 apply. The IP requirements are:
  - Enclosures containing bare conductive live parts shall provide at least the degree of protection IP54.
  - Enclosures containing only insulated conductive live parts shall provide at least the degree of protection IP44.
  - Enclosures for containing only insulated conductive live parts, can provide a reduced degree of protection of IP23 for Group I, or IP20 for Group II, if solid foreign bodies are prevented from falling vertically through any openings into the enclosure. For this equipment, the certificate number shall include the "X" suffix in accordance with the marking requirements of EN/IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall detail the degree of protection provided by enclosure and provide



guidance on the protection by location that is required. An example of an application where this reduced degree of protection could be suitable is a clean environment.

### 1.10.2.3 EX eb COMPARED TO EX ec

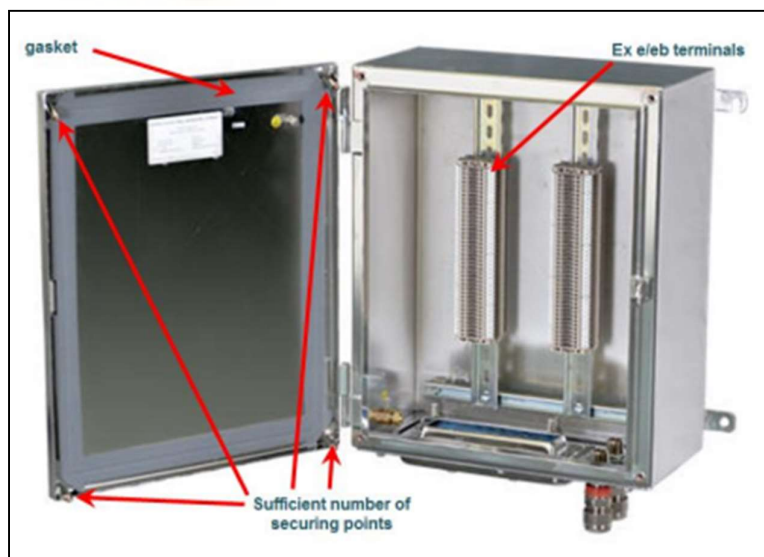
Although Ex ec was only introduced in 2015, it is in fact a replacement for Ex nA (a zone 2 concept) that has been around for decades. Ex nA was known as 'non-sparking' and was a simplified version of Ex e. It is extremely common and there is a large quantity of Ex nA equipment installed on hazardous area sites.

Ex ec is likewise a simplified version of Ex eb. The main difference in philosophy is that Ex eb considers fault conditions, whereas Ex ec does not. This allows significant relaxations between the two.

Ex ec permits electronic components on circuit boards without the requirement for them to be protected by encapsulation. Thus, resistors, capacitors, semiconductors, even fuses are allowed under Ex ec, but prohibited under Ex eb. A large section of the equipment previously certified as Ex nA is low power instrumentation of all types, now covered under Ex ec

### 1.10.2.4 TYPICAL EX e APPLICATIONS

#### 1.10.2.4.1 EX e ENCLOSURES



Ex e equipment is robust in construction and the enclosure is extensively tested during the certification process. In addition to this, it is now a mandatory



requirement of EN/IEC 60079-14 for glands used on Ex e enclosures to be certified.

The standard requires an ingress protection of IP54 minimum:

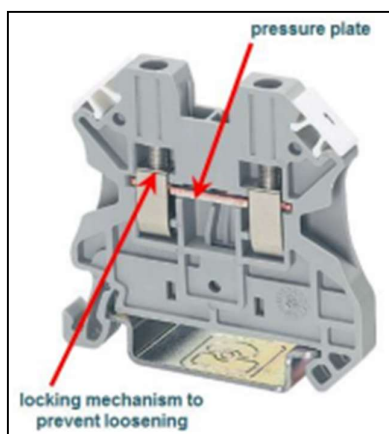
- IP5X: dust protected (but not dust-tight)
- IPX4: protected against sprays

This would probably be suitable for an indoor environment where there is a possibility of a sprinkler system being operated, but it is not sufficient for an outdoor location, so, invariably, manufacturers of Ex e equipment aim for higher levels of protection (typically IP66/67).

The IP54 requirement must be seen as a minimum. Clearly, if arcs and sparks are avoided by design, then the electrical circuits must be protected from water and conductive dusts which could cause tracking and eventual breakdown on the insulation.

#### 1.10.2.4.2 EX e TERMINALS

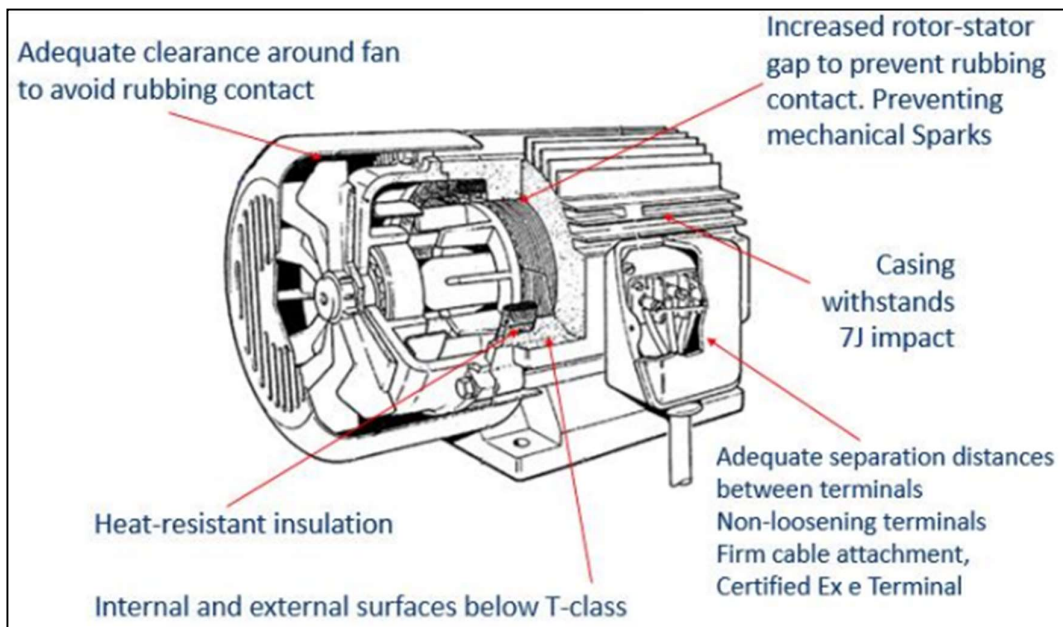
Terminals in an Ex eb enclosure must be certified. If the terminals can be removed (as with rail-mounted terminals, for example), then they should be individually certified. The usual coding is Ex eb IIC Gb. Terminals that are not removable may be certified with the equipment and need not be individually marked with a certification code.



Locking devices are incorporated in terminals so that they will not work loose. Clearance between terminals and creepage distances on insulating material are arranged to meet minimum requirements.

#### 1.10.2.4.3 EX e MOTORS

A typical Ex e motor has the following features:



- Ex eb motors: Ex eb motors are more stringently designed than most others in that:
  - They can be stalled at working temperatures for at least 5 seconds without any part of them, including the rotor, exceeding the temperature classification.
  - A minimum size of wiring is specified unless fully encapsulated.
  - The rotor/stator air gap is deliberately enlarged to make it even less likely that the rotor will hit the stator when the bearings are worn.
  - Frequently the Ex eb frame is larger than for other motors of the same rating because of lower efficiency.

It is important with all Ex eb motors that the overcurrent or overload settings and trip times on the starters are set and periodically checked as required by the motor certification.

- Ex ec motors: Since these are assessed under worst-case normal operation, stalling is not considered and the temperature control can be less sophisticated.

#### 1.10.2.4.4 EX e LUMINAIRES



These are likely to be lighter than their flameproof equivalents and also easier to maintain. Ex eb luminaires usually incorporate components protected by other methods, such as:

- Ex mb for the control circuit
- Ex db lamp-holder (in case a spark occurs)
- Ex db cut-out switch (to disconnect the battery in an emergency light)
- Capacitor protected by Ex db or Ex q in case of overheating

The starter circuit must not include cathode heating for “eb”, but it can for “ec”. End of life protection for the tube must be provided for “eb”.

Since fault conditions are not considered, luminaires especially can be made much more cheaply as Ex ec.

#### 1.10.2.4.5 EX e JUNCTION BOXES USED FOR INTRINSICALLY SAFE TERMINALS

Junction boxes used for intrinsically safe circuits need not, strictly speaking, be certified at all, but it is common to use Ex e certified boxes, suitably marked on the outside with words such as “CONTAINS INTRINSICALLY SAFE CIRCUITS ONLY”. In this case, it is generally agreed that it is permissible to use uncertified terminals and test-disconnect terminals (but not fuse terminals), since any sparks are ‘safe’. However, terminals should nevertheless be designed to meet the creepage and clearance distances required by the intrinsic safety standard.

#### 1.10.2.5 LIMITATIONS OF EX e CONCEPT

If a flammable gas/air mixture is ignited inside an Ex e enclosure, unlike flameproof, there is no protection left - the enclosure is not designed to withstand an explosion! The ingress protection of IP54 minimum covers the exclusion of dust and water only, so the enclosure is not gas-tight. It is therefore vital that no sources of ignition are present in such enclosures.

Items that should definitely not be found inside an Ex eb enclosure include:

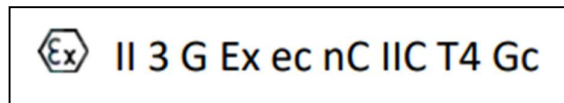
- uncertified terminals
- fuses and fuse terminals
- test-disconnect terminals ('knife-edge switches')
- relays (unless otherwise protected)
- electronic circuitry (unless otherwise protected)
- switches, circuit breakers
- programmable logic controllers (PLCs)

In summary, only Ex eb certified devices can be installed inside Ex eb enclosures, which generally comes down to terminals only.

Where an Ex eb enclosure requires any of the above, the equipment must use another type of protection, e.g.

- Ex db for switches
- Ex mb for electronic circuitry
- Ex q for fuses

An Ex eb enclosure containing such devices might be certified as follows:



Another common example where increased safety is 'helped' by flameproof is shown below:



This emergency stop contains an Ex db component-approved switch inside an Ex eb enclosure that provides the required mechanical protection and an ingress protection rating of IP6.

A certified Ex db gland is not required, since the enclosure is Ex eb, so a certified Ex eb gland is sufficient.

The coding for the equipment in this case would be Ex db eb IIC T6 Gb.

### 1.10.3 EQUIPMENT PROTECTION BY INTRINSIC SAFETY “i”

#### 1.10.3.1 INTRINSIC SAFETY PROTECTION, EX i

Put simply, intrinsic safety is the ‘safe spark’ concept, with temperature rise also strictly controlled.

It is a protection method where the electrical energy available in any spark that can occur in the hazardous area will be non-incendive. The generally used values for the spark ignition energies (from EN/IEC 60079-11) are as follows and impose a severe restriction on the design of equipment:

- Group IIC (hydrogen/air) limited to 40  $\mu$ J
- Group IIB (ethylene/air) limited to 160  $\mu$ J
- Group IIA (propane/air) limited to 320  $\mu$ J
- Group I (methane) limited to 525  $\mu$ J

The above are measures of the discharge of energy stored in, for instance, an inductor when discharging into a single spark. The EN/IEC standards apply a safety factor of 2.25 to these energy values. In addition, there are limits on the current that can flow into a spark at a given voltage.

Intrinsically safe apparatus and systems are therefore designed such that a spark, even if produced accidentally (by a conductor coming loose, a PCB track breaking or a cable fault, for example), will not cause ignition of the gas. This allows ‘live’ working. It can be seen from the above ignition energies, however,

that a piece of apparatus designed for IIA gases would be inappropriate for IIB or IIC gases. This is because the spark energy limit of 320  $\mu\text{J}$  is too high for IIB and IIC. Intrinsically safe equipment should be selected per the gas group of the hazard gas. For certification reasons, intrinsically safe equipment is usually given a T4 temperature class.

With such limitations, intrinsic safety is only suitable for low-power equipment, typically instrumentation, fixed and battery-powered.

If the design challenges of intrinsic safety can be overcome, it can offer a cost-effective method of protection, since the enclosure has relatively modest requirements, particularly if only gas certification is required, so can be cheaper to manufacture. A negative aspect is that fixed equipment must be supplied from a 'barrier' or 'galvanic isolator', which adds to the installation cost.

#### 1.10.3.2 INTRINSIC SAFETY LEVELS OF PROTECTION

Intrinsically safe levels of protection are 'ia' or 'ib' or 'ic'. The differences are as follows:

- Ex ia: Ex ia equipment is safe with two major ('countable') faults and any number of minor ('non-countable') faults. It can be used in zones 0, 1 and 2 (usually EPL Ga, Category 1G equipment, although sometimes 'Gb' to avoid additional restrictions associated with zone 0 use).
- Ex ib: Ex ib equipment is safe with 1 major ('countable') fault and any number of minor ('non-countable') faults. It can be used in zones 1 and 2 (EPL Gb, Category 2G equipment).
- Ex ic: Ex ic equipment is safe in normal operation – can be used in zone 2 (EPL Gc, Category 3G equipment).

If the equipment is additionally assessed for use in flammable dusts, EPLs Da, Db and Dc apply.

Ex ic is designed for zone 2 instrumentation (mainly) where live working is required (as for 'ia' and 'ib') and also fits in with manufacturers who require "FISCO ic" certification.

#### 1.10.3.3 APPLICATIONS OF INTRINSIC SAFETY PROTECTION

#### 1.10.3.3.1 BATTERY POWERED EQUIPMENT

Intrinsically safe equipment such as test meters, data loggers, torches, etc. that are battery-powered should only be used with the batteries specified in the certificate - usually this information is also on the battery compartment cover. Under fault conditions, the wrong batteries may become too hot, deliver too much current, leak, or fail to meet the standard in other ways. Rechargeable batteries and some disposable batteries are capable of dangerously high currents if short-circuited but can be used in intrinsically safe equipment in conjunction with a current-limiting resistor or current-limiting circuitry.

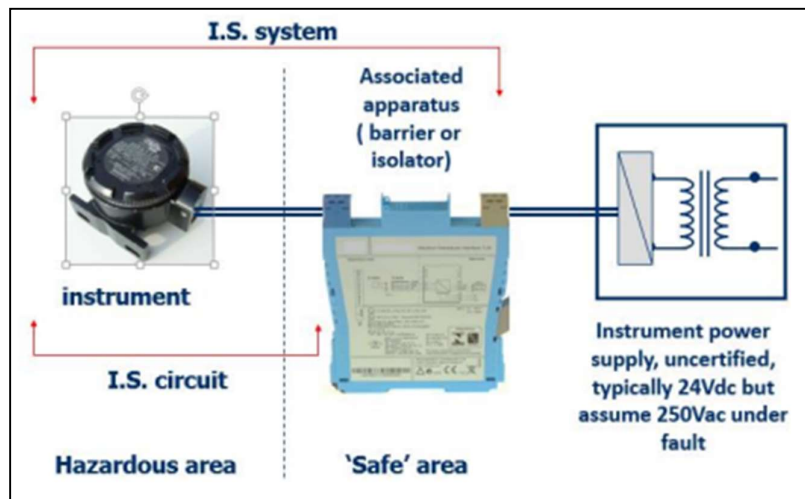


Unless the apparatus certificate says otherwise, rechargeable batteries should only be recharged in the non-hazardous area. It is very unusual for charging to be allowed in a hazardous area and, for portable equipment, is usually not required anyway. Also, the output of the charger must be checked against the certificate - excessive voltage may damage safety-critical components in the apparatus and render it unsafe for use in the hazardous area. For equipment certified from 2011 onwards, the charger is likely to be specified.

#### 1.10.3.3.2 FIXED EQUIPMENT

An 'Intrinsically Safe System' typically consists of at least two items of equipment, one in the hazardous area and the other in the non-hazardous area, connected by cable.





Intrinsic safety is a system concept so it is necessary to consider the safety of each item of equipment in the loop, as well as the cable. A spark at any point, including sparks due to 'live' working or cable faults, is safe. Intrinsic safety starts at the light blue output terminals of the associated apparatus, which is located in the non-hazardous ('safe') area.

Using an intrinsically safe interface (known as associated apparatus) between the safe area equipment and the hazardous area removes the necessity for detailed consideration of the safe area equipment, which need not be certified. This might be an uncertified instrument power supply, an uncertified PC or any other power source, provided the maximum voltage under fault conditions cannot exceed 250 V.

#### 1.10.3.3.3 ASSOCIATED APPARATUS

There are basically two types of interfaces, known as 'associated apparatus':

- Zener barriers - these have a relatively simple network of fuses, resistors and zener or ordinary diodes to clamp the voltage and limit the current.
- Galvanic isolators - these provide galvanic isolation between the hazardous and safe areas using transformers, opto-isolators or relays.

The barrier or isolator must be able to limit the voltage and current even when the safe area power supply malfunctions. Usually, such devices are certified up to a maximum fault voltage ( $U_m$ ) of 250 Vrms relative to earth; this is more or less the only restriction on the power supply.



Most intrinsically safe systems use proprietary barriers and isolators, from manufacturers such as Pepperl & Fuchs, MTL, Stahl, Turck, Elcon and others. These are invariably certified and have the advantage that equipment upstream (e.g. instrument transformer, computer, etc.) need not be certified. However, a manufacturer of an intrinsically safe instrument may decide to combine the power supply and signal processing circuitry with suitable interface circuitry, in which case the entire equipment requires certification (though the certifying process will concentrate on the relatively simple voltage/current limiting circuitry protecting the outputs to the hazardous area terminals).

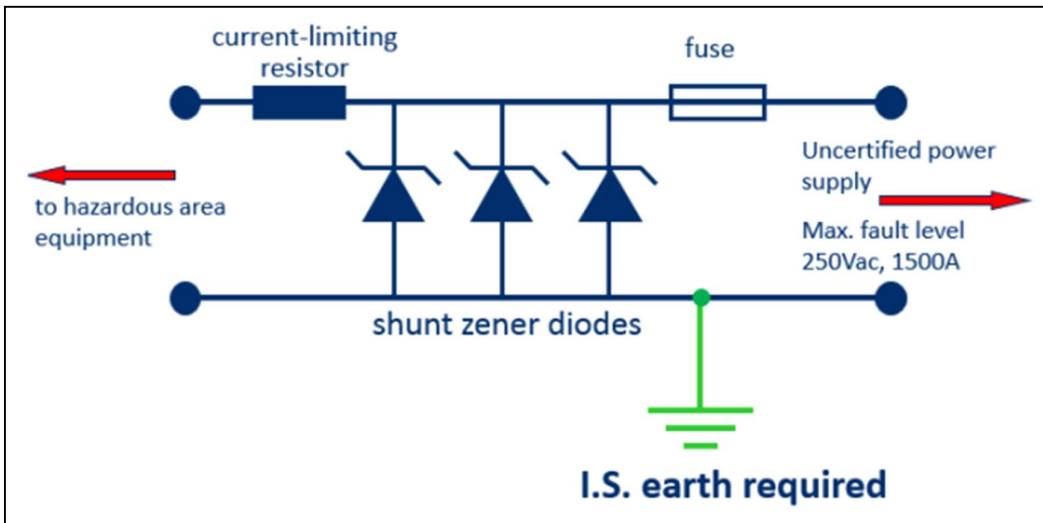
Associated apparatus is not intended to be installed in a hazardous area, although it does have an output that can supply equipment in a hazardous area. The fact that this is non-hazardous area equipment is indicated by square brackets, for example: [Ex ia Ga Da] IIC. This indicates that the equipment is intrinsically safe 'ia', and can supply suitably-certified equipment up to EPL Ga or Da and a IIC temperature class.

The key difference between barriers and isolators is that barriers require a high integrity earth and isolators do not. This is explained in the following sections.

#### 1.10.3.3.3.1 ZENER BARRIERS

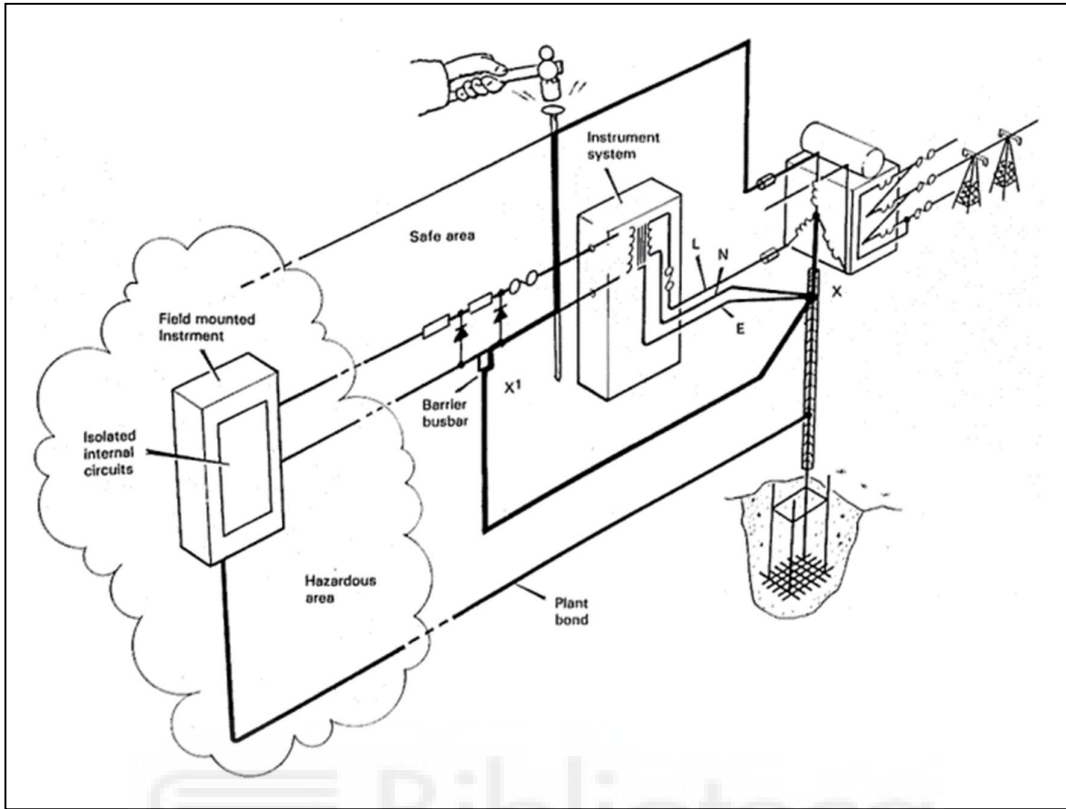
##### 1.10.3.3.3.1.1 BASIC CIRCUIT

Refer to the below diagram for a diagram of a basic zener barriers circuit. The terminals on the right hand side are connected to normal industrial apparatus in the non-hazardous area. The fuse and zener diodes are chosen so that even if mains voltage,  $U_m$ , is applied to these terminals on failure of the industrial apparatus, then the zener diodes will hold the barrier voltage down until the fuse blows. The final resistor defines the barrier output current. The resistors used are of a type and rating such that they are not considered subject to short circuit faults and the zener diodes are subjected to tests after which their possible open circuit failure is discounted. The entire device is usually encapsulated. If the internal fuse blows, user replacement is not permitted and replacement of the device is necessary.



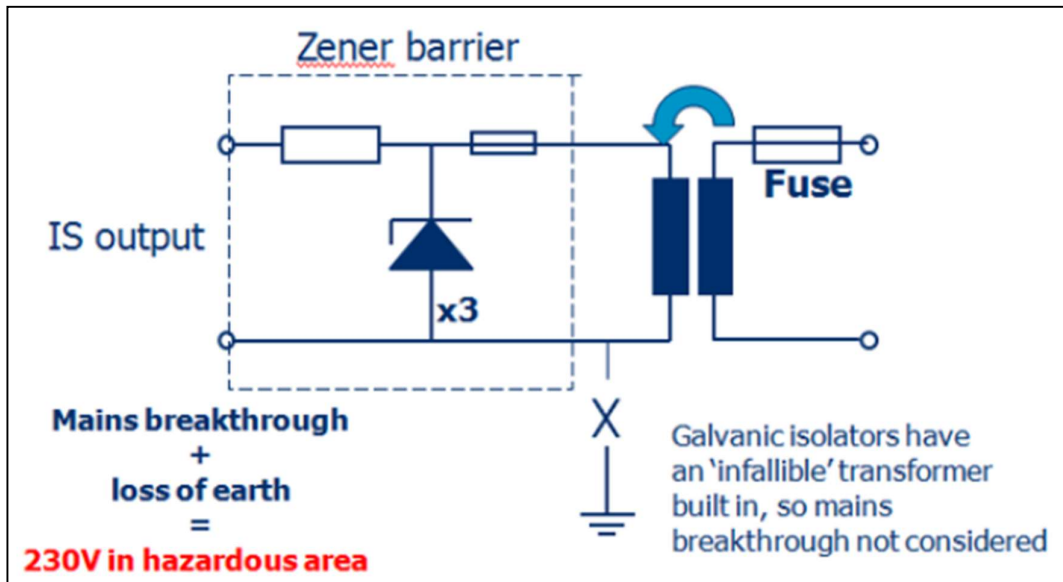
#### 1.10.3.3.3.1.2 BARRIER EARTHING

The diagram below illustrates this basic principle and how the barrier protects the hazardous area circuit against excessive voltage should a high voltage appear on the non-hazardous area terminals, caused in this illustration by a metal spike being hammered through a mains cable and then the supply cable to the barrier. The low resistance ( $\leq 1$  ohm) between point X' and X reduces potential differences experienced to an acceptable level and provides a route for the fault current, thus blowing the fuse.



It should be stressed that applying mains voltage to the non-intrinsically safe side of the barrier is only in the case of an extremely rare fault. More commonly, the barrier provides protection against raised voltage on the supply and will also limit the current from the supply. The end-to-end resistance of the barrier, quoted in the data sheet, must be considered when calculating the voltage drop between the supply and the instrument, the other source of voltage drop being the resistance of the cable.

It is important that the barrier earth provides a low resistance path back to the source of supply. In case of mains breakthrough, this arrangement prevents an elevated voltage from reaching the hazardous area.



In the highly unlikely event of the upstream transformer failing and allowing mains onto the 'safe' area terminals of the barrier, normally the fuse would blow. However, what would happen if the earth connection back to the source of supply has a very high resistance (possibly due to a failure)? In this case, there is nowhere for the current to go, so the fuse does not blow and mains voltage appears on the hazardous area terminals. The vast majority of IS instruments have their circuit isolated from the enclosure (a 500 V test is required during certification, though usually not by the installer), so there is no immediate spark danger to the enclosure in the instrument in the hazardous area. However, it is not a good situation having mains voltage inside an IS instrument, because IS equipment can usually be worked on 'live' and mains voltage would be a surprise at best and fatal at worst. Therefore, a barrier earth is provided to prevent this scenario. This is usually not a problem and one earth does for all barriers. However, for a new installation or where a single circuit is required, the choice of a galvanic isolator, rather than a zener barrier, might be more cost-effective, since it does not require earthing

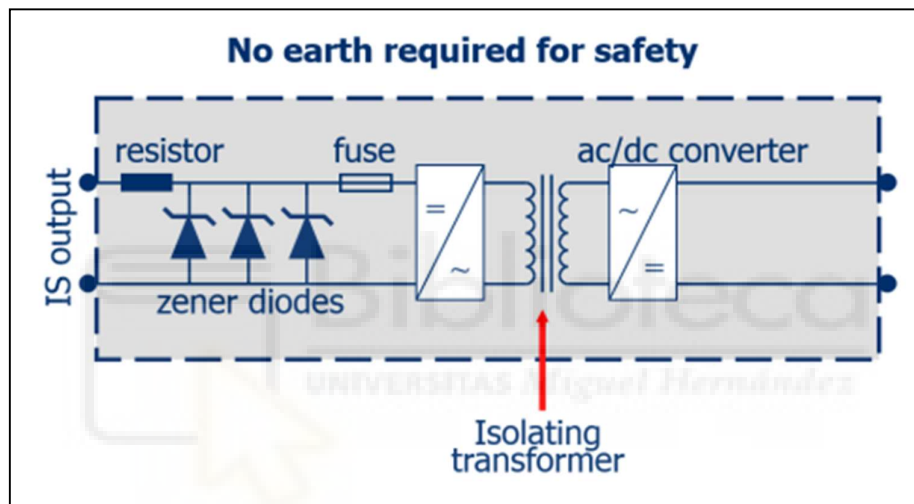
EN/IEC 60079-14 lists the following points to describe an intrinsically safe earth:

- Connects barrier earth bus-bar to defined zero, preferably the transformer main earth (or switch room bus-bar).
- Less than 1 ohm (aim for 0.1 ohm).

- Two cables of 1.5 mm<sup>2</sup> in parallel or one cable 4 mm<sup>2</sup> minimum may be used.
- Two cables recommended, to assist testing.
- No plugs and sockets.
- Not to be used for any non-IS circuits.
- Protect cable against invasion.

#### 1.10.3.3.2 GALVANIC ISOLATOR, BASIC CIRCUIT AND FUNCTION

Refer to the below diagram for an example of a basic galvanic isolator circuit.



Galvanically isolated interfaces perform the same basic functions as zener barriers, that is:

- to limit the current into the hazardous area to a safe level at the given maximum voltage, and
- prevent mains breakthrough.

Effectively, a galvanic isolator can be looked upon as a zener barrier with the addition of an isolating component, typically a transformer. With the transformer, there is now no issue with mains breakthrough, since the transformer is made to the intrinsic safety standards of separation, insulation, etc. If mains breakthrough can now be discounted, there is no need to earth the intrinsically safe circuit back to the source of the mains supply. Note that the intrinsic safety standard introduces a concept of 'infallibility' for a number of components such as

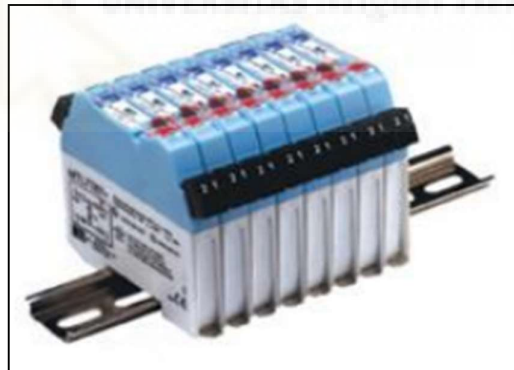
transformers and opto-isolators, provided they meet the requirements of the standard. Assemblies of components, such as three series diodes, are also considered to be 'infallible'. In these cases, faults need not be considered.

The most obvious single difference, therefore, between galvanic isolators and zener barriers is that there is no need for an earth connection, although an isolator can be earthed for functional reasons if necessary (but no special earthing connection is required). This means that intrinsically safe or simple apparatus that would not withstand the normal 500 Vrms test can be used in conjunction with an isolator.

#### 1.10.3.3.3 COMPARING BARRIERS AND ISOLATORS

Sometimes the factor governing the choice between zener barriers and galvanic isolators is the difficulty of providing and maintaining a high integrity earth system. In such cases the small additional unit cost of galvanically isolating devices is offset by the cost of the earth system required for zener barriers.

- Barrier: the return line is connected to the DIN rail, which must be connected to a 'barrier earth' by the installer.



- Isolator: the return line is NOT connected to the DIN rail, so the intrinsically safe circuit is not earthed. Isolation is provided by transformers, relays or opto-isolators.



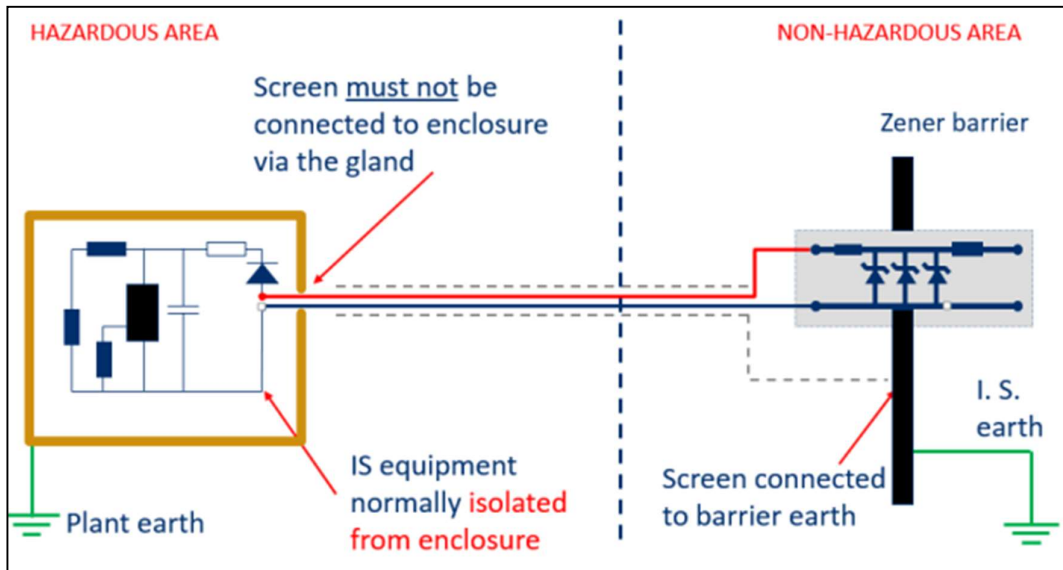
Galvanic isolators have the following advantages and are the interface of choice for most applications:

- May be cheaper to install in a remote location as no earth required.
- Allows use of equipment that cannot meet 500V isolation requirements (this is a small proportion of intrinsically safe field devices).
- May be used when there is an operational requirement to earth the equipment in the hazardous area.
- When earth-free, a single earth fault does not cause the system to 'go down', even if the earth fault is on the supply line.
- EN/IEC 60079-14 recommends galvanic isolation for zone 0 and zone 20 systems.

#### 1.10.3.3.4 INTRINSICALLY SAFE SYSTEMS

##### 1.10.3.3.4.1 INTRINSICALLY SAFE SYSTEM USING A ZENER BARRIER

Intrinsically safe circuits must be kept away from invasion from non-intrinsically safe voltage and currents.



There are recommendations in EN/IEC 60079-14 as to how this can be achieved:

- keep intrinsically safe and non- intrinsically safe separate, e.g. by the use of separate cable trays, or
- if not separated by a physical barrier, the intrinsically safe cables should be located to prevent risk of mechanical damage (this might be the case in protected environments such as control rooms), or
- use armoured, metal-sheathed or screened cable for all the intrinsically safe or all the non- intrinsically safe cables.

External magnetic fields need to be considered, but, in practice, only strong fields such as nearly overhead power lines or heavy current-carrying single core cables pose a significant risk to intrinsic safety. Signal degradation may be a concern, but this is not an intrinsic safety issue.

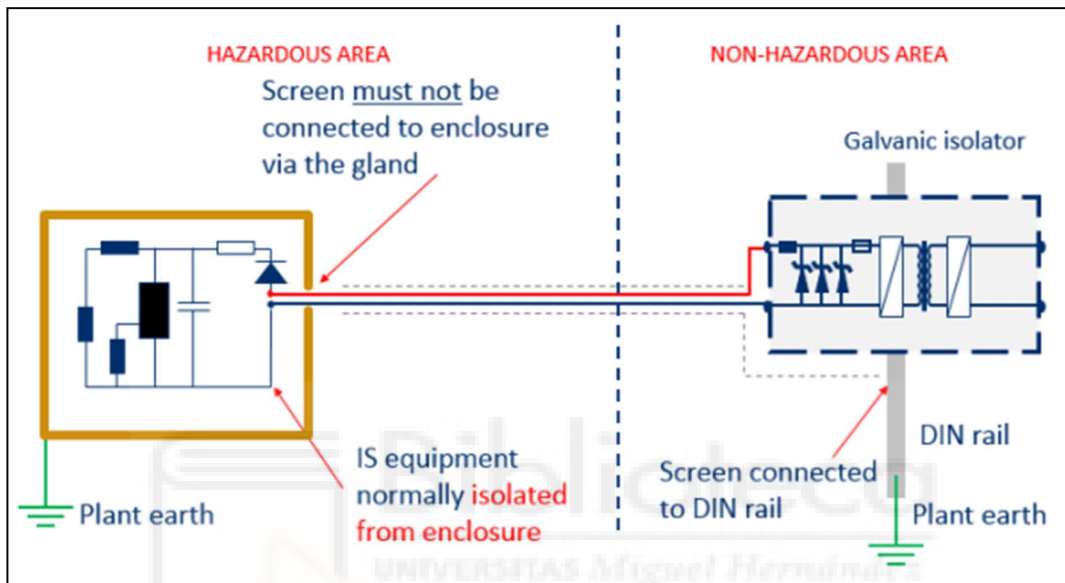
A second requirement of intrinsically safe circuits is that they can only be earthed at one point which leads to the following problem: if any conductor is connected to two different earth points, maybe hundreds of metres apart, they may be at a different potential and a current would therefore flow. This current is not intrinsically safe. Therefore, it is not permitted for the circuit to be earthed in two places.

#### 1.10.3.3.4.2 INTRINSICALLY SAFE SYSTEM USING A GALVANIC ISOLATOR

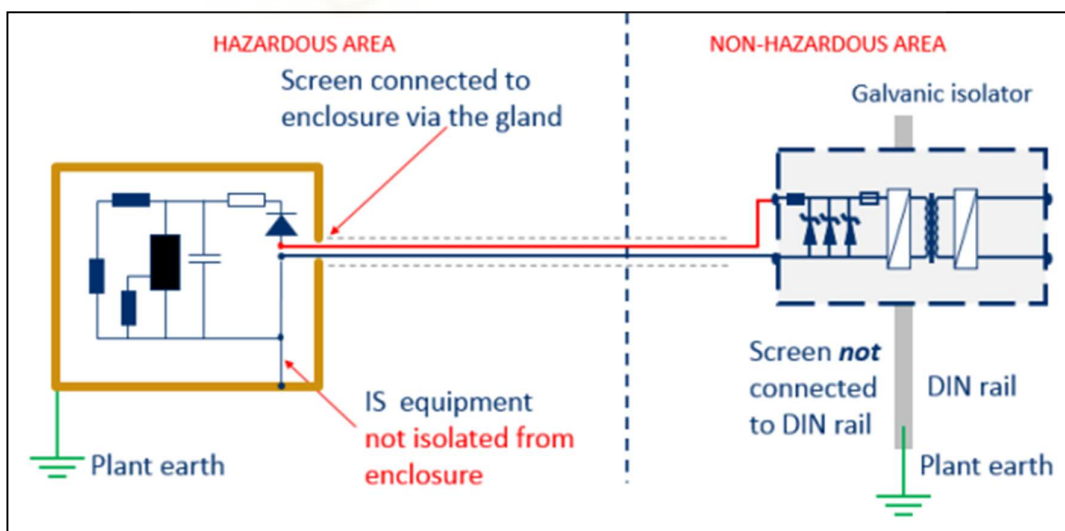


In a galvanically-isolated circuit, it may be earthed at one point or not at all. If the instrument cannot pass the 500 V circuit-to-enclosure isolation test, then it is easiest to use a galvanic isolator. The circuit is assumed to be earthed in the hazardous area at the instrument, in which case this is where the screen should also be earthed.

- Equipment isolated from earth:



- Equipment not isolated from earth:



The above diagram shows that, if the intrinsically safe circuit is connected to earth in the hazardous area, the screen should also be connected at the same point.

In normal operation, the circuit and screen are not connected, but cable damage must be considered.

#### 1.10.3.3.5 SIMPLE APPARATUS

It is sometimes assumed that supplying any uncertified instrument through a barrier makes the system intrinsically safe. This is only rarely true because the design of the barrier and the instrument meet different criteria: the barrier limits the voltage and current into the hazardous area to a safe level whereas the instrument is designed not to store up too much energy (in capacitors or inductors, for example) which could then be released in an incendive spark. However, an exception to the rule that all equipment must be certified can be made in the case of 'simple apparatus'.

Simple apparatus is defined as an electrical component or combination of components of simple construction with well-defined electrical parameters which is compatible with the intrinsic safety or energy-limited safety of the circuit in which it is used.

Simple apparatus may be used in an intrinsically safe system without requiring certification. Simple apparatus must not generate or store significant levels of voltage, current or power, as applicable. Simple apparatus includes:

- passive components, e.g. switches, junction boxes, resistors and simple semi-conductor devices.
- sources of stored energy consisting of single components in simple circuits with well- defined parameters, e.g. capacitors or inductors, whose values are considered when determining the overall safety of the system.
- sources of generated energy, e.g. thermocouples and photocells, which do not generate more than 1,5 V, 100 mA and 25 mW.

Such devices can be inserted into certified or uncertified systems without adversely affecting intrinsic safety provided their temperature elevation is acceptable and, generally, they have passed a 500 V isolation test required by the construction standard. However, as it would be confusing for a person carrying out a hazardous area inspection to see uncertified equipment, such equipment should be clearly marked to indicate the reference number (e.g. loop

number) of the intrinsically safe system to which it belongs. Guidance on temperature classification is given in EN/IEC 60079-14, which can be summarised as if the power available to the simple apparatus does not exceed 1.3 W at 40°C ambient, switches and junction boxes are given a T6 temperature class and other equipment T4, provided it does not contain very small components.

It should be remembered that simple apparatus is a concept that exists only within the context of an intrinsically safe system. An uncertified thermocouple, pressure switch, etc. in a hazardous area is not permitted unless it is supplied via a barrier or isolator, thus forming part of an intrinsically safe system.

Simple apparatus shall also conform to the relevant requirements of EN/IEC 60079-11.

#### **1.10.4 EQUIPMENT PROTECTION BY PRESSURISED ENCLOSURE “p”**

##### **1.10.4.1 PURGED TYPE OF PROTECTION, EX p**

The principle of this type of protection is to house electrical equipment in an enclosure to which a slight overpressure with air or inert gas is applied and maintained, thus preventing the ingress of a flammable atmosphere and making the equipment safe. The minimum overpressure required to be maintained relative to the external pressure at every point is 50 Pa for level of protection “pxb” or level of protection “pyb” and 25 Pa for level of protection “pzc”.

The technique of pressurising and purging enclosures of electrical apparatus to prevent the ingress of a flammable atmosphere has been around for many years. One of the main advantages of this technique is the ease with which the basic philosophy can be grasped and the fact that it can be retrospectively fitted to protect uncertified equipment which is already installed.

Because of the apparent simplicity of the technique it has, historically, been applied by individual engineers on an ad hoc basis and it was relatively common for equipment based on the Ex p standard to be used as the basis for protection in zone 2 areas without certification being sought. Nowadays, it is mandatory that the complete unit (including contents, control/purging devices and associated

devices) is certified as a system. It should not be assumed that simply connecting a component-certified purge controller to an uncertified industrial enclosure is sufficient. Although this was acceptable practice in the past for zone 2, this is no longer true. Rather than validation by the site engineer, approval by a Certification Body is now required to verify, for example, the required flow rate and that the internal area is adequately swept and that all alarms operate as they should.

Unlike the other methods of protection, this technique is virtually unlimited particularly in the physical size or power rating of the apparatus being protected. Applications vary in size from a small enclosure for a single instrument up to an entire off-shore accommodation module - the former can be certified as 'Ex p' but the latter cannot (a different standard applies, EN/IEC 60079-13). As the flammable gas is kept out, certified apparatus is applicable to the gases of all gas groups, provided the temperature class is appropriate.

Ex "p" enclosures and components (such as purge controllers) having only a component certificate (i.e. marked with a "U") must not be installed in the hazardous area – further certification of the system is required

Pressurized type of protection can be used for Group I, Group II or Group III applications. The levels of protection of pressurised type of protection are:

- pxb: pressurized enclosure providing equipment protection level Mb, Gb or Db. This permits unprotected equipment to be installed within the pressurized enclosure except for safety devices.
- pyb: pressurized enclosure providing equipment protection level Gb or Db with equipment protection level Gc or Dc internal to the pressurized enclosure. This permits equipment protection level Gc or Dc equipment to be installed within the pressurized enclosure, safety devices.
- pzc: pressurized enclosure providing equipment protection level Gc or Dc. This permits unprotected equipment to be installed within the pressurized enclosure except for safety devices.

A safety device is a device used to implement or maintain the integrity of the type of protection.

'Ex pxb' for zone 1 and 'Ex pzc' for zone 2 are quite straightforward. The full marking would be, for example: Ex pxb IIC T6 Gb or Ex pzc IIC T6 Gc.

'Ex pyb' is applied when, as sometimes happens, the equipment is already zone 2 compliant but the area has changed to a zone 1. The additional protection of 'py' pressurisation (although not quite as stringent as 'px') allows the equipment to be used in zone 1.

The pressurisation protection method allows uncertified equipment into a hazardous area. This is particularly useful for equipment that cannot be certified any other way and can also be used to globally protect a large number of uncertified devices. The advantages of pressurisation are as follows:

- Few limitations on internal equipment.
- No limit to enclosure size.
- Can be a number of connected enclosures.
- Caters for all flammable gases of all groups.
- Can be modified for flammable dusts.
- Easy to achieve T6.

Disadvantages include:

- Enclosure and ducting may leak (needs  $\geq 200$  Pa test).
- Energy costs to maintain overpressure.
- Delay whilst purge takes place.
- Modifications to equipment may be required to avoid 'dead spots'.
- Rather complex/expensive for small items.
- May still require items of certified electrical equipment; e.g. pressure switch, flow monitor, main electrical contactor.
- When an inert gas such as nitrogen is used, there is a danger of asphyxiation.

For smaller items, flameproof (Ex d) protection is often more practical and, like Ex p, also allows uncertified devices into a hazardous area.

A typical pressurisation system used to protect a large number of items within pressurized cabinets is shown below:



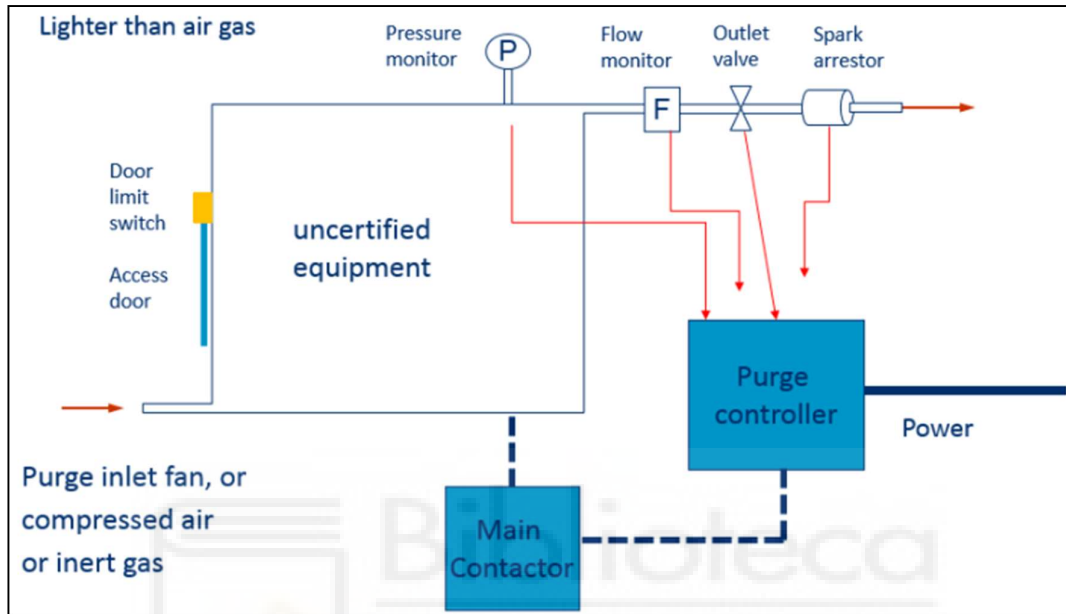
#### 1.10.4.2 TYPES OF PRESSURISATION

##### 1.10.4.2.1 WITH NO INTERNAL RELEASE

The pressurisation technique is simpler when there is no internal release of flammable material, e.g. an enclosure containing only electrical equipment.



The purge controller, which is a separately certified device, can be pneumatic (Ex h) or electrical (normally intrinsically safe) or a combination. Any of the associated monitoring and control devices (for differential pressure, flow, proximity, etc.) also need to be separately certified if they are not inside the Ex p enclosure and protected by pressurisation.



The purge flow rate and duration are shown on the marking plate and listed in the certificate. Before the equipment is energised, the inside of the enclosure is purged. When the purge is complete, the equipment is energised and can remain so unless the internal overpressure drops below the minimum threshold. Usually, the differential pressure sensor initiates at least one early warning alarm, to indicate that the overpressure is close to the minimum; this allows the system to be checked for leaks or blockages without powering down.

#### 1.10.4.2.2 WITH AN INTERNAL RELEASE

The design and certification of a pressurised enclosure with an internal flammable release is more complicated. Unless an inert gas such as nitrogen is used, a dilution zone must be identified, in which there must be no ignition sources. A typical application is a gas analyser.

#### 1.10.4.3 TYPES OF PRESSURISED EQUIPMENT

The protective gas is employed in three ways:

- Leakage compensation.
- Continuous dilution.
- Static pressurisation.

For leakage compensation and continuous dilution, air is the usual choice of protective gas. Static pressurisation requires an inert gas, such as nitrogen.

#### 1.10.4.3.1 LEAKAGE COMPENSATION

When the required upper pressure is reached within the pressurised enclosure, the protective gas supply is shut off and only switches on again if the pressure falls to the 'low' threshold due to leakage from the enclosure and its ducts. Leakage compensation does not provide a significant cooling effect compared to continuous circulation, so some equipment that requires such a flow of cooling air is not suitable for leakage compensation.

Examples of typical applications are:

- Monitors.
- some motors.
- Input/Output panels.

#### 1.10.4.3.2 CONTINUOUS DILUTION

Continuous dilution is the continuous supply of a protective gas, after purging, at such a rate that the concentration of a flammable substance inside the pressurized enclosure is maintained at a value outside the explosive limits at any potential ignition source (that is to say, outside the dilution area).

Continuous dilution with protective gas (usually air) is applicable when, for example, a motor needs air as a coolant, in which case enclosing it in an enclosure would cause over-heating. It is also simpler than leakage compensation but has higher energy costs. As the name suggests, air flows continuously through the equipment, and the outlet control offers some resistance to flow, allowing the internal pressure to build up.





Where there is an internal release of flammable materials, continuous dilution with air may be possible, provided the flow rate is sufficient to quickly dilute below 25% of the lower explosive limit.

If this is not possible, the continuous flow may need to be with an inert gas.

Control rooms and analyser houses (as the one shown below) use the same principle but are approved to a different standard, EN/IEC 60079-13, and are not marked 'Ex p'.



#### 1.10.4.3.3 STATIC PRESSURISATION

Static pressurisation is the maintenance of an overpressure within a pressurized enclosure without the addition of protective gas in a hazardous area. This means that with static pressurisation, the enclosure is completely sealed and pressurised in the non-hazardous area with an inert gas. (only inert gases are permitted) and then the equipment can be moved into the hazardous area where it can be used without further pressurisation unless the pressure drops below the allowed minimum.

It is only for portable items such as torches or analysers. Another example is the navigation buoy shown below, which could potentially have an Ex marking similar to Ex pb eb db mb IIC T4 Gb:



#### 1.10.4.4 CONSTRUCTIONAL REQUIREMENTS

All pressurised apparatus must meet the following minimum requirements of the standard:

- Flow meter to monitor that initial purge and subsequent flow is sufficient.
- It is not possible to over-ride the initial purge.
- Overpressure monitored and maintained.
- Protection against excessive pressure.
- Alarm and, possibly, isolation of electrical equipment, if overpressure falls below 50 Pa.

- Internal equipment must not act as a gas trap. Holes may need to be drilled to avoid 'dead spots'. Consequently, enclosures within the main enclosure may not be allowed.
- There should be no energy-storage devices (capacitors, batteries) which store energy and spark incendively when the equipment is isolated. Such devices may be acceptable if made intrinsically safe, for example, with current-limiting resistors.

The minimum over-pressure is quite small:

- 50 Pa for "pxb" and "pyb" in zones 1 and 21. This equates to 0.5 millibar or 0.2 inches of water.
- 25 Pa for "pzc" in zones 2 and 22. This equates to 0.25 millibar or .1 inches of water.

If the pressure falls below this level, the controller can be programmed to react depending on the risk. EN/IEC 60079-14 Table 18 determines whether electrical isolation is required:

<b>Table 18 – Summary of protection requirements for enclosures without an internal source of release</b>		
<b>EPL requirement</b>	<b>Enclosure contains equipment not meeting EPL "Gc" requirements without pressurization</b>	<b>Enclosure contains equipment meeting EPL "Gc" requirements without pressurization</b>
"Gb"	Alarm and switch-off <sup>a</sup> (Apply 17.2.3.2.2 and 17.2.3.2.3)	Alarm <sup>b</sup> (Apply 17.2.3.2.3)
"Gc"	Alarm <sup>b</sup> (Apply 17.2.3.2.3)	No pressurisation required
<p>Restoration of pressurization should be completed as soon as possible, but in any case within 24 h. During the time that the pressurization is inoperative, action should be taken to avoid the entry of flammable material into the enclosure.</p> <p>Provided that pressurized equipment is switched off automatically upon pressurization failure, an additional alarm may not be necessary for safety, even in locations requiring EPL "Gb". If power is not switched off automatically, e.g. in a locations requiring EPL "Gc", an alarm is the minimum action that is recommended if combined with immediate action by the operator to restore the pressurization or switch off the equipment.</p> <p>Equipment within the pressurized enclosure suitable for the EPL requirements of the external location need not be switched off when pressure fails. However, care should be taken to ensure that there is no trapped flammable material inside the enclosed equipment which may leak out into the larger pressurized enclosure where work involving the creation of ignition capable sparks may occur.</p>		
<p><sup>a</sup> If automatic switch-off would introduce a more dangerous condition, other precautionary measures should be taken, for example duplication of protective gas supply.</p> <p><sup>b</sup> If the alarm operates, immediate action should be taken, for example to restore the integrity of the system.</p>		

This is clearly inconvenient from a production perspective and may even have a safety implication if a critical system suddenly shuts down. A stand-by ventilation system should be considered.

Usually, the pressurising system is arranged so that the enclosure can be purged to remove any accumulation of flammable gases before the apparatus within is switched on. 5 volume changes are typically required. This may not be necessary in a zone 2 provided a flammable gas check is performed.

#### 1.10.4.5 MAINTENANCE CONSIDERATIONS

For maintenance purposes it is necessary to work on the apparatus within the enclosure while the purge is off and the enclosure is open. Usually this is done under a gas clearance or hot work permit for safety but there are other safety implications which have to be taken into account.

Once the enclosure has been opened the pressure switch will, via the control unit, cause the power to be isolated from the enclosure. Naturally, power must be on for some fault-finding operations, so some means are required to by-pass this function of the control system. One way of achieving this is to wire a key-operated switch in parallel with the pressure switch. This prevents the loss of pressure from causing the enclosure to be isolated. However, this has two disadvantages:

- No re-purge takes place automatically when the enclosure is closed.
- No alarm is raised in the control room.

An alternative is to fit a key-operated switch in parallel with the contacts which energise the contactor. This technique does not suffer from the previous two disadvantages but is not without problems because the key operated switch is usually remote from the enclosure and is not, therefore, under the close control of the person working on the enclosure. The key cannot be removed until the re-purge is complete

#### 1.10.4.6 ON-SITE TESTING SPECIFIC TO PRESSURISATION

A typical testing regime is:

- determination of purge time with helium and then argon, looking for dead spots.
- verification of the operation of the purge controller and all related sensors, alarms and trips.

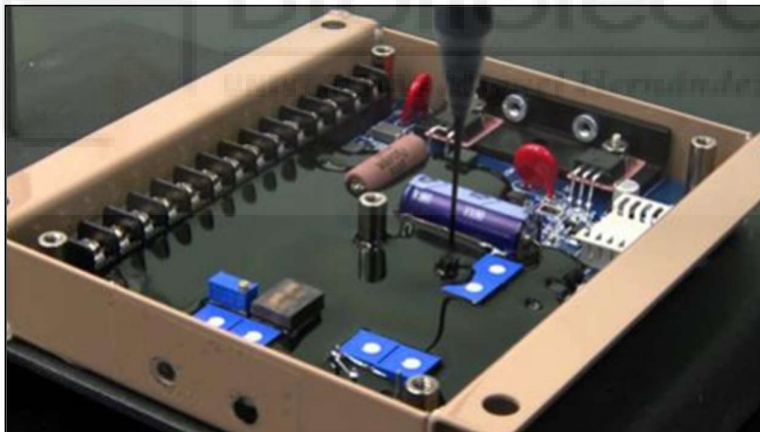
- temperature class determination. Usually only the external surface is relevant; an infra-red thermal imaging device can be used to locate hot spots.
- Checking the overpressure relief valve, if required. Consideration must be given to the pressure becoming excessive due to, for example, failure of the air pressure regulator.

Ex p equipment is often very large and it is therefore more convenient for certification tests to take place at the manufacturer's site.

### **1.10.5 OTHER TYPES OF PROTECTION**

#### **1.10.5.1 EQUIPMENT PROTECTION BY ENCAPSULATION "m"**

Encapsulation is a type of protection whereby parts that are capable of igniting an explosive atmosphere, by either sparking or heating, are enclosed in a compound in such a way that the explosive atmosphere cannot be ignited under operating or installation conditions.



Put more simply, the explosive atmosphere is kept away from ignition sources using a solid compound. The compound can be any thermosetting, thermoplastic, epoxy resin or elastomeric material with or without fillers and/or additives. The compound must be free from internal voids but small devices with internal free volume of air (such as fuses and relays) are permitted.

Encapsulation can be used for gas and/or dust applications as shown below:

Level or protection	EPL	Zone
Ex ma	Ga / Da	0 / 20
Ex mb	Gb / Db	1 / 21
Ex mc	Gc / Dc	2 / 22

Encapsulation is a protection method that is typically used for electronic equipment as an alternative to intrinsic safety, where the power or voltage is too high, or to avoid the requirement to supply it through a barrier or isolator.



In equipment such as solenoids, the encapsulant itself may form the outside of the enclosure, but it is more common for the encapsulant to be poured into a mould, either plastic or metal, which then forms the outside of the equipment.



#### 1.10.5.2 EQUIPMENT PROTECTION BY TYPE OF PROTECTION “n”

Type of protection “n” is a method of protection for Zone 2 only (EPL Gc, ATEX Category 3G equipment). The probability of a flammable atmosphere arising in

Zone 2 is low and, consequently, the level of protection provided by Type n is less than that provided for zones 0 and 1: it is required to be safe in normal operation.

Ex n is covered by standard EN/IEC 60079, which specifies requirements for the construction, testing and marking for Group II electrical equipment with type of protection “n” which includes sealed devices “nC”, hermetically sealed devices “nC”, non-incendive components “nC” and restricted breathing enclosures “nR” intended for use in explosive gas atmospheres:

- hermetically-sealed device “nC”: device which is so constructed that it cannot be opened and is sealed effectively by fusion to prevent entry of an external atmosphere.
- non-incendive component “nC”: component having contacts for making or breaking a specified ignition capable circuit but in which the contacting mechanism is designed and constructed so that the component is not capable of causing ignition of the specified explosive gas atmosphere.
- sealed device “nC”: device which is so constructed that it cannot be opened during normal service and is sealed effectively to prevent entry of an external atmosphere.
- restricted-breathing enclosure “nR”: enclosure that is designed to restrict the entry of gases, vapours and mists.

Typical type “n” equipment:

- Junction boxes.
- Control panels.
- Luminaires.
- Motors.



## **2 SELF CERTIFICATION OF ATEX CATEGORY 3 CONTROL PANEL**

### **2.1 INTRODUCTION**

A systems integrator is working on a project for which they need to source various pieces of equipment with ATEX certification, as these are going to be installed in a plant in which there is a risk of potentially explosive atmospheres forming.

In a previous phase of the project, the plant owner prepared an 'explosion protection document'. For this he hired the services of a company that specialises in this type of assessments and that has qualified personnel at its service, with the appropriate IECEx and CompEx qualifications.

This document states that throughout the plant there are a number of areas that have been classed as 'zone 2', and in one of these zones there is a requirement for a network interface panel to be installed.

Equipment installed in a 'zone 2' must be at least ATEX category 3 certified. This means that the panel can be category 1, 2 or 3.

Article 13 of Directive 2014/34/EU indicates the procedures that must be followed to evaluate the conformity of a product. For ATEX category 3 equipment the procedure is internal production control as established in annex VIII of the Directive.

Internal production control is the conformity assessment procedure whereby the manufacturer fulfils the obligations with respect to the technical documentation and manufacturing process established in this annex, and ensures and declares on his sole responsibility that the products concerned satisfy the requirements of this Directive that apply to them. In other words, the manufacturer can prepare the technical documentation and declare that the product is in compliance with the Directive and the selected standards without having to involve a Notified Body. This is known as self-certification.

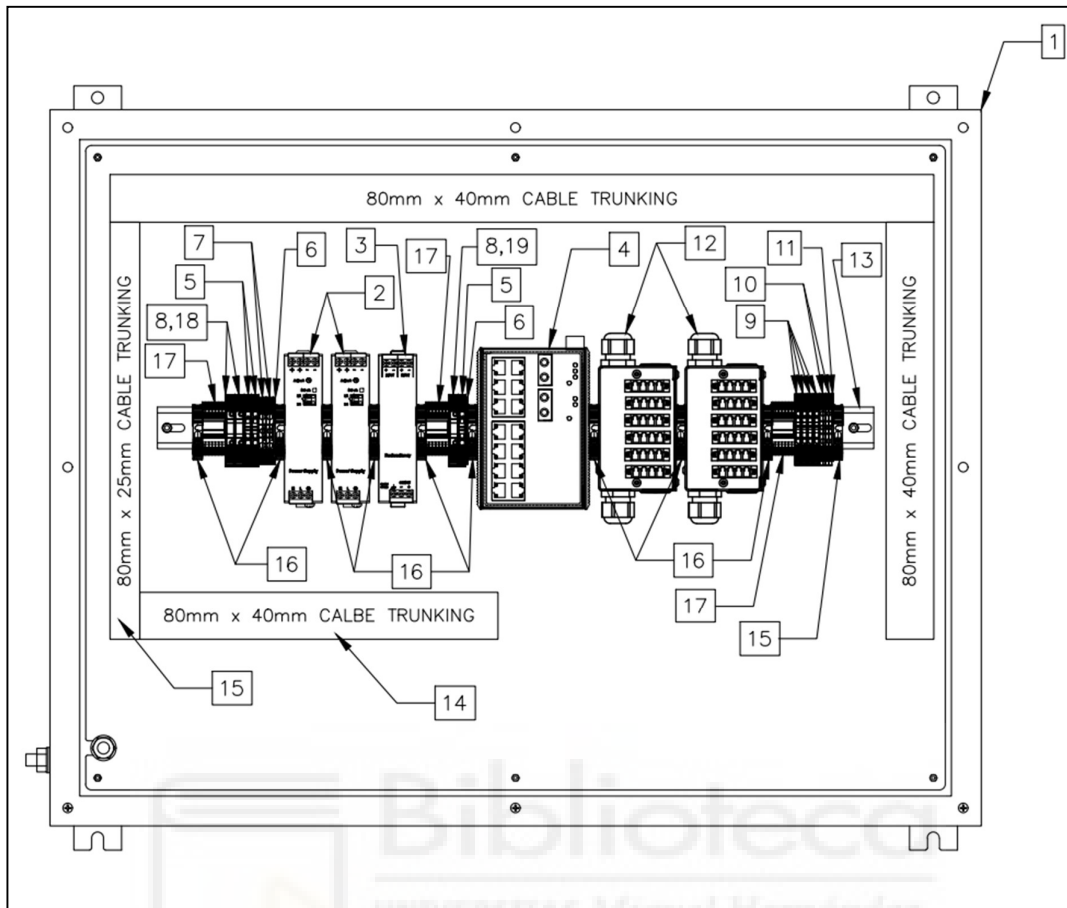
The systems integrator reaches out to a manufacturer with demonstrated experience in the certification of ATEX and IECEx products for the manufacture of the network interface panel. Several meetings take place and it is agreed that the manufacturer will self-certify the panel as they have extensive experience and



robust quality procedures in place and have an ATEX QAN (Quality Assurance Notification of the production process) in place. This approach is also more economic as you avoid the Notified Body fees which can be significant as well as adding several months to the delivery of the product.

The systems integrator and manufacturer agree that the panel will be made of stainless steel, with approximate dimensions of 800 mm x 600 mm x 300 mm. 18 plain entries for the fitting of M20 cable glands must be provided on the bottom side of the enclosure. The following parts and layout are agreed for the panel:

Bill of materials - Major parts							
Item	Quantity	Part	Manufacturer	Model no.	Certificate	Marking	Notes
1	1	Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb	Marking updated to Ex eb IIC Gb, refer to Appendix 2
2	2	Power supply	Puis GmbH	CP5.241	EPS 19 ATEX 1 201 X	II 3G Ex ec nC IIC T4 Gc	-
3	1	Redundancy module	Puis GmbH	YR20.242	EPS 11 ATEX 1 312 X	II 3G Ex ec IIC T4 Gc	-
4	1	Industrial ethernet switch	Moxa Inc.	EDS-516A-MM-SC	DEMKO 09 ATEX 0812123X	II 3 G Ex nA nC IIC T4 Gc	Marking updated to Ex ec nC IIC T4 Gc, refer to Appendix 2
5	3	4 mm <sup>2</sup> feed through terminal block	Weidmüller Interface GmbH & Co. KG	WDU 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
6	2	4 mm <sup>2</sup> end plate	Weidmüller Interface GmbH & Co. KG	WAP 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
7	2	4 mm <sup>2</sup> earth terminal	Weidmüller Interface GmbH & Co. KG	WPE 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
8	3	Terminal block with fuse holder	Weidmüller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc	-
9	4	2.5 mm <sup>2</sup> feed through terminal block	Weidmüller Interface GmbH & Co. KG	WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
10	2	2.5 mm <sup>2</sup> end plate	Weidmüller Interface GmbH & Co. KG	WAP 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
11	1	2.5 mm <sup>2</sup> earth terminal	Weidmüller Interface GmbH & Co. KG	WPE 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
12	2	Fiber optic patch panel	Dinspace	SNAP-12LC-MM-OM 3	N/A	N/A	-
13	As required	DIN rail	Weidmüller Interface GmbH & Co. KG	TS35	N/A	N/A	-
14	As required	80 x 40 cable duct	Betaduct	10430034	N/A	N/A	-
15	As required	80 x 25 cable duct	Betaduct	10430024	N/A	N/A	-
16	10	End stop	Weidmüller Interface GmbH & Co. KG	EW 35	N/A	N/A	-
17	3	Label holder	Weidmüller Interface GmbH & Co. KG	SCHT 5	N/A	N/A	-
18	2	6.3A fuse	Schurter	0001.2512	N/A	N/A	-
19	1	2A fuse	Schurter	0001.2507	N/A	N/A	-
20					N/A	N/A	-



Parts will be ATEX certified where possible.

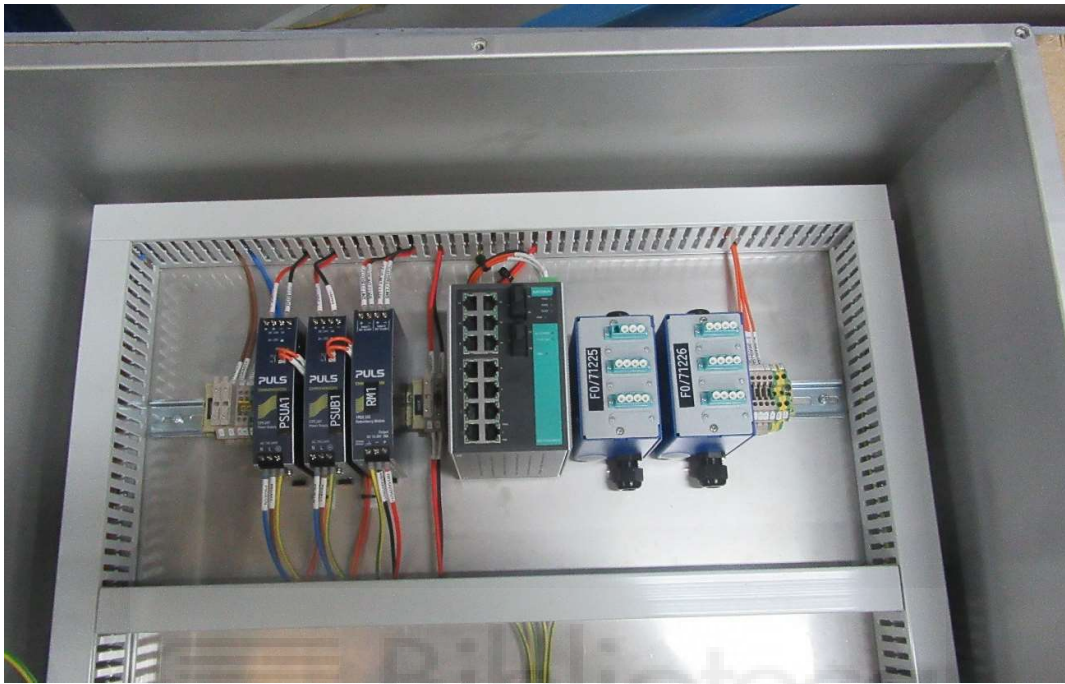
The panel must be suitable for gas group IIB and shall have a temperature class of T3 or better.

In the following chapters I proceed to evaluate the panel for compliance with the Directive and compile its technical file, which is made up of the following parts:

- Equipment summary
- Drawings.
- Conformity checklists.
- Assessment of certified parts.
- Information regarding non-certified parts.
- Test reports.
- Manual.

- EU Declaration of Conformity.

The following image shows the final build of the control panel:



## 2.2 EQUIPMENT SUMMARY (APPENDIX 1)

### 2.2.1 TECHNICAL FILE OVERVIEW

This technical file is to self-certify the Network Interface Control Panel model NICP as suitable for use in ATEZ zone 2 applications by demonstrating compliance with the Directive 2014/34/UE and the applicable harmonised standards.

### 2.2.2 MANUFACTURER NAME AND ADDRESS

COMPANY NAME

ADDRESS LINE 1

ADDRESS LINE 2

POST CODE

COUNTRY

### 2.2.3 PRODUCT NAME AND MODEL NUMBER

Network Interface Control Panel model NICP

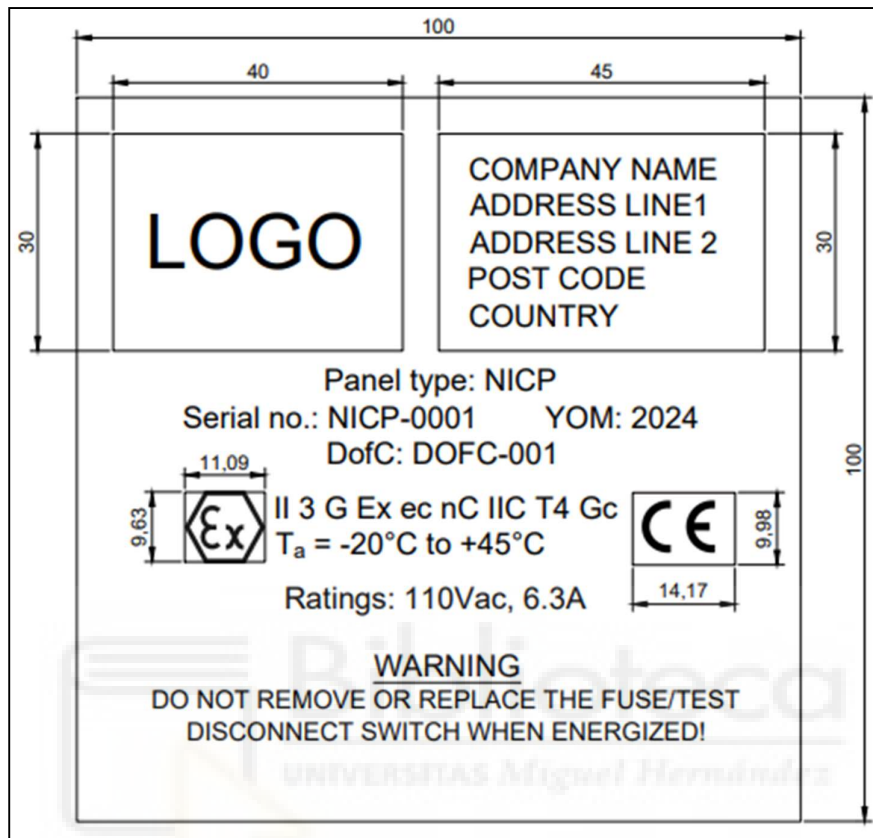
### 2.2.4 LEGISLATION AND ASSESSMENT STANDARDS:

Directive 2014/34/EU	Equipment and protective systems intended for use in potentially explosive atmospheres
EN IEC 60079-0:2018	Explosive atmospheres - Part 0: Equipment - General requirements
EN IEC 60079-7:2015+A1:2018	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
EN IEC 60079-15:2019	Explosive atmospheres - Part 15: Equipment protection by type of protection "n"

Checklists against the requirements of Annex II of the Directive and of each of the above listed standards have been carried out and are held in the technical file associated with Network Interface Control Panel model NICP.

## 2.2.5 MARKING

The NICP is marked as shown below:



## 2.2.6 PRODUCT DESCRIPTION

The NICP network interface control panel is designed to be mounted in a Zone 2 hazardous location (ATEX Category 3) and is intended for interfacing copper ethernet cables and data into fibre-optic media. The NICP utilises an approved IP66, Ex eb, unpainted stainless steel enclosure to house approved electrical Ex Equipment and Ex Components. Approximate dimensions are 600 mm (height) x 780 mm (width) x 300 mm (depth) with a single door. The panel is supplied as a complete unit, with no assembly required by the end user other than cabling the system. The NICP is provided with 18 x M20 entries on the bottom side of the enclosure.

The NICP uses the following Ex Component parts:

Part	Manufacturer	Part no.	Certificate	Marking
Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb
Feed through terminal blocks	Weidmüller Interface GmbH & Co. KG	WDU 4  WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb
End plates		WAP 4  WAP 2.5		
Protective conductor terminal block		WPE 4  WPE 2.5		
Terminal block with fuse holder	Weidmüller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc

## 2.2.7 TECHNICAL DOCUMENTATION

Title	Drawing	Revision	Date
NICP – GENERAL ARRANGEMENT	NICP-GA-001	A	17.06.2024
NICP – INTERNAL LAYOUT	NICP-IL-001	A	17.06.2024
NICP – WIRING DIAGRAM	NICP-WD- 001	A	17.06.2024
NICP – MARKING LABEL	NICP-ML-001	A	17.06.2024

## 2.2.8 SPECIFIC CONDITIONS OF USE

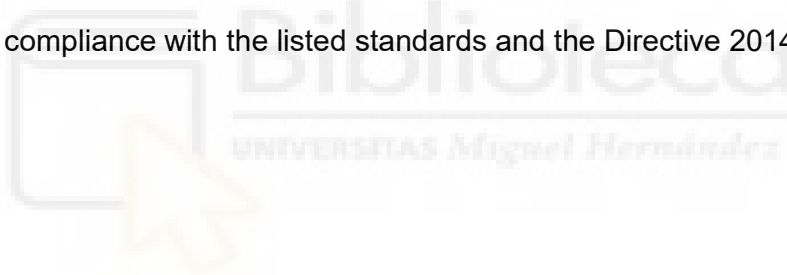
- Provisions shall be made, either in the equipment or external to the equipment, to provide the transient protection device to be set at a level not exceeding 140% of the peak rated voltage.
- Only replacement fuses provided by the manufacturer shall be used. Contact the manufacturer if replacement of fuses is required.
- Only suitably certified IP66 rated cable glands and blanking elements shall be used.

## **2.2.9 CONDITIONS OF MANUFACTURE**

- Each unit manufactured shall be subjected to a dielectric strength test in accordance with clause 6.1 of EN IEC 60079-7:2015+A1:2018. Refer to TR-001 for test details.

### **2.2.10 CONCLUSION**

The assessment conducted demonstrates that Network Interface Control Panel NICP is in compliance with the listed standards and the Directive 2014/34/EU.



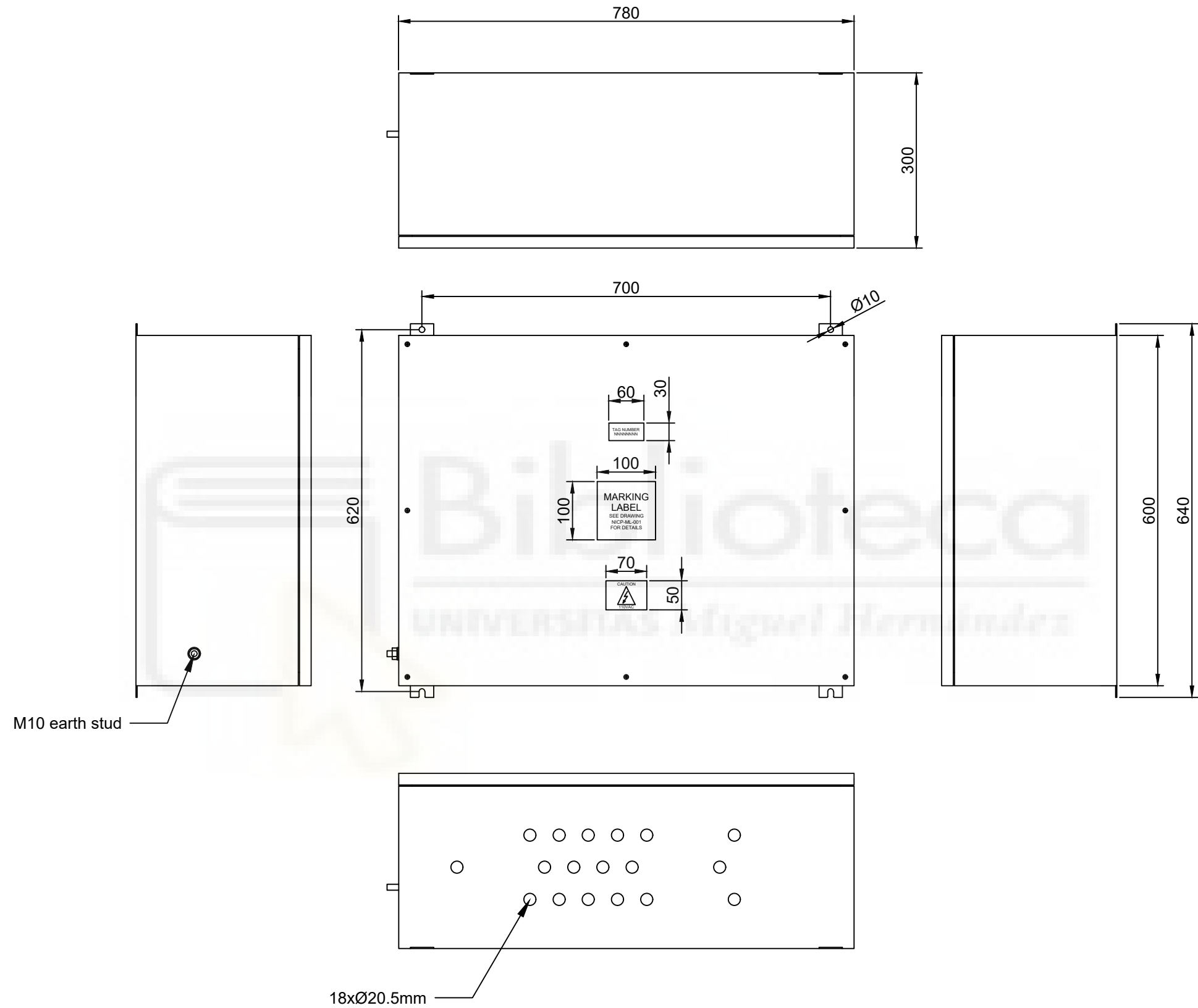
## 2.3 DRAWINGS

Below are the four certification drawings that define the characteristics of the NICP network interface control panel. These are shown in the following order:

1. NICP-GA-001: General arrangement drawing.
2. NICP-IL-001: Internal layout drawing.
3. NICP-WD-001: Wiring diagram drawing.
4. NICP-ML-001: Marking label drawing.



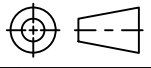



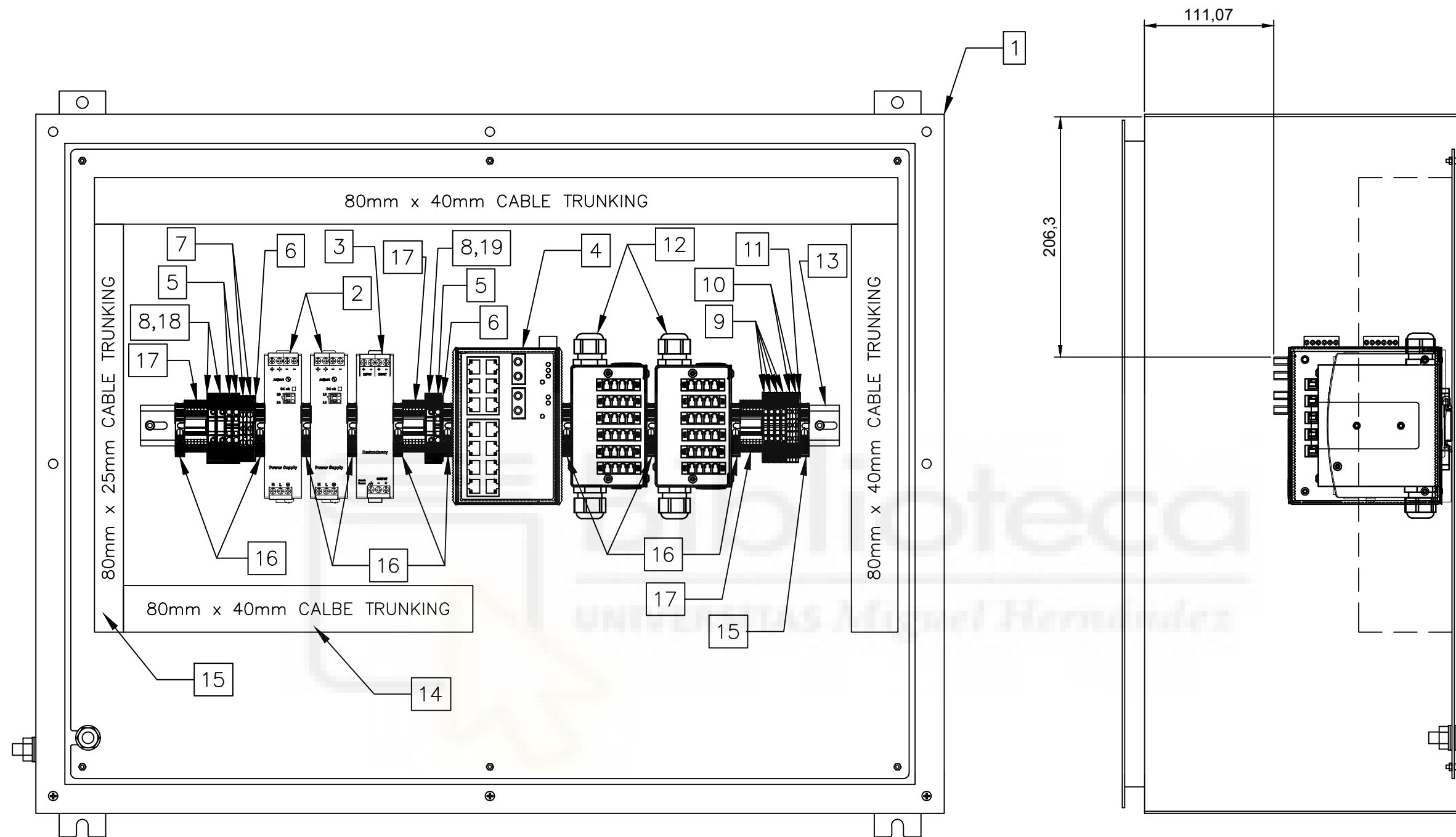


A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

**NOTES**

1. This is a certification drawing. No changes are permitted without approval from the Certification Manager.
2. All labels are metalized polyester (3M material 7872), 0.178 mm thick.
3. Enclosure is unpainted stainless steel.
4. Only suitable certified IP66 rated cable glands shall be used.
5. Unused entries shall be fitted with a suitable certified IP66 rated blanking element.

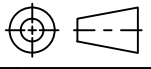

Third angle projection 		COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3	Title: NICP - GENERAL ARRANGEMENT	
Scale: 1:8	Drawing No.: NICP-GA-001	Sheet: 1 of 1	Rev: A



**NOTES**

1. This is a certification drawing. No changes are permitted without approval from the Certification Manager.
2. Only one core per terminal.
3. Unused terminals shall be tightened.
4. Dielectric strength test in accordance with clause 6.1 of EN IEC 60079-7:2015+A1:2018 shall be performed on each unit manufactured.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection 		COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3	Title: NICP – INTERNAL LAYOUT	
Scale: 1:4	Drawing No.: NICP-IL-001	Sheet: 1 of 2	Rev: A

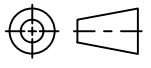

**Bill of materials - Major parts**

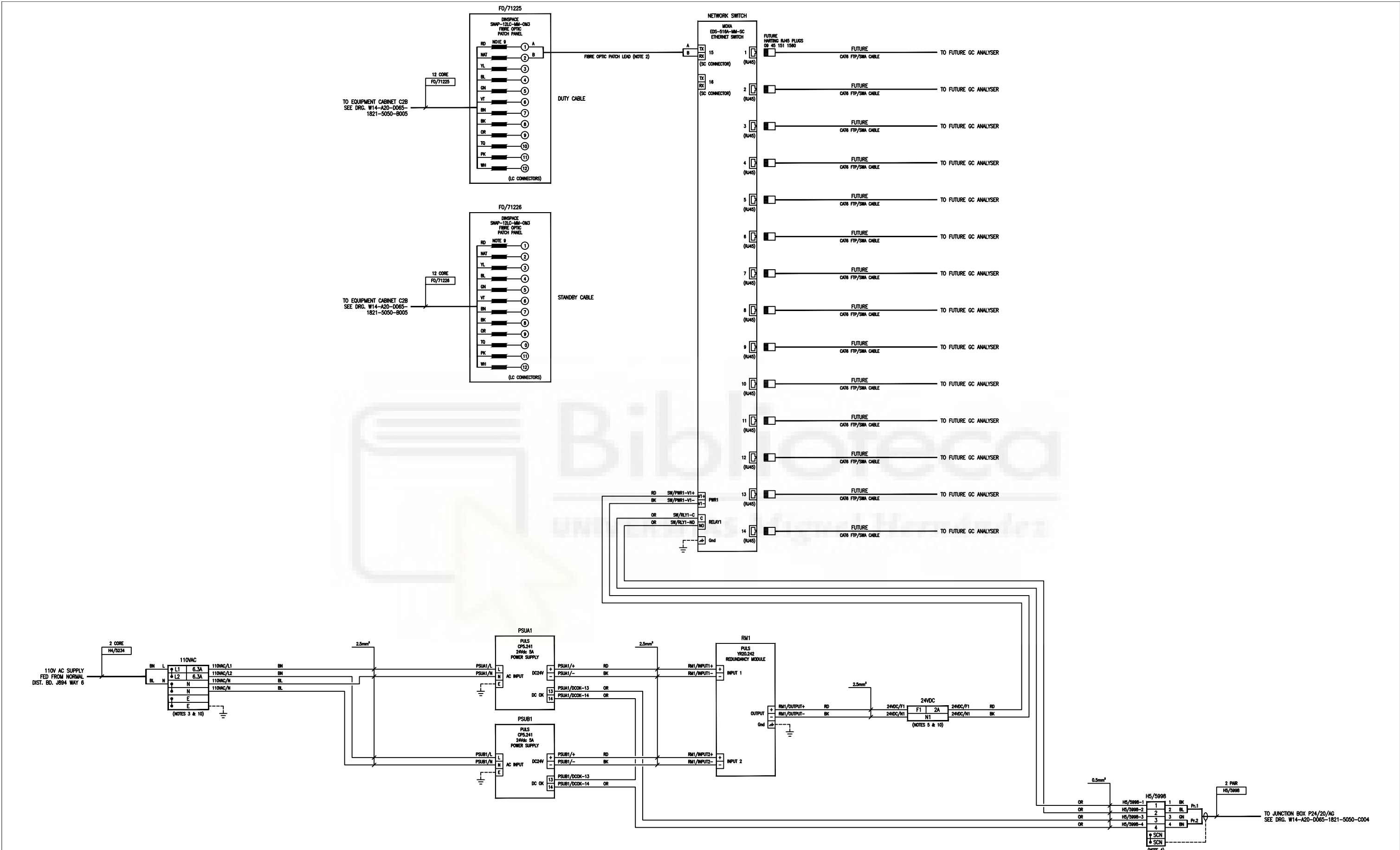
Item	Quantity	Part	Manufacturer	Model no.	Certificate	Marking	Notes
1	1	Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb	Marking updated to Ex eb IIC Gb, refer to Appendix 2
2	2	Power supply	Puls GmbH	CP5.241	EPS 19 ATEX 1 201 X	II 3G Ex ec nC IIC T4 Gc	-
3	1	Redundancy module	Puls GmbH	YR20.242	EPS 11 ATEX 1 312 X	II 3G Ex ec IIC T4 Gc	-
4	1	Industrial ethernet switch	Moxa Inc.	EDS-516A-MM-SC	DEMKO 09 ATEX 0812123X	II 3 G Ex nA nC IIC T4 Gc	Marking updated to Ex ec nC IIC T4 Gc, refer to Appendix 2
5	3	4 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
6	2	4 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
7	2	4 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
8	3	Terminal block with fuse holder	Weidmuller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc	-
9	4	2.5 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
10	2	2.5 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
11	1	2.5 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
12	2	Fiber optic patch panel	Dinspace	SNAP-12LC-MM-0M3	N/A	N/A	-
13	As required	DIN rail	Weidmuller Interface GmbH & Co. KG	TS35	N/A	N/A	-
14	As required	80 x 40 cable duct	Betaduct	10430034	N/A	N/A	-
15	As required	80 x 25 cable duct	Betaduct	10430024	N/A	N/A	-
16	10	End stop	Weidmuller Interface GmbH & Co. KG	EW 35	N/A	N/A	-
17	3	Label holder	Weidmuller Interface GmbH & Co. KG	SCHT 5	N/A	N/A	-
18	2	6.3A fuse	Schurter	0001.2512	N/A	N/A	-
19	1	2A fuse	Schurter	0001.2507	N/A	N/A	-
20					N/A	N/A	-

**NOTES**

1. This is a certification drawing. No changes are permitted without approval from the Certification Manager.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection 		COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3	Title: NICP – INTERNAL LAYOUT	
Scale: NTS	Drawing No.: NICP-IL-001	Sheet: 2 of 2	Rev: A

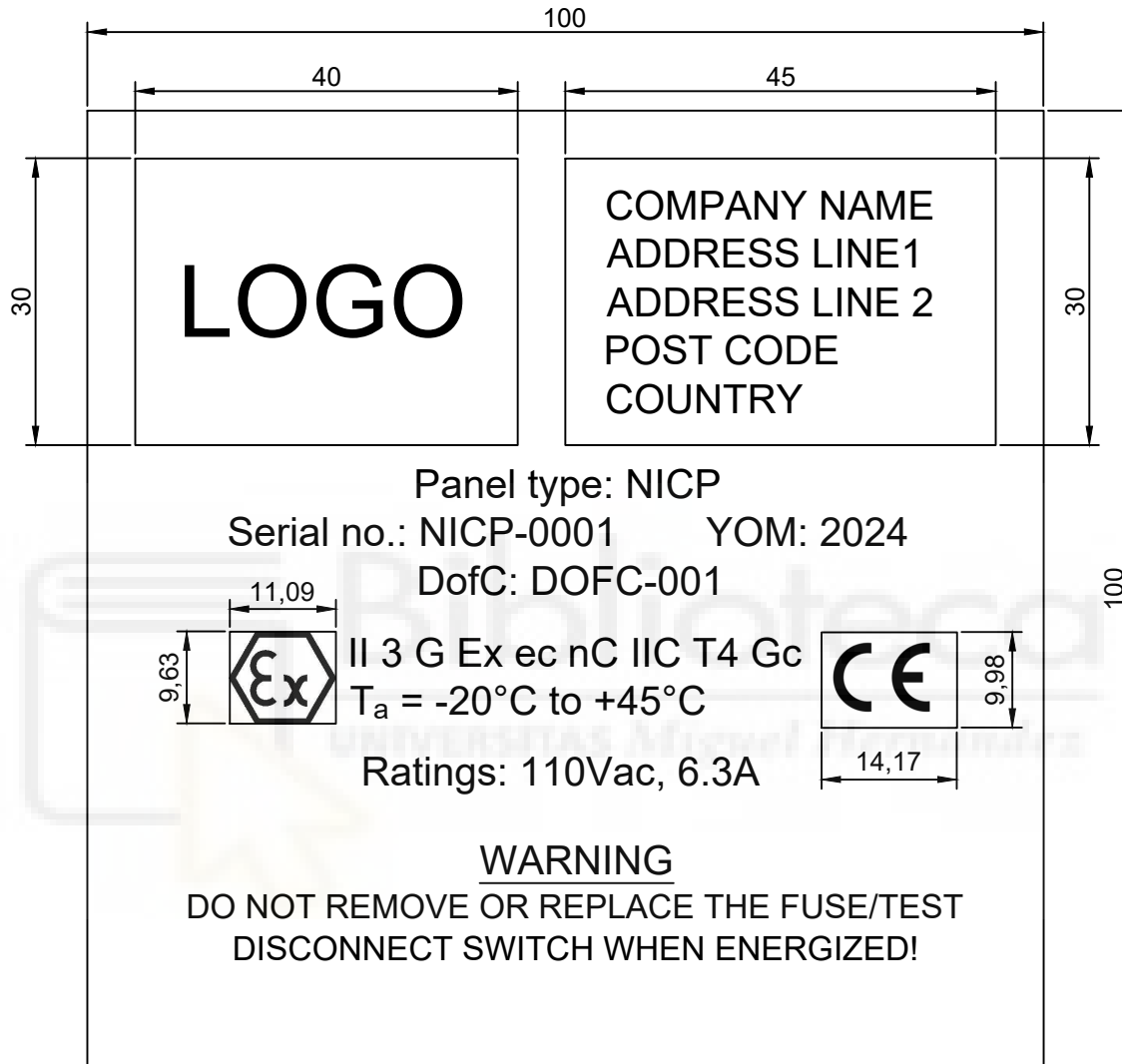


**NOTES**

1. This is a certification drawing. No changes are permitted without approval from the Certification Manager.
2. Dielectric strength test according to clause 6.1 of EN IEC 60079-7:2015+A1:2018 shall be performed on each fully wired unit.
3. All single core wiring to be tri-rated 1.0 mm<sup>2</sup> unless otherwise stated

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection			COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3 Scale: NTS	Title: NICP - WIRING DIAGRAM		Drawing No.: NICP-WD-001 Sheet: 1 of 1 Rev: A



**NOTES**

1. This is a certification drawing. No changes are permitted without approval from the Certification Manager.
2. Label material: 3M label material 7872 (metalized polyester), 0.178 mm thick.
3. Black lettering on white background. Minimum character height is 3 mm.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection		LOGO	COMPANY NAME	t: +44 (0)NNNNNNNNNN
All dimensions are in mm unless otherwise specified	Paper size: A4		ADDRESS LINE 1	e: email@company.com
	Scale: NTS	Title: NICP - MARKING LABEL		
		Drawing No.: NICP-ML-001	Sheet: 1 of 1	Rev: A

## 2.4 CHECKLISTS

### 2.4.1 EN IEC 60079-0:2018 CHECKLIST

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

1	Scope		
---	-------	--	--

2	Normative references		
---	----------------------	--	--

3	Terms and definitions		
---	-----------------------	--	--

4	Equipment grouping		
---	--------------------	--	--

4.1	General	The equipment is intended for Group II applications.	Pass
-----	---------	--	------

4.2	Group I	The enclosure is not intended for Group I applications.	N/A
-----	---------	---	-----

4.3	Group II	The enclosure is intended for Group IIC applications.	Pass
-----	----------	---	------

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
4.4	Group III	The enclosure is not intended for Group III applications.	N/A

4.5	Equipment for a particular explosive gas atmosphere	The enclosure is not intended for use in a particular gas atmosphere.	N/A
-----	---	---	-----

5	Temperatures		
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5.1	Environmental influences		
5.1.1	Ambient temperature	The equipment is designed for use in an ambient temperature range of -20°C to +45°C and is marked accordingly.	Pass
5.1.2	External source of heating or cooling	The equipment is not intended to be influenced by a separate external source of heating or cooling.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
5.2	Service temperature	The equipment's service temperature was determined at its rated voltage in accordance with clause 26.5.1 and was found to be +51.97°C on the cover gasket on the top side of enclosure above power supply (+45°C ambient and 6.97K rise). Refer to measurement section at the end of this checklist for details.	Pass

5.3	Maximum surface temperature		
5.3.1	Determination of maximum surface temperature	Maximum surface temperature was determined according to clause 26.5.1 and takes into consideration the equipment's maximum ambient temperature. See measurement section at the end of this checklist for details.	Pass
5.3.2	Limitation of maximum surface temperature		
5.3.2.1	Group I electrical equipment	The equipment is not intended for Group I applications.	N/A



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Clause	Requirement – Test	Result – Remark	Verdict
5.3.2.2	Group II electrical equipment	<p>The Ex Equipment parts used in the equipment have a T4 temperature class.</p> <p>The maximum surface temperature was measured on the external surface of the equipment and, as required by EN IEC 60079:7, on the surface of the electrical parts installed inside the enclosure.</p> <p>A maximum surface temperature of 69.3°C was measured on the surface of the power supply.</p> <p>T4 temperature class is therefore assigned based on the temperature classes of the Ex Equipment parts installed in the enclosure.</p>	Pass
5.3.2.3	Group III electrical equipment		
5.3.2.3.1	Maximum surface temperature for EPL Da	The equipment is not intended for Group II applications.	N/A
5.3.2.3.2	Maximum surface temperature for EPL Db	See clause 5.2.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
5.3.2.3.3	Maximum surface temperature determined without a layer of dust for EPL Dc	See clause 5.2.3.1.	N/A
5.3.3	Small component temperature for Group I or Group II electrical equipment	The equipment does not utilise small components.	N/A
5.3.4	Component temperature of smooth surfaces for Group I or Group II electrical equipment	There are no smooth surfaces that have to be considered.	N/A

6	Requirements for all electrical equipment		
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6.1	General	The equipment is formed of approved Ex Equipment and Ex Components which comply with the applicable Ex and industrial standards.	Pass
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6.2	Mechanical strength of equipment	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.3	Opening times	<p>The Ex Equipment parts installed in the enclosure are rated T4.</p> <p>The maximum surface temperature measured on the Ex Components parts installed in the enclosure is 62.82°C measured on the terminals.</p> <p>The overall equipment is therefore assigned a T4 temperature class.</p> <p>As the temperature class of the internal parts is the same as that of the enclosure in which they are installed no warning is required.</p>	N/A
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6.4	Circulating currents in enclosures (e.g. of large electric machines)	The equipment is a control panel, circulating currents are not considered to be an issue.	N/A
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6.5	Gasket retention	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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6.6	Electromagnetic and ultrasonic energy radiating equipment		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
6.6.1	General	The equipment does not radiate electromagnetic or ultrasonic energy.	N/A
6.6.2	Radio frequency sources	See clause 6.6.1.	N/A
6.6.3	Ultrasonic sources	See clause 6.6.1.	N/A
6.6.4	Lasers, luminaires, and other non-divergent continuous wave optical sources	See clause 6.6.1.	N/A

7	Non-metallic enclosures and non-metallic parts of enclosures		
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7.1	General		
7.1.1	Applicability	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
7.1.2	Specification of materials		
7.1.2.1	General	See clause 7.1.1.	Pass
7.1.2.2	Plastic materials	Plastic materials are not relied upon for the type of protection.	N/A
7.1.2.3	Elastomers	See clause 7.1.1.	

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
7.1.2.4	Materials used for cementing	Cements are not relied upon for the type of protection.	Pass

7.2	Thermal endurance		
7.2.1	Tests for thermal endurance	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
7.2.2	Material selection	See clause 7.2.1.	N/A
7.2.3	Alternative qualification of elastomeric sealing O-rings	Alternative qualification of elastomeric sealing O-rings relaxation is not applied to the gaskets used by the equipment.	N/A

7.3	Resistance to ultraviolet light	There are no external non-metallic parts on which the type of protection relies upon exposed to light.	N/A
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7.4	Electrostatic charges on external non-metallic materials		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
7.4.1	Applicability	The certified enclosure is unpainted stainless steel. A non-metallic marking label, tag number label and voltage warning label are fixed to the enclosure cover.	Pass
7.4.2	Avoidance of a build-up of electrostatic charge for Group I or Group II	The thickness of the non-metallic labels is 0.178mm as indicated on drawing NICP-ML-01 and NICP-GA-001. This is less than the maximum of 0.2 mm that is allowed for IIC applications.	Pass
7.4.3	Avoidance of a build-up of electrostatic charge for Group III	The equipment is not intended for Group III applications.	N/A

7.5	Attached external conductive parts	The enclosure is metallic.	N/A
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8	Metallic enclosures and metallic parts of enclosures		
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8.1	Material composition	The documents according to clause 24 specify the material of construction of the enclosure, which is stainless steel 316L.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

8.2	Group I	The enclosure is not intended for Group I applications.	N/A
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8.3	Group II	The equipment's EPL is Gc, for which there are no requirements.	N/A
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8.4	Group III	The equipment is not intended for Group III applications.	N/A
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8.5	Copper Alloys	Reliance is placed on the use of a suitably certified IIC enclosure, refer to Appendix 2 for details.	Pass
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9	Fasteners		
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9.1	General	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
9.2	Special fasteners	Special fasteners are not required by the type of protection applied (increased safety).	N/A

9.3	Holes for special fasteners		
9.3.1	Thread engagement	Special fasteners are not required by the type of protection applied (increased safety).	N/A
9.3.2	Tolerance and clearance	Special fasteners are not required by the type of protection applied (increased safety).	N/A

9.4	Hexagon socket set screws	The cover is not threaded, therefore this clause does not apply.	N/A
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10	Interlocking devices	Interlocking devices are not used.	N/A
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11	Bushings	Bushings are not used.	N/A
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12	(Reserved for future use)		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
13	Ex Components		
13.1	General	This is not an Ex Component approval.	N/A
13.2	Mounting	See clause 13.1.	N/A
13.3	Internal mounting	See clause 13.1.	N/A
13.4	External mounting	See clause 13.1.	N/A
13.5	Ex Component certificate	See clause 13.1.	N/A
14	Connection facilities		
14.1	General	Connection facilities are provided.	Pass
14.2	Type of protection	Connection facilities comply with type of protection Ex e.	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

14.3	Creepage and clearance	Creepage and clearance is maintained by the use of suitably certified Ex e Ex Equipment and Ex Component parts.	Pass
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15	Connection facilities for earthing or bonding conductors		
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15.1	Equipment requiring earthing or bonding		
15.1.1	Internal earthing	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
15.1.2	External bonding	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass

15.2	Equipment not requiring earthing	The enclosure requires earthing.	N/A
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15.3	Size of protective earthing conductor connection	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

15.4	Size of equipotential bonding conductor connection	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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15.5	Protection against corrosion	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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15.6	Secureness of electrical connections	Reliance is placed on the use of a suitably certified enclosure, refer to Appendix 2 for details.	Pass
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15.7	Internal earth continuity plate	The enclosure is metallic, an internal earth continuity plate is not required.	N/A
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16	Entries into enclosures		
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16.1	General	Entries into the enclosure are provided via plane holes located on a gland plate fitted to the bottom side of the enclosure.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
16.2	Identification of entries	The documents according to clause 24 adequately specify the entries, their position and the maximum number permitted.  20 x 25mm diameter holes are provided on the gland plate.	Pass
16.3	Cable glands	Only suitably certified IP66 cable glands are to be used. A condition of use applies to this effect.	Pass
16.4	Blanking elements	Only suitably certified IP66 blanking elements are to be used. A condition of use applies to this effect.	Pass
16.5	Thread adapters	Thread adaptors are not used.	N/A
16.6	Temperature at branching point and entry point	Temperatures below 80°C and 70°C respectively, no guidance for the proper selection of cables and cable glands required.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

16.7	Electrostatic charges of cable sheaths	Informative only.	-
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17	Supplementary requirements for electric machines		
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17.1	General	The equipment is not an electric machine.	N/A
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17.2	Ventilation		
17.2.1	Ventilation openings	See clause 17.1.	N/A
17.2.2	Materials for external fans	See clause 17.1.	N/A
17.2.3	Cooling fans of rotating electric machines	See clause 17.1.	N/A
17.2.3.1	Fans and fan hoods	See clause 17.1.	N/A
17.2.3.2	Construction and mounting of the ventilating systems	See clause 17.1.	N/A
17.2.3.3	Clearances for the ventilating system	See clause 17.1.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
17.2.4	Auxiliary motor cooling fans	See clause 17.1.	N/A
17.2.5	Room ventilating fans		
17.2.5.1	Applicability	See clause 17.1.	N/A
17.2.5.2	General	See clause 17.1.	N/A
17.2.5.3	Fan and fan hoods	See clause 17.1.	N/A
17.2.5.4	Construction and mounting	See clause 17.1.	N/A
17.2.5.5	Clearances for rotating parts	See clause 17.1.	N/A

17.3	Bearings	See clause 17.1.	N/A
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18	Supplementary requirements for switchgear		
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18.1	Flammable dielectric	The equipment is not switchgear.	N/A
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18.2	Disconnectors	See clause 18.1.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
18.3	Group I – Provisions for locking	See clause 18.1.	N/A

18.4	Doors and covers	See clause 18.1.	N/A
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19	Reserved for future use		
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20	Supplementary requirements for external plugs, socket outlets and connectors for field wiring connection		
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20.1	General	The equipment is not a plug, socket outlet or connector for field wiring connection, nor does it incorporate them.	N/A
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20.2	Explosive atmospheres gas	See clause 20.1.	N/A
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20.3	Explosive atmospheres dust	See clause 20.1.	N/A
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<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
20.4	Energized plugs	See clause 20.1.	N/A

21	Supplementary requirements for luminaires		
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21.1	General	The equipment is not a luminaire.	N/A
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21.2	Covers for luminaires of EPL Mb, EPL Gb, or EPL Db	See clause 21.1.	N/A
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21.3	Covers for luminaires of EPL Gc or EPL Dc	See clause 21.1.	N/A
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21.4	Sodium lamps	See clause 21.1.	N/A
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22	Supplementary requirements for caplights and handlights		
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22.1	Group I caplights	The equipment is not a caplight or handlight.	N/A
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<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
22.2	Group II and Group III caplights and handlights	See clause 22.1.	N/A

23	Equipment incorporating cells and batteries		
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23.1	General	The equipment does not contain cells or batteries.	N/SA
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23.2	Interconnection of cells to form batteries	See clause 23.1.	N/A
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23.3	Cell types	See clause 23.1.	N/A
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23.4	Cells in a battery	See clause 23.1.	N/A
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23.5	Ratings of batteries	See clause 23.1.	N/A
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23.6	Interchangeability	See clause 23.1.	N/A
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Clause	Requirement – Test	Result – Remark	Verdict
23.7	Charging of primary batteries	See clause 23.1.	N/A
23.8	Leakage	See clause 23.1.	N/A
23.9	Connections	See clause 23.1.	N/A
23.10	Orientation	See clause 23.1.	N/A
23.11	Replacement of cells or batteries	See clause 23.1.	N/A
23.12	Replaceable battery pack	See clause 23.1.	N/A
24	Documentation	The documents prepared give a full and correct specification of the explosion safety aspects of the equipment.	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
25	Compliance of prototype or sample with documents	The unit manufactured was inspected and found to be in compliance with the documentation that forms the technical file.	Pass

26	Type tests		
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26.1	General	The equipment is formed of suitably certified Ex Equipment and Ex Component parts, all of which are IIC Gc as a minimum. It is therefore considered that no type testing other than temperature rise tests is required	Pass
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26.2	Test configuration	Temperature rise tests were conducted in the most unfavourable configuration.	Pass
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26.3	Tests in explosive test mixtures	Tests in explosive test mixtures were not performed.	N/A
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<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
26.4	Tests of enclosures		
26.4.1	Order of tests		
26.4.1.1	Metallic enclosures, metallic parts of enclosures and glass parts of enclosures	See clause 26.1.	N/A
26.4.1.2	Non-metallic enclosures or non-metallic parts of enclosures		
26.4.1.2.1	General	See clause 26.1.	N/A
26.4.1.2.2	Group I equipment	The product under evaluation is not intended for Group I applications.	N/A
26.4.1.2.3	Group II and Group III equipment	See clause 26.1.	N/A
26.4.2	Resistance to impact	See clause 26.1.	N/A
26.4.3	Drop test	The product under evaluation is not portable or hand-held.	N/A
26.4.4	Acceptance criteria	See clause 26.1.	N/A
26.4.5	Degree of protection (IP) by enclosures		
26.4.5.1	Test procedure	See clause 26.1.	N/A
26.4.5.2	Acceptance criteria	See clause 26.1.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.5	Thermal tests		
26.5.1	Temperature measurement		
26.5.1.1	General	Service and maximum surface temperature tests were conducted in accordance with the requirements of this clause, see measurement section at the end of this checklist for details.	Pass
26.5.1.2	Service temperature	See clause 26.5.1.1	N/A
26.5.1.3	Maximum surface temperature	See clause 26.5.1.1	N/A
26.5.2	Thermal shock test	No glass parts, therefore thermal shock test not required.	N/A
26.5.3	Small component ignition test (Group I and Group II)		
26.5.3.1	General	The product under evaluation is not considered a small component, nor does it incorporate them.	N/A
26.5.3.2	Procedure	See clause 26.5.3.1.	N/A
26.5.3.3	Acceptance criteria	See clause 26.5.3.1.	N/A
26.6	Torque test for bushings		

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.6.1	Test procedure	The product under evaluation is not a bushing.	N/A
26.6.2	Acceptance criteria	See clause 26.6.1.	N/A

26.7	Non-metallic enclosures or non-metallic parts of enclosures		
26.7.1	General	See clause 26.1.	N/A
26.7.2	Test temperatures	See clause 26.1.	N/A

26.8	Thermal endurance to heat	See clause 26.1.	N/A
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26.9	Thermal endurance to cold	See clause 26.1.	N/A
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26.10	Resistance to UV light		
26.10.1	General	There are no non-metallic parts on which the type of protection relies upon exposed to light.	N/A
26.10.2	Light exposure	See clause 26.10.1.	N/A
26.10.3	Acceptance criteria	See clause 26.10.1.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.11	Resistance to chemical agents for Group I equipment	The product under evaluation is not intended for Group I applications.	N/A
26.12	Earth continuity	The certified enclosure is metallic.	N/A
26.13	Surface resistance test of parts of enclosures of non-metallic materials	The certified enclosure is metallic.	N/A
26.14	Measurement of capacitance		
26.14.1	General	The certified enclosure is metallic.	N/A
26.14.2	Test procedure	See clause 26.14.1.	N/A
26.15	Verification of ratings of ventilating fans	The equipment is not a ventilating fan.	N/A
26.16	Alternative qualification of elastomeric sealing O-rings	Alternative qualification of elastomeric sealing O-rings method not applied.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

26.17	Transferred charge test		
26.17.1	Test equipment	Transferred charge test not required.	N/A
26.17.2	Test sample	See clause 26.17.1.	N/A
26.17.3	Test procedure	See clause 26.17.1.	N/A

27	Routine tests	Routine tests are not required on the equipment by any of the standards applied.	N/A
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28	Manufacturer's responsibility		
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28.1	Conformity with the documentation	The unit manufactured was checked against the documentation of the technical file and found to be in compliance with its contents.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
28.2	Certificate	A declaration of conformity in compliance with Annex X of Directive 2014/34/EU has been prepared by the manufacturer, refer to document DOF-001 held in the technical file.	Pass

28.3	Responsibility for marking	The manufacturer is aware of their responsibility for marking.	Pass
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29	Marking		
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29.1	Applicability	The equipment complies with the applicable standards for the types of protection listed in Clause 1 and is marked accordingly.	Pass
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29.2	Location	The equipment is legibly marked. The self-adhesive marking label is fixed on the outside of the enclosure cover.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
29.3	General	The equipment bears the appropriate marking as required by this clause.	Pass

29.4	Ex marking for explosive atmospheres for gas	The Ex marking includes the appropriate information: II 3 G Ex ec nC IIC T4 Gc T <sub>a</sub> = -20°C to +45°C	Pass
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29.5	Ex marking for explosive atmospheres for dust	The equipment is not intended for dust applications.	N/A
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29.6	Combined types (or levels) of protection	Combined types of protection are applied, see clause 29.4.	Pass
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29.7	Multiple types of protection	Multiple types of protection are not applied.	N/A
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29.8	Ga equipment using two independent Gb types (or levels) of protection	The equipment is not Ga.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
29.9	Boundary wall	The equipment is not intended to be installed on a boundary wall between an area requiring EPL Ga or Da and a less hazardous area.	N/A
29.10	Ex Components	The equipment is not an Ex Component.	N/A
29.11	Small Ex Equipment and small Ex Components	The equipment is not small Ex Equipment or a small Ex Component.	N/A
29.12	Extremely small Ex Equipment and extremely small Ex Components	The equipment is not extremely small Ex Equipment or an extremely small Ex Component.	N/A
29.13	Warning markings	The equipment bears the following warning:  WARNING – DO NOT REMOVE OR REPLACE THE FUSE/TEST DISCONNECT SWITCH WHEN ENERGIZED!	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

29.14	Cells and batteries	The equipment does not incorporate cells or batteries.	N/A
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29.15	Electric machines operated with a converter	The equipment is not an electric machine operated with a converter.	N/A
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29.16	Examples of marking	Informative only.	-
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30	Instructions		
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30.1	General	A set of instructions has been prepared. These are in compliance with the minimum requirements specified in this clause. A copy of these instructions is held in the enclosure's technical file.	Pass
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30.2	Cells and batteries	The equipment does not incorporate cells or batteries.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

30.3	Electrical machines	The equipment is not an electrical machine.	N/A
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30.4	Ventilating fans	The equipment is not a ventilating fan.	N/A
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30.5	Cable glands	The equipment is not a cable gland.	N/A
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Annex A (Normative)	Supplementary requirements for cable glands		
A.1	General	The equipment is not a cable gland.	N/A
A.2	Constructional requirements		
A.2.1	Cable sealing	See clause A.1.	N/A
A.2.2	Filling compounds	See clause A.1.	N/A
A.2.3	Clamping		
A.2.3.1	General	See clause A.1.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
A.2.3.2	Group II or III cable glands	See clause A.1.	N/A
A.2.4	Lead-in of cable		
A.2.4.1	Sharp edges	See clause A.1.	N/A
A.2.4.2	Point of entry	See clause A.1.	N/A
A.2.5	Released by a tool	See clause A.1.	N/A
A.2.6	Fixing	See clause A.1.	N/A
A.2.7	Degree of protection	See clause A.1.	N/A
A.3	Type tests		
A.3.1	Tests of clamping of non-armoured and braided cables		
A.3.1.1	Cable glands with clamping by the sealing ring	See clause A.1.	N/A
A.3.1.2	Cable glands with clamping by filling compound	See clause A.1.	N/A
A.3.1.3	Cable glands with clamping by means of a clamping device	See clause A.1.	N/A
A.3.1.4	Clamping test	See clause A.1.	N/A
A.3.1.5	Mechanical strength	See clause A.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
A.3.2	Tests of clamping of armoured cables		
A.3.2.1	Tests of clamping where the armourings are clamped by a device integral to the gland		
A.3.2.1.1	General	See clause A.1.	N/A
A.3.2.1.2	Clamping test	See clause A.1.	N/A
A.3.2.1.3	Mechanical strength	See clause A.1.	N/A
A.3.2.2	Tests of clamping where the armourings are not clamped by a device integral to the gland	See clause A.1.	N/A
A.3.3	Type test for resistance to impact	See clause A.1.	N/A
A.3.4	Test for degree of protection (IP) of cable glands	See clause A.1.	N/A
A.4	Marking		
A.4.1	Marking of cable glands	See clause A.1.	N/A
A.4.2	Identification of cable-sealing rings	See clause A.1.	N/A
A.5	Instructions	See clause A.1.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

Annex B (Normative)	Requirements for Ex Components		
Table B.1	Applicability of clauses to Ex Components	The equipment is not an Ex Component.	N/A

Annex C (Informative)	Example of rig for resistance to impact test		
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Annex D (Informative)	Electric machines connected to converters		
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Annex E (Informative)	Temperature evaluation of electric machines		
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Annex F (Informative)	Guideline flowchart for tests of non-metallic enclosures or non-metallic parts of enclosures (26.4)		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

Annex G (Informative)	Guidance flowchart for tests of cable glands		
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Annex H (Informative)	Shaft voltages resulting in motor bearing or shaft brush sparking Discharge energy calculation		
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<b>Measurement Section, including Additional Narrative Remarks (as deemed applicable)</b>			
<p>The suitability of the certified parts used to form the equipment is assessed in section 2.5 (appendix 2) of the technical file associated with this product.</p> <p>Network Interface Control Panel with serial number NICP-0001 was subjected to the temperature rise tests as detailed in the table below:</p>			
Test	Standard ref.	Evaluation and test result	Test report #
Temperature rise	EN IEC 60079-0:2017, clause 26.5.1	Temperature rise tests were carried out in accordance with this clause.  Network Interface Control Panel, with serial number NICP-0001 was assembled as shown in the documents according to clause 24 and connected to the appropriate actuators to simulate working	TP-001 05/06/2024

	<p>conditions. The unit was then subjected to temperature rise tests. These were performed at 110Vac (100% of rated voltage) for service temperature measurement and 99Vac (90% of rated voltage) and 121Vac (110% of rated voltage) for maximum surface temperature measurement.</p> <p>Results:</p> <ul style="list-style-type: none"><li>- <u>Service temperature</u>: The maximum service temperature rise was 6.97K, measured on the cover gasket on the top side of the enclosure above the power supply.</li><li>- <u>Maximum surface temperature</u>: The maximum surface temperature rise was 24.3K, measured on the surface of the power supply.</li></ul> <p>Note: at 100% of the rated voltage the following temperature rises were recorded:</p> <ul style="list-style-type: none"><li>- Internal ambient: 13.81K</li><li>- Cable entry point: 5.04K</li><li>- Cable branching point: 5.6K</li></ul>	
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**2.4.2 EN IEC 60079-7:2015+A1:2018 CHECKLIST**

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

1	Scope		
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2	Normative references		
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3	Terms and definitions		
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4	Constructional requirements		
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4.1	Level of Protection	The equipment's level of protection is "ec".	
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4.2	Electrical connections		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.2.1	General	All the electrical connections on the equipment are provided by approved Ex Equipment and Ex Component parts with level of protection “Ex eb” or “Ex ec” and are therefore acceptable for level of protection “Ex ec”.	Pass
4.2.2	Field wiring connections		
4.2.2.1	General	See clause 4.2.1.	Pass
4.2.2.2	Connections made using terminals conforming to IEC 60947-7-1, IEC 60947-7-2, IEC 60947-7-4, IEC 60999-1, or IEC 60999-2	See clause 4.2.1.	Pass
4.2.2.3	Integral field wiring connection facilities	See clause 4.2.1.	Pass
4.2.2.4	Connections designed to be used with cable lugs and similar devices	See clause 4.2.1.	Pass

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.5	Connections using permanent arrangements	Permanent connections are not used.	N/A
4.2.3	Factory connections		
4.2.3.1	General	See clause 4.2.1.	Pass
4.2.3.2	Twist-on connectors for Level of Protection “ec”	See clause 4.2.1.	Pass
4.2.3.3	Permanent connections	Permanent connections are not used.	N/A
4.2.3.4	Pluggable connections for Level of Protection “eb”	The equipment’s level of protection is “ec”.	N/A
4.2.3.5	Pluggable connections for Level of Protection “ec”	See clause 4.2.1.	Pass
4.2.3.6	Pluggable terminal bridging connections	Pluggable terminal bridging connections are not used.	N/A
4.2.4	External plug and socket connections for field wiring connection	External plug and socket connections for field wiring connection are not used.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.3	Clearances	<p>All the electrical connections on the equipment are provided by approved Ex Equipment and Ex Components with level of protection “Ex eb” or “Ex ec”.</p> <p>The clearance distances between terminal block connections and other circuits or the enclosure walls have been checked and are in excess of the minimum requirements of this clause.</p>	Pass
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4.4	Creepage distances		
4.4.1	General	<p>All the electrical connections on these control panels are provided by approved Ex Equipment and Ex Components with level of protection “Ex eb” or “Ex ec”.</p> <p>The creepage distances between terminal block connections and other circuits or the enclosure walls have been checked and are in excess of the minimum requirements of this clause.</p>	Pass

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.4.2	Creepage between differing voltages	See clause 4.4.1.	Pass
4.4.3	Determining creepage distances	See clause 4.4.1.	Pass

4.5	Printed wiring boards with conformal coating, Level of Protection “ec”	The equipment does not incorporate printed wiring boards.	N/A
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4.6	Solid electrical insulating materials		
4.6.1	Specification	All approved parts are certified to at least Level of Protection “ec”. Reliance is therefore placed on each individual approval for compliance against this clause.	Pass
4.6.2	Long-term thermal stability	See clause 4.6.1.	Pass

4.7	Windings		
4.7.1	General	The equipment does not incorporate windings.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.7.2	Insulated conductors	See clause 4.7.1.	N/A
4.7.3	Winding impregnation	See clause 4.7.1.	N/A
4.7.4	Conductor dimensions	See clause 4.7.1.	N/A
4.7.5	Sensing elements	See clause 4.7.1.	N/A

4.8	Temperature limitations		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.8.1	General	<p>The Ex Equipment parts used in the equipment have a T4 temperature class.</p> <p>The maximum surface temperature was measured on the external surface of the equipment and, as required by this standard, on the surface of the electrical parts installed inside the enclosure.</p> <p>A maximum surface temperature of 69.3°C was measured on the surface of the power supply.</p> <p>T4 temperature class is therefore assigned based on the temperature classes of the Ex Equipment parts installed in the enclosure.</p>	Pass
4.8.2	Conductors	See clause 4.8.1.	Pass
4.8.3	Insulated windings	No insulated windings.	N/A

4.9	Wiring internal to equipment	Internal wiring is suitably routed and secured.	Pass
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4.10	Degrees of protection provided by enclosures		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.10.1	Enclosure requirements	Reliance is placed on the suitably certified enclosure rated IP66. Refer to appendix 2 for details.	Pass
4.10.2	Enclosures with drain holes or ventilation	The enclosure is not provided with drain holes or ventilation.	N/A
4.10.3	Enclosures with apparatus protected with Protection type “I”	The equipment does not incorporate apparatus protected by type of protection “I”.	N/A

4.11	Fasteners	The equipment is not intended for Group I applications.	N/A
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5	Supplementary requirements for specific electrical equipment		
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5.1	General	The equipment’s level of protection is “ec”. The applicable requirements have been met.	Pass
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5.2	Electrical machines		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.2.1	General	The equipment is not an electrical machine.	N/A
5.2.2	Degrees of protection provided by electrical machines, Level of Protection “eb”	See clause 5.2.1.	N/A
5.2.3	Degrees of protection provided by electrical machines, Level of Protection “ec”	See clause 5.2.1.	N/A
5.2.4	Connection facilities for external conductors	See clause 5.2.1.	N/A
5.2.5	Internal fans	See clause 5.2.1.	N/A
5.2.6	Minimum air gap	See clause 5.2.1.	N/A
5.2.7	Rotating electrical machines with cage rotors		
5.2.7.1	General	See clause 5.2.1.	N/A
5.2.7.2	Rotor cages		
5.2.7.2.1	Rotor cages built from bars connected to end rings	See clause 5.2.1.	N/A
5.2.7.2.2	Cast rotor cages	See clause 5.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.2.7.3	Assessment for possible air gap sparking	See clause 5.2.1.	N/A
5.2.8	Limiting temperature		
5.2.8.1	Limiting temperature of rotor	See clause 5.2.1.	N/A
5.2.8.2	Limiting temperature by current-dependent safety device	See clause 5.2.1.	N/A
5.2.8.3	Limiting temperature by temperature and other sensors	See clause 5.2.1.	N/A
5.2.8.4	Operation with a converter or a non-sinusoidal supply		
5.2.8.4.1	General	See clause 5.2.1.	N/A
5.2.8.4.2	Type test with a converter	See clause 5.2.1.	N/A
5.2.8.4.3	Alternative type verification by calculation	See clause 5.2.1.	N/A
5.2.9	Machines with permanent magnet rotors		
5.2.9.1	Construction	See clause 5.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.2.9.2	Operating from fixed frequency sinusoidal supply	See clause 5.2.1.	N/A
5.2.9.3	Operation with a converter	See clause 5.2.1.	N/A
5.2.10	Stator winding insulation system	See clause 5.2.1.	N/A
5.2.11	Supplemental winding requirements Level of Protection “eb”	See clause 5.2.1.	N/A
5.2.12	Bearing seals and shaft seals		
5.2.12.1	Machines of Levels of Protection “eb” and “ec”	See clause 5.2.1.	N/A
5.2.12.2	Non-rubbing seals and labyrinths	See clause 5.2.1.	N/A
5.2.12.3	Rubbing seals	See clause 5.2.1.	N/A
5.2.13	Neutral point connections	See clause 5.2.1.	N/A

5.3	Luminaires, hand lights, or caplights		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.3.1	General	The equipment is not a luminaire, caplight or hand light.	N/A
5.3.2	Light source		
5.3.2.1	General	See clause 5.3.1.	N/A
5.3.2.2	Lamps	See clause 5.3.1.	N/A
5.3.2.3	Lamps for rated voltages not greater than 50 V	See clause 5.3.1.	N/A
5.3.2.4	Lamps for rated voltages not greater than 12 V	See clause 5.3.1.	N/A
5.3.2.5	Light Emitting Diodes (LED)	See clause 5.3.1.	N/A
5.3.3	Minimum distance between lamp and protective cover	See clause 5.3.1.	N/A
5.3.4	Electrical spacings		
5.3.4.1	General	See clause 5.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.3.4.2	Creepage distances and clearances at peak values of pulse voltages greater than 1,5 kV	See clause 5.3.1.	N/A
5.3.4.3	Light Emitting Diodes (LEDs) for Level of Protection “ec”	See clause 5.3.1.	N/A
5.3.5	Lampholders and lamp caps		
5.3.5.1	General	See clause 5.3.1.	N/A
5.3.5.2	Screw lampholders and lamp caps		
5.3.5.2.1	General	See clause 5.3.1.	N/A
5.3.5.2.2	Screw lampholders and lamp caps in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.5.2.3	Screw lampholders for screw lamp caps in Level of Protection “ec”	See clause 5.3.1.	N/A
5.3.5.3	Lampholders for bi pin lamps		
5.3.5.3.1	General	See clause 5.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
5.3.5.3.2	Lampholders for bi-pin lamps in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.5.3.3	Lampholders for bi-pin lamps in Level of Protection “ec”	See clause 5.3.1.	N/A
5.3.5.4	Other lampholders and lamp caps		
5.3.5.4.1	Single pin lampholder and lamp caps in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.5.4.2	Bayonet lamp holders	See clause 5.3.1.	N/A
5.3.5.5	Requirements for electrical contact between the lampholder and lamp cap in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.6	Auxiliaries for Luminaires in Level of Protection “ec”		
5.3.6.1	Glow-type starters	See clause 5.3.1.	N/A
5.3.6.2	Electronic starters and ignitors	See clause 5.3.1.	N/A



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Clause	Requirement – Test	Result – Remark	Verdict

5.3.6.3	Starter holders	See clause 5.3.1.	N/A
5.3.6.4	Ballasts	See clause 5.3.1.	N/A
5.3.7	Surface temperatures		
5.3.7.1	Luminaires	See clause 5.3.1.	N/A
5.3.7.2	Lamp	See clause 5.3.1.	N/A
5.3.7.3	LEDs	See clause 5.3.1.	N/A
5.3.7.4	Temperature of lamp caps for tungsten-filament and tungsten-halogen lamps	See clause 5.3.1.	N/A
5.3.8	Limiting temperatures	See clause 5.3.1.	N/A
5.3.9	Luminaires for tubular fluorescent bi-pin lamps		
5.3.9.1	General	See clause 5.3.1.	N/A
5.3.9.2	Maximum ambient temperature	See clause 5.3.1.	N/A
5.3.9.3	Temperature class	See clause 5.3.1.	N/A
5.3.9.4	Disconnection device	See clause 5.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.3.9.5	Starting voltage for Level of Protection “eb” lamps	See clause 5.3.1.	N/A
5.3.9.6	Starting voltage for Level of Protection “ec” lamps	See clause 5.3.1.	N/A
5.3.10	Tests for resistance to impact	See clause 5.3.1.	N/A

5.4	Analog measuring instruments and instrument transformers		
5.4.1	General	The equipment is not an analog measuring instrument or instrument transformer.	N/A
5.4.2	Limiting temperature	See clause 5.4.1.	N/A
5.4.3	Short-circuit currents	See clause 5.4.1.	N/A
5.4.4	Short time thermal current		
5.4.5	Measuring instruments supplied by current transformers	See clause 5.4.1.	N/A
5.4.6	Moving coils	See clause 5.4.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.4.7	External secondary circuits	See clause 5.4.1.	N/A
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5.5	Transformers other than instrument transformers	The equipment is not a transformer other than an instrument transformer.	N/A
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5.6	Supplementary requirements for equipment incorporating cells and batteries		
5.6.1	Type of cells and batteries		
5.6.1.1	General	The equipment does not incorporate cells or batteries.	N/A
5.6.1.2	Sealed cells	See clause 5.6.1.1.	N/A
5.6.1.3	Valve-regulated cells and batteries	See clause 5.6.1.1.	N/A
5.6.1.4	Vented cells and batteries	See clause 5.6.1.1.	N/A
5.6.2	Requirements for cells and batteries $\leq 25$ Ah		
5.6.2.1	Encapsulation of cells or batteries	See clause 5.6.1.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.2.2	Use of secondary cells or batteries	See clause 5.6.1.1.	N/A
5.6.2.3	Cell connection	See clause 5.6.1.1.	N/A
5.6.2.4	Discharge mode		
5.6.2.4.1	General		
5.6.2.4.1.1	Connecting cells in series	See clause 5.6.1.1.	N/A
5.6.2.4.1.2	Deep discharge protection	See clause 5.6.1.1.	N/A
5.6.2.4.2	Discharge conditions for Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.2.4.3	Discharge conditions for Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.2.5	Service temperature	See clause 5.6.1.1.	N/A
5.6.2.6	Creepage and clearance		
5.6.2.6.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.2.6.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.6.2.7	Connections	See clause 5.6.1.1.	N/A
5.6.2.8	Replaceable battery packs	See clause 5.6.1.1.	N/A
5.6.2.9	Replaceable battery pack connections	See clause 5.6.1.1.	N/A
5.6.2.10	Release of electrolyte		
5.6.2.10.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.2.10.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.2.11	Disconnection and transportation	See clause 5.6.1.1.	N/A
5.6.3	Requirements for valve-regulated or vented cells or batteries >25 Ah		
5.6.3.1	Types of permissible batteries	See clause 5.6.1.1.	N/A
5.6.3.2	Battery containers		
5.6.3.2.1	Internal surfaces	See clause 5.6.1.1.	N/A
5.6.3.2.2	Mechanical requirements	See clause 5.6.1.1.	N/A
5.6.3.2.3	Creepage distances		

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.6.3.2.3 .1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.3.2.3 .2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.3.2.4	Cover	See clause 5.6.1.1.	N/A
5.6.3.2.5	Cell assembly	See clause 5.6.1.1.	N/A
5.6.3.2.6	Liquid extraction	See clause 5.6.1.1.	N/A
5.6.3.2.7	Ventilation	See clause 5.6.1.1.	N/A
5.6.3.2.8	Plugs and sockets	See clause 5.6.1.1.	N/A
5.6.3.2.9	Polarity marking	See clause 5.6.1.1.	N/A
5.6.3.2.1 0	Other equipment	See clause 5.6.1.1.	N/A
5.6.3.2.1 1	Insulation resistance	See clause 5.6.1.1.	N/A
5.6.3.3	Cells		
5.6.3.3.1	Lids	See clause 5.6.1.1.	N/A
5.6.3.3.2	Support	See clause 5.6.1.1.	N/A
5.6.3.3.3	Electrolyte maintenance	See clause 5.6.1.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.6.3.3.4	Expansion space	See clause 5.6.1.1.	N/A
5.6.3.3.5	Filling and vent plugs	See clause 5.6.1.1.	N/A
5.6.3.3.6	Electrolyte seals	See clause 5.6.1.1.	N/A
5.6.3.4	Connections		
5.6.3.4.1	Intercell connections	See clause 5.6.1.1.	N/A
5.6.3.4.2	Temperature assessment		
5.6.3.4.2 .1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.3.4.2 .2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.3.4.3	Connector protection	See clause 5.6.1.1.	N/A
5.6.4	Charging of cells and batteries		
5.6.4.1	Charger specifications		
5.6.4.1.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.4.1.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.4.2	Outgassing during charging of valve-regulated or vented cells or batteries		

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.4.2.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.4.2.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A

5.7	General purpose connection and junction boxes	The equipment is not a general purpose connection or junction box.	N/A
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5.8	Resistance heating equipment (other than trace heating systems)		
5.8.1	General	The equipment is not resistance heating equipment other than a trace heating system.	N/A
5.8.2	Heating resistors	See clause 5.8.1.	N/A
5.8.3	Temperature coefficient	See clause 5.8.1.	N/A
5.8.4	Insulating material	See clause 5.8.1.	N/A
5.8.5	Cold-start current	See clause 5.8.1.	N/A
5.8.6	Electrical safety device		
5.8.6.1	General	See clause 5.8.1.	N/A



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Clause	Requirement – Test	Result – Remark	Verdict

5.8.6.2	Method of protection		
5.8.6.2.1	General	See clause 5.8.1.	N/A
5.8.6.2.2	TT and TN systems	See clause 5.8.1.	N/A
5.8.6.2.3	IT system	See clause 5.8.1.	N/A
5.8.7	Electrically conductive covering	See clause 5.8.1.	N/A
5.8.8	Exclusion of explosive atmosphere	See clause 5.8.1.	N/A
5.8.9	Conductor cross- section	See clause 5.8.1.	N/A
5.8.10	Limiting temperature	See clause 5.8.1.	N/A
5.8.11	Safety device	See clause 5.8.1.	N/A

5.9	Supplementary requirements for fuses		
5.9.1	General	The equipment's Level of Protection is "ec". Only non-renewable fuses are used.	Pass

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Clause	Requirement – Test	Result – Remark	Verdict

5.9.2	Temperature class of equipment	A maximum surface temperature rise of 10.94K was measured on the fuse. When corrected to a maximum ambient of +45°C, results in a maximum surface temperature of 55.94°C on the fuse. The fuses are therefore deemed to comfortably comply with the equipment's T4 temperature classification.	Pass
5.9.3	Fuse mounting	A suitably certified "Ex ec" terminal block with fuse holder is used, refer to appendix 2 for details.	Pass
5.9.4	Fuse enclosures	The enclosure bears the warning:  WARNING – DO NOT REMOVE OR REPLACE THE FUSE/TEST DISCONNECT SWITCH WHEN ENERGIZED!	Pass
5.9.5	Replacement fuse identification	A specific condition of use is applied stating that only replacement fuses supplied by the manufacturer shall be used and to contact the manufacturer when replacement of fuses is required.	Pass

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.10	Other electrical equipment	No other electrical equipment is used.	N/A
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6	Type verifications and type tests		
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6.1	Dielectric strength	<p>Dielectric strength tests are not required at manufacturing stage as:</p> <ul style="list-style-type: none"> <li>- The equipment contains only suitably certified EX Equipment and Ex component parts.</li> <li>- Has no factory installed interconnecting wiring.</li> <li>- All creepage and clearance distances are rigidly controlled by the mounting of the Ex Equipment and Ex Component parts.</li> </ul> <p>Wiring of the equipment is the responsibility of the end user. A dielectric strength test will be performed when the FAT is conducted or at the time of installation.</p>	N/A
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.2	Rotating electrical machines		
6.2.1	Determination of starting current ratio $I_A / I_N$ and the time $t_E$	The equipment is not a rotating electrical machine.	N/A
6.2.2	Mounting of machine for test	See clause 6.2.1.	N/A
6.2.3	Additional tests for machines		
6.2.3.1	Stator winding insulation system		
6.2.3.1.1	Test samples	See clause 6.2.1.	N/A
6.2.3.1.2	Impulse ignition test for Level of Protection “eb” stator insulation systems	See clause 6.2.1.	N/A
6.2.3.1.3	Steady state ignition test for Levels of Protection “eb” and “ec” stator insulation systems	See clause 6.2.1.	N/A
6.2.3.2	Cage rotor		
6.2.3.2.1	General requirements	See clause 6.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.2.3.2.2	Locked Rotor Tests	See clause 6.2.1.	N/A
6.2.3.2.3	Explosive test mixture	See clause 6.2.1.	N/A
6.2.3.2.4	Test parameters	See clause 6.2.1.	N/A
6.2.4	Overspeed test of cemented magnets	See clause 6.2.1.	N/A

6.3	Luminaires		
6.3.1	Battery operated luminaires	The equipment is not a luminaire.	N/A
6.3.2	Impact and drop tests		
6.3.2.1	General	See clause 6.3.1.	N/A
6.3.2.2	Tests for resistance to impact (portable and transportable luminaires and handlights)	See clause 6.3.1.	N/A
6.3.3	Mechanical tests for screw lampholders other than E10		
6.3.3.1	Testing the force on the bottom contact of the lamp/lampholder	See clause 6.3.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.3.3.2	Testing the minimum removal torque of the lamp/lampholder	See clause 6.3.1.	N/A
6.3.4	Abnormal operation of luminaires		
6.3.4.1	Abnormal operations of ballasts for discharge lamps		
6.3.4.1.1	Level of Protection “eb”, rectification test	See clause 6.3.1.	N/A
6.3.4.1.2	Level of Protection “ec”	See clause 6.3.1.	N/A
6.3.4.2	Abnormal operation of luminaires with tubular fluorescent lamps		
6.3.4.2.1	Level of Protection “eb”		
6.3.4.2.1.1	Rectification test	See clause 6.3.1.	N/A
6.3.4.2.1.2	Inoperative lamp test	See clause 6.3.1.	N/A
6.3.4.2.2	Level of Protection “ec”	See clause 6.3.1.	N/A
6.3.4.3	Power dissipation of cathodes of lamps supplied by electronic ballasts		
6.3.4.3.1	Luminaires in Level of Protection “eb”	See clause 6.3.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.3.4.3.2	Luminaires in Level of Protection “ec”	See clause 6.3.1.	N/A
6.3.5	Sulphur dioxide test for Level of Protection “eb” for the connection of bi-pin lamp caps to lampholders	See clause 6.3.1.	N/A
6.3.6	Vibration test for Level of Protection “eb” for luminaires with bi-pin lamps	See clause 6.3.1.	N/A
6.3.7	Test for wiring of luminaires subject to high-voltage impulses from ignitors	See clause 6.3.1.	N/A
6.3.8	Tests for electronic starters for tubular fluorescent lamps and for ignitors in Level of Protection “ec” for discharge lamps		
6.3.8.1	General	See clause 6.3.1.	N/A
6.3.8.2	Cut-out device test	See clause 6.3.1.	N/A
6.3.8.3	Life test (failed lamp)		

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.3.8.3.1	Ignitor thermal endurance test	See clause 6.3.1.	N/A
6.3.8.3.2	Evaluation criteria	See clause 6.3.1.	N/A
6.3.9	Test for starter holders for luminaires in Level of Protection “ec”	See clause 6.3.1.	N/A

6.4	Measuring instruments and instrument transformers	The equipment is not a measuring instrument or instrument transformer.	N/A
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6.5	Transformers other than instrument transformers	The equipment is not a transformer other than an instrument transformer.	N/A
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6.6	Verification and tests for cells and batteries of Level of Protection “eb”		
6.6.1	General	The equipment does not incorporate cells or batteries.	N/A
6.6.2	Insulation resistance	See clause 6.6.1.	N/A



EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.6.3	Mechanical shock test		
6.6.3.1	General	See clause 6.6.1.	N/A
6.6.3.2	Test conditions	See clause 6.6.1.	N/A
6.6.3.3	Test procedure	See clause 6.6.1.	N/A
6.6.3.4	Acceptance criteria	See clause 6.6.1.	N/A
6.6.4	Test for ventilation of Level of Protection “eb” battery container	See clause 6.6.1.	N/A

6.7	Verification and tests for cells and batteries of Level of Protection “ec”		
6.7.1	General	The equipment does not incorporate cells or batteries.	N/A
6.7.2	Insulation resistance	See clause 6.7.1.	N/A
6.7.3	Mechanical shock test	See clause 6.7.1.	N/A
6.7.4	Test for ventilation of Level of Protection “ec” battery container	See clause 6.7.1.	N/A

6.8	General purpose connection and junction boxes		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.8.1	General	The equipment is not a general purpose connection or junction box.	N/A
	Maximum dissipated power method	See clause 6.8.1.	N/A
6.8.3	Defined arrangement method	See clause 6.8.1.	N/A

6.9	Resistance heating equipment		
6.9.1	Test sample	The equipment is not resistance heating equipment.	N/A
6.9.2	Verification of the electrical insulation	See clause 6.9.1.	N/A
6.9.3	Thermal stability of the electrical insulation	See clause 6.9.1.	N/A
6.9.4	Resistance to impact	See clause 6.9.1.	N/A
6.9.5	Test for cold start current	See clause 6.9.1.	N/A
6.9.6	Tests for specific forms of resistance heaters	See clause 6.9.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

6.10	Terminal insulating material tests	The equipment is not a terminal.	N/A
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7	Routine verifications and routine tests		
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7.1	Dielectric tests	See clause 6.1.	N/A
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7.2	Dielectric tests for batteries	The equipment does not incorporate cells or batteries.	N/A
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7.3	Inter-turn overvoltage tests	The equipment does not incorporate current transformers.	N/A
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8	Ex Component certificates		
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8.1	General	The equipment is not an Ex Component.	N/A
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

8.2	Terminals	See clause 8.1.	N/A
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9	Marking and instructions		
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9.1	General marking	The equipment's level of protection is "ec" and is marked appropriately.	Pass
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9.2	Ex Component enclosures	The equipment is not an Ex Component enclosure.	N/A
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9.3	Instructions for use		
9.3.1	Battery operated equipment	The equipment is not battery operated.	N/A
9.3.2	Terminals	The instructions contain the appropriate terminal information.	Pass
9.3.3	Luminaires	The equipment is not a luminaire.	N/A
9.3.4	Machines	The equipment is not an electric machine..	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

9.4	Warning markings	The enclosure bears the warning:  WARNING – DO NOT REMOVE OR REPLACE THE FUSE/TEST DISCONNECT SWITCH WHEN ENERGIZED!	Pass
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10	Documentation	The documents prepared are in accordance with EN IEC 60079-0 and give a full and correct specification of the explosion safety aspects of the equipment	Pass
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Annex A (Normative)	Temperature determination of electrical machines – Methods of test and of calculation		
A.1	General	The equipment is not an electrical machine.	N/A
A.2	Determination of maximum service temperatures		
A.2.1	Rotor temperature – normal operation	See clause A.2.1.	N/A
A.2.2	Winding temperature – normal operation	See clause A.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

A.3	Determination of maximum surface temperatures		
A.3.1	General	See clause A.2.1.	N/A
A.3.2	Locked rotor tests		
A.3.2.1	Test conditions	See clause A.2.1.	N/A
A.3.2.2	Optional testing at reduced voltage	See clause A.2.1.	N/A
A.3.2.3	Rotor temperature	See clause A.2.1.	N/A
A.3.2.4	Determination of starting current $I_A$	See clause A.2.1.	N/A
A.3.2.5	Stator temperature	See clause A.2.1.	N/A
A.4	Optional calculation of maximum surface temperature		
A.4.1	General	See clause A.2.1.	N/A
A.4.2	Rotor temperature	See clause A.2.1.	N/A
A.4.3	Stator temperature	See clause A.2.1.	N/A
A.5	Determination of $t_E$ time	See clause A.2.1.	N/A
A.6	Arduous starting conditions	See clause A.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

A.7	Motors operated with a converter	See clause A.2.1.	N/A
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Annex B (Normative)	Type tests for specific forms of resistance heating devices or resistance heating units (other than trace heater)		
B.1	Resistance heating devices subjected to mechanical stresses	The equipment is not a resistance heating device or unit.	N/A
B.2	Resistance heating devices or units intended for immersion	See clause B.1.	N/A
B.3	Resistance heating devices or units having hygroscopic insulating material	See clause B.1.	N/A
B.4	Verification of limiting temperature of resistance heating devices (other than trace heaters)		
B.4.1	General	See clause B.1.	N/A
B.4.2	Safety devices		
B.4.2.1	General	See clause B.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

B.4.2.2	Safety device sensing the temperature	See clause B.1.	N/A
B.4.2.3	Safety device sensing the temperature and at least one other parameter	See clause B.1.	N/A
B.4.2.4	Safety device sensing a parameter other than the temperature	See clause B.1.	N/A
B.4.3	Resistance heating unit of stabilized design	See clause B.1.	N/A
B.4.4	Heating device with temperature self-limiting characteristic	See clause B.1.	N/A

Annex C (Informat ive)	Cage motors – Thermal protection in service		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

Annex D (Informat ive)	Resistance heating devices and units – Additional electrical protection		
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Annex E (Informat ive)	Combinations of terminals and conductors for general purpose connection and junction boxes		
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Annex F (Normati ve)	Dimensions of copper conductors	Noted.	Pass
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Annex G (Normati ve)	Test procedure for T5 (only 8 W), T8, T10 and T12 lamps		
G.1	Asymmetric pulse test		
G.1.1	General	The equipment is not a lamp.	N/A
G.1.2	Test procedure	See clause G.1.	N/A
G.2	Asymmetric power test		
G.2.1	General	See clause G.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

G.2.2	Test procedure	See clause G.1.	N/A
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Annex H (Normative)	Alternative separation distances for Level of Protection “ec” equipment under controlled environments		
H.1	General	Alternative separation distances for level of protection “ec” have not been applied.	N/A
H.2	Specific Conditions of Use	See clause H.1.	N/A
H.3	Control of pollution access	See clause H.1.	N/A
H.4	Voltage limitation	See clause H.1.	N/A
H.5	Control of overvoltages and transient protection	See clause H.1.	N/A
H.6	Alternative separation distances	See clause H.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

Annex I (Informat ive)	Application, installation, and testing considerations for Level of Protection “ec” asynchronous machines		
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Annex J (informat ive)	Luminaires incorporating LEDs		
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**Measurement Section, including Additional Narrative Remarks (as deemed applicable)**

The suitability of the certified parts used to form the equipment is assessed in section 2.5 (appendix 2) of the technical file associated with this product.

**2.4.3 EN IEC 60079-15:2019 CHECKLIST**

EN IEC 60079-15:2019			
Clause	Requirement – Test	Result – Remark	Verdict

1	Scope		
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EN IEC 60079-15:2019			
Clause	Requirement – Test	Result – Remark	Verdict
	The equipment utilises a power supply and industrial ethernet switch which are suitably certified Ex Equipment with type of protection Ex nC. All aspects of type of protection nC relate to these parts and as such the only assessment required is the review of their certificates and assessment of their conditions of use. Assessment of the suitability of these parts is carried out in appendix 2 of the technical file associated with this product. No further consideration is deemed necessary.		

#### 2.4.4 DIRECTIVE 2014/EU/34 EHSRs

DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)			
Clause	Requirement – Test	Result – Remark	Verdict
1	GENERAL REQUIREMENTS		
1.0.1	Principles of integrated explosion protection	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.0.2	Analysis of possible operating faults	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.0.3	Special checking and maintenance conditions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
1.0.4	Surrounding area conditions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.0.5	Marking	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.0.6	Instructions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

1.1	MATERIALS		
1.1.1	Materials not to trigger off explosion	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.1.2	Effect of explosive atmosphere on materials	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.1.3	Changes in characteristics of materials and combinations thereof	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

1.2	DESIGN AND CONSTRUCTION		
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**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
1.2.1	Design with regard to technological knowledge	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.2.2	Components for incorporation or replacement	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.2.3	Enclosed structures and prevention of leaks	Covered by EN IEC 60079-7:2015+A1:2018.	Pass
1.2.4	Dust deposits	The equipment is not intended for dust applications.	N/A
1.2.5	Additional means of protection	Covered by EN IEC 60079-7:2015+A1:2018.	Pass
1.2.6	Safe opening	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.2.7	Protection against other hazards	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.2.8	Overloading of equipment	Covered by EN IEC 60079-7:2015+A1:2018.	Pass
1.2.9	Flameproof enclosure systems	Not a flameproof enclosure system.	N/A

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

Clause	Requirement – Test	Result – Remark	Verdict
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1.3	POTENTIAL IGNITION SOURCES		
1.3.1	Hazard arising from different ignition sources	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.3.2	Hazards arising from static electricity	Covered by EN IEC 60079-0:2018.	Pass
1.3.3	Hazards arising from stray electric and leakage currents	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.3.4	Hazards arising from overheating	Covered by EN IEC 60079-7:2015+A1:2018.	Pass
1.3.5	Hazards arising from pressure compensation operations	No pressure compensation operations.	N/A

1.4	HAZARDS ARISING FROM EXTERNAL EFFECTS		
1.4.1	Safe function in changing external conditions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
1.4.2	Withstanding attack by aggressive substances	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

1.5	REQUIREMENTS IN RESPECT OF SAFETY RELATED DEVICES		
1.5.1	General requirements for safety related devices	The equipment is not a safety related device.	N/A
1.5.2	Safety device failure	The equipment is not a safety related device.	N/A
1.5.3	Restart lockouts	The equipment is not a safety related device.	N/A
1.5.4	Control and display units	The equipment is not a safety related device.	N/A
1.5.5	Devices with a measuring function	The equipment is not a safety related device.	N/A
1.5.6	Checking accuracy and serviceability	The equipment is not a safety related device.	N/A
1.5.7	Safety Factor	The equipment is not a safety related device.	N/A
1.5.8	Risk arising from software	The equipment is not a safety related device.	N/A



**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

Clause	Requirement – Test	Result – Remark	Verdict
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1.6	INTEGRATION OF SAFETY REQUIREMENTS RELATING TO THE SYSTEM		
1.6.1	Manual override	The equipment does not have a manual override.	N/A
1.6.2	Emergency shutdown	The equipment does not have an emergency shutdown.	N/A
1.6.3	Hazards arising from power failure	There are no hazards associated with the equipment in the event of power failure.	Pass
1.6.4	Hazards arising from connections	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.6.5	Placing of warning devices as parts of equipment	The equipment is not fitted with detection or alarm devices for monitoring the occurrence of explosive atmospheres.	N/A

2	SUPPLEMENTARY REQUIREMENTS IN RESPECT OF EQUIPMENT		
2.0.1	Category M1	The equipment is not Category M1.	N/A

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
2.0.2	Category M2	The equipment is not Category M2.	N/A
2.1.1	Category 1G	The equipment is not Category 1G.	N/A
2.1.1.1	Equipment design and construction	The equipment is not Category 1G.	N/A
2.1.1.2	Surface Temperature	The equipment is not Category 1G.	N/A
2.1.1.3	Opening	The equipment is not Category 1G.	N/A
2.1.2	Category 1D	The equipment is not Category 1D.	N/A
2.2.1	Category 2G	The equipment is not Category 2G.	N/A
2.2.2	Category 2D	The equipment is not Category 2D.	N/A
2.3.1	Category 3G	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018	Pass
2.3.2	Category 3D	The equipment is not Category 3D.	N/A

<b>3</b>	<b>SPECIFIC REQUIREMENTS FOR PROTECTIVE SYSTEMS</b>		
3.0	General Requirements	The equipment is not a protective system.	N/A
3.1	Planning and Design	The equipment is not a protective system.	N/A

## **2.5 CERTIFIED PARTS**

### **2.5.1 ASSESSMENT OF CERTIFIED PARTS (APPENDIX 2)**

The equipment utilises the following Ex Equipment and Ex component parts:

- Enclosure
- Power supply
- Redundancy module
- Industrial ethernet switch
- Terminals
- Fuse holder

Assessment of each individual part is performed in the subsequent pages of this document.



## 2.5.1.1 ENCLOSURE

### 2.5.1.1.1 INFORMATION

Manufacturer	Rittal-Werk, Duolph Loh GmbH & Co. KG
Part number	KEL 9407.600
Certificate	PTB 02 ATEX 1082 U
Marking	II 2 G Ex e IIC Gb
Standards applied	EN 60079-0:2009 EN 60079-7:2007 EN 60079-31:2009

### 2.5.1.1.2 SCHEDULE OF LIMITATIONS

The Ex Component certificate does not include a schedule of limitations. Upon review of the enclosure instructions, it was noted that that the following warning is made:

**Attention:**  
Empty enclosures with component certificate require a  
examination certificate of a notified body for the overall  
approval.

Since the equipment in which the enclosure is utilised is for use in zone 2 (ATEX Category 3), self-certification is acceptable, therefore examination by a notified body as indicated in the above warning is not necessary. Complete assessment is conducted by the manufacturer.

### 2.5.1.1.3 OTHER CONSIDERATIONS

Although the Ex Component enclosure certificate does not list the latest editions of the standards, the manufacturer's declaration of conformity states compliance with the latest editions of the standards. It is therefore considered that a standards upgrade gap analysis is not required. Reliance for compliance against the latest editions of the standards is placed on the enclosure manufacturer's declaration

of conformity. A copy of the manufacturer's declaration of conformity is held in the equipment's technical file.

The certificate states an ambient temperature range of -30°C to +80°C when a silicone gasket is used. Since this is a component certificate it is understood that this temperature is in fact the component's service temperature range, not its allowable ambient temperature range.

The equipment in which the enclosure is used has a minimum service temperature of -20°C (the equipment's lower ambient), which is within the limits of the enclosure's service temperature range.

The equipment in which the enclosure is used has a maximum service temperature of +51.97°C (+45°C maximum ambient temperature of the equipment plus a 6.97K rise measured on the enclosure gasket during temperature rise testing), which is within the limits of the enclosure's service temperature range.

The enclosure's ingress protection rating is IP66.

#### 2.5.1.1.4 VERDICT

Assessment of the suitability of the Ex Component enclosure has been carried out. The enclosure is deemed suitable for use in this application with no further consideration deemed necessary.

## 2.5.1.2 POWER SUPPLY

### 2.5.1.2.1 INFORMATION

Manufacturer	PULS GmbH
Part number	CP5.241
Certificate	EPS 19 ATEX 1 201 X
Marking	II 3G Ex ec nC IIC T4 Gc
Standards applied	EN 60079-0:2018 EN 60079-7:2015+A1:2018 EN 60079-15:2019

### 2.5.1.2.2 SPECIFIC CONDITIONS OF USE

Specific condition of use	Justification for compliance
The equipment shall be installed in an enclosure that provides a minimum ingress protection of IP 54 in accordance with IEC 60079-0	The enclosure is IP66 as detailed in certificate PTB 02 ATEX 1082 U. Suitably certified IP66 cable glands and blanking elements are to be used.
The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC 60664-1	The power supply is installed in an IP66 rated enclosure.
Ambient temperature range is $-25\text{ }^{\circ}\text{C} < T_{\text{amb}} < +70\text{ }^{\circ}\text{C}$ ; derating conditions above $+45\text{ }^{\circ}\text{C}$ and different mounting orientations must be considered	The equipment's minimum rated ambient temperature is $-20\text{ }^{\circ}\text{C}$ , and the maximum internal ambient inside the enclosure where the power supply is fitted is $58.81\text{ }^{\circ}\text{C}$ . See section 2.5.1.2.3 for derating considerations.

### 2.5.1.2.3 OTHER CONSIDERATIONS

The Ex Equipment power supply is certified to the latest editions of the standards.

The power supply's electrical data is shown below:

<b>CP5.241, CP5.241-S1, CP5.241-S2:</b>
<b>Input:</b>
AC 100-240V <sup>(-15%/+10%)</sup>   1.6-0.7A   50-60Hz
DC 110-150V <sup>(+/-20%)</sup>   1.4A
<b>Output:</b>
DC 24-28V   6.0-5.1A (below +45 °C)
DC 24-28V   5.0-4.3A (at +60 °C)
DC 24-28V   3.8-3.2A (at +70° C)
Derate linearly between +45 °C and +70 °C
Ambient temperature range: -25 °C to +70 °

The power supply output is below 3.2A, so would be suitable for use in an ambient of up to +70°C according to the electrical data extracted from the certificate.

The installation instructions have been followed. A copy of the instructions is held in the technical file.

#### 2.5.1.2.4 VERDICT

Assessment of the suitability of the Ex Equipment power supply has been carried out. The power supply is deemed suitable for use in this application with no further consideration deemed necessary.

### 2.5.1.3 REDUNDANCY MODULE

#### 2.5.1.3.1 INFORMATION

Manufacturer	PULS GmbH
Part number	YR20.242
Certificate	EPS 11 ATEX 1 312 X
Marking	II 3G Ex ec IIC T4 Gc
Standards applied	EN IEC 60079-0:2018 EN 60079-7:2015+A1:2018

#### 2.5.1.3.2 SPECIFIC CONDITIONS OF USE

Specific condition of use	Justification for compliance
The equipment shall be installed in an enclosure that provides a degree of protection not less than IP 54 in accordance with IEC 60079-7	The enclosure is IP66 as detailed in certificate PTB 02 ATEX 1082 U. Suitably certified IP66 cable glands and blanking elements are to be used.
The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC 60664-1	The power supply is installed in an IP66 rated enclosure.
Output power de-rating conditions at high ambient temperatures must be considered according to manufacturer's instructions.	See section 2.5.1.3.3 for derating considerations.

#### 2.5.1.3.3 OTHER CONSIDERATIONS

The Ex Equipment redundancy module is certified to the latest editions of the standards.

The power supply's electrical data is shown below:



**YR20.242****Input 1+2**

1: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32,5A up to 5s

2: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32,5A up to 5s

**Output:**

24A continuous, 32,5A up to 5s (below 45°C)

20A continuous, 32,5A up to 5s (below 70°C)

Derate linearly between +45°C and +70°C

Input to output voltage loss: typ. 0,06V

The redundancy module outputs are below 3.2A, so would be suitable for use in an ambient of up to +70°C according to the electrical data extracted from the certificate.

The installation instructions have been followed. A copy of the instructions is held in the technical file.

#### 2.5.1.3.4 VERDICT

Assessment of the suitability of the Ex Equipment redundancy module has been carried out. The redundancy module is deemed suitable for use in this application with no further consideration deemed necessary.

## 2.5.1.4 INDUSTRIAL ETHERNET SWITCH

### 2.5.1.4.1 INFORMATION

Manufacturer	Moxa Inc.
Part number	EDS-516A-MM-SC
Certificate	DEMKO 09 ATEX 0812123X
Marking	II 3 G Ex nA nC IIC T4 Gc
Standards applied	EN 60079-0:2012+A11:2013 EN 60079-15:2010 EN 60079-28:2015

### 2.5.1.4.2 SPECIFIC CONDITIONS OF USE

Specific condition of use	Justification for compliance
The Ethernet communication devices are to be mounted in a tool accessible only IP54 enclosure in accordance with IEC 60079-15, and used in an area of not more than pollution degree 2 as defined in IEC 60664-1.	The industrial ethernet switch is installed in a suitably certified increased safety enclosure rated IP66 as detailed in certificate PTB 02 ATEX 1082 U. Suitably certified IP66 cable glands and blanking elements are to be used.
Provisions shall be made, either in the equipment or external to the equipment, to provide the transient protection device to be set at a level not exceeding 140% of the peak rated voltage.	This condition is carried on to the overall equipment certificate.

### 2.5.1.4.3 OTHER CONSIDERATIONS

The Ex Equipment industrial ethernet switch is not certified to the latest editions of the standards. A Gap Analysis has been carried out to bring the equipment in line with the requirements of the latest editions of the standards. No issues have been found for continued compliance to the latest editions of the standards. Refer to Gap Analysis checklists below. As a result, “nA” can be changed to “ec” in the marking code.

<b>EN IEC 60079-0:2018 from EN 60079-0:2012+A11:2013</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
6.5	Gasket retention	Added requirement that where an adhesive is used to secure a gasket, it shall be used within its COT and shall comply with the requirements for cements.	Installed in a suitably certified IP66 enclosure.	N/A
7.4.2 c)	Avoidance of a build-up of electrostatic charge on Group I or Group II electrical equipment	Added reference to IEC 60243-1 and IEC 60243-2 for test method to require a 4 kV DC test.  (Requires that the test be conducted at <4 kV DC)	Installed in a suitably certified IP66 enclosure.	N/A

<b>EN IEC 60079-0:2018 from EN 60079-0:2012+A11:2013</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
8.5	Copper Alloys	Added limitation for external surfaces of >65% copper (Cable glands, blanking elements, thread adapters and bushings are not considered an enclosure surface requiring coating or Copper content restrictions)	Installed in a suitably certified IP66 enclosure.	N/A
20.1	General	Added requirements for EPL Gc and Dc	The equipment is for EPL Gc but it does not incorporate any external plugs, sockets outlets or connectors for field wiring connection.	N/A
Table 14	Table 14	New cell types and data added based on latest available data	The equipment does not incorporate any batteries or cells.	N/A

<b>EN IEC 60079-0:2018 from EN 60079-0:2012+A11:2013</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
29.13	Alternate marking of equipment protection Level (EPLs)	The alternate marking of EPL has been deleted.	The previous marking is unaffected by the changes to this clause.	N/A
30.3	Instructions Electrical machines	Additional instruction material for electric machines added	The equipment is not an electrical machine.	N/A
30.5 A.5	Instructions Cable glands	Additional instruction material for cable glands added	The equipment is not a cable gland.	N/A

<b>EN 60079-7:2015 from EN 60079-15:2010</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
4.2.2.5 4.2.3.3	Soldered connections	Although a clarification, it is recognized that some existing equipment may not meet the clarified requirement. The requirements for soldered connections were revised to specify that mechanical support of the connection was required in addition to the solder. It is not a requirement that the connection function electrically in the absence of the solder.	No soldered connections.	N/A

<b>EN 60079-7:2015 from EN 60079-15:2010</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
4.6	Thermal stability of solid insulating materials	Requirements added for the use of solid insulating materials within the limits of their thermal stability.	All parts are used within their maximum rated service temperatures., refer to temperature considerations below.	Pass
6.3.4.3.2 Table 16	Addition of end of-life test	Based on further research, requirements for T5 lamps added.	Not a luminaire.	N/A

<b>EN 60079-7:2015 from EN 60079-15:2010</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
9.2	Ex Component enclosures	Requirements for Ex Component “e” enclosures introduced based on those for Ex Component “d” enclosures. Even if the other technical aspects on the product are unchanged and comply with the revised requirements, a change in the marking will be required.	Not an Ex Component enclosure.	N/A

<b>EN 60079-7:2015+A1 2018 from EN 60079-7:2015</b>				
<b>Clause</b>	<b>Title</b>	<b>Nature of change</b>	<b>Compliance</b>	<b>Verdict</b>
No major or significant technical changes introduced.				

The industrial ethernet switch is rated T4, as is the overall equipment.

The industrial ethernet switch is suitable for use in an ambient temperature range of -40°C to +70°C. The ambient temperature range inside the enclosure in which the industrial ethernet switch is installed is -20°C to +58.81°C.

The installation instructions have been followed. A copy of the instructions is held in the technical file.



#### 2.5.1.4.4 VERDICT

Assessment of the suitability of the Ex Equipment industrial ethernet switch has been carried out. The industrial ethernet switch is deemed suitable for use in this application with no further consideration deemed necessary.



## 2.5.1.5 FEED THROUGH TERMINAL BLOCK, END PLATE AND PROTECTIVE CONDUCTOR TERMINAL BLOCK

### 2.5.1.5.1 INFORMATION

Manufacturer	Weidmüller Interface GmbH & Co. KG
Part number	Feed through terminal block: WDU 4 and WDU 2.5 End plate: WAP 4 and WAP 2.5 Protective conductor terminal block: WPE 4 and WPE 2.5
Certificate	DEMKO 14 ATEX 1338U
Marking	II 2 GD Ex eb IIC Gb
Standards applied	EN IEC 60079-0:2018 EN IEC 60079-7:2015+A1:2018

### 2.5.1.5.2 SCHEDULE OF LIMITATIONS

Schedule of limitations	Justification for compliance
The feed through and protective conductor terminal blocks are suitable for use in enclosures in atmospheres with flammable gases and combustible dust. For flammable gases these enclosures must satisfy the requirements according to EN 60079-0 and EN 60079-7. For combustible dust these enclosures must satisfy the requirements according to EN 60079-31.	The feed through and protective conductor terminal blocks are installed in a suitably certified increased safety enclosure as detailed in certificate PTB 02 ATEX 1082 U. Suitably certified cable glands and blanking elements are to be used.  The equipment is not intended for dust applications.

<p>The terminal blocks shall be placed inside a suitable ATEX certified IP54 enclosure for gas atmosphere. For dust atmosphere the terminal blocks shall be mounted inside a suitable ATEX certified 't' enclosure (EN60079-31).</p>	<p>The feed through and protective conductor terminal blocks are installed in an IP66 rated enclosure as detailed in certificate PTB 02 ATEX 1082 U. IP66 cable glands and blanking elements are to be used.</p> <p>The equipment is not intended for dust applications.</p>
<p>The enclosure shall be constructed to block all sun and UV light from affecting the terminal blocks.</p>	<p>The enclosure does not incorporate any windows or openings that would expose the terminals to light.</p>
<p>Under normal operating conditions the temperature rise of the terminal blocks is max 40 K, measured with 110% of the maximum rated current. Due to the above mentioned the terminal blocks may be used in apparatus of temperature classes T6...T1 as long as the terminal block ambient temperature range is not exceeded as shown below. No part of terminal block must exceed 110 °C under any condition.</p> <ul style="list-style-type: none"> <li>• T6 (- 60°C ≤ Tamb ≤ +40 °C)</li> <li>• T5 (- 60°C ≤ Tamb ≤ +55 °C)</li> <li>• T4 (- 60°C ≤ Tamb ≤ +70 °C)</li> </ul>	<p>The ambient temperature range inside the enclosure in which the industrial ethernet switch is installed is -20°C to +58.81°C.</p> <p>The terminals are used within their allowable ratings.</p> <p>The terminals are therefore suitable for T4 applications.</p>
<p>When using the types WDU and WPE with other terminal blocks series or sizes or accessories, the requirements for clearance and</p>	<p>Only appropriately Ex e certified terminals are used. The manufacturer's instructions have been followed.</p>

<p>creepage distances according to table 1 of EN 60079-7 must be observed. Regarding the use of covers, cross-connectors and end brackets the instructions of the manufacturer must be followed.</p>	
<p>For terminal jumper accessories current ratings and the resistances across the terminals please refer to the table under “types &amp; electrical rating” above. Details on creepage and clearance values and the required torque values are in the respective “Notice to installers”</p>	<p>Guidance has been followed.</p>
<p>The terminal can be used with either one or two wires into either side of the terminal. When two wires are used they must be of the same type, and of equal sizes. No other wire sizes or types than the ones specified in instructions must be used. The terminal blocks must either be mounted next to another block of the same type and size or with an end plate.</p>	<p>Only one wire per terminal is used. Different sized terminals are separated by an endplate.</p>
<p>If smaller conductor cross sections than the rated conductor cross sections are used, then the corresponding lower current shall be stated in the Certificate of the complete apparatus.</p>	<p>Smaller conductor cross sections than the rated conductor cross sections are not used.</p>

Unused terminals shall be tightened.	Information included in the equipment instructions.
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#### 2.5.1.5.3 OTHER CONSIDERATIONS

The Ex Component terminals and terminal accessories are certified to the latest editions of the standards.

The ambient temperature range of the terminals and terminal accessories is -60°C to +70°C depending of T-Code as shown in the schedule of limitations. The overall equipment is rated T4 and has an internal ambient temperature range of -20°C to +58.81°C. The terminals are therefore used within their ambient temperature range limits.

The service temperature range of the terminals and terminal accessories is -60°C to +110°C. The schedule of limitations indicates that the temperature rise of the terminal blocks is maximum 40K when measured with 110% of the maximum rated current applied to them. The internal ambient of the overall equipment in which the terminals and terminal accessories are installed is -20°C to +58.81°C. The terminal and terminal accessories are therefore used within their service temperature range limits.

The installation instructions have been followed. A copy of the instructions is held in the technical file.

#### 2.5.1.5.4 VERDICT

Assessment of the suitability of the Ex Component terminals and terminal accessories has been carried out. The terminals and terminal accessories are deemed suitable for use in this application with no further consideration deemed necessary.

## 2.5.1.6 TERMINAL BLOCK WITH FUSE HOLDER

### 2.5.1.6.1 INFORMATION

Manufacturer	Weidmüller Interface GmbH & Co. KG
Part number	WSI 6
Certificate	DEMKO 14 ATEX 1339U
Marking	II 3 G Ex ec IIC Gc
Standards applied	EN IEC 60079-0:2018 EN IEC 60079-7:2015+A1:2018

### 2.5.1.6.2 SCHEDULE OF LIMITATIONS

Schedule of limitations	Justification for compliance
These terminal blocks are to be installed within an ATEX certified enclosure with a minimum rating of IP54, suitable for the intended application.	The terminal block is installed in a suitably certified increased safety enclosure IP66 rated as detailed in certificate PTB 02 ATEX 1082 U. Suitably certified IP66 cable glands and blanking elements are to be used.
The enclosure shall bear the following warning dependent on the terminal block model: "WARNING – DO NOT REMOVE OR REPLACE THE FUSE/TEST DISCONNECT SWITCH WHEN ENERGIZED!"	The enclosure bears the required warning.
The maximum permitted service temperature of the terminal blocks is 130°C.	The maximum service temperature was measured during the temperature rise tests and found to be 55.94°C.

For additional limitations refer to the “Installation instructions & conditions for safe use” of the according models.	The installation instructions were followed. A copy of the instructions is held in the technical file.
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#### 2.5.1.6.3 OTHER CONSIDERATIONS

The Ex Component terminal block with fuse holder are certified to the latest editions of the standards.

The terminal block with fuse holder’s applicable electrical data is shown below:

WSI 6	500 V, 6.3 A
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The fuse holder is used within its electrical data limits in this application.

#### 2.5.1.6.4 VERDICT

Assessment of the suitability of the Ex Component terminal block with fuse holder has been carried out. The terminal block with fuse holder is deemed suitable for use in this application with no further consideration deemed necessary.



### 2.5.1.7 CONCLUSION

The assessment conducted indicates that the parts selected for use are suitable for this application.

A copy of each of the parts' certificate and instructions is held in the technical file associated with the NICP Network Interface Control Panel.





## 2.5.2 CERTIFICATES AND MANUALS

### 2.5.2.1 ENCLOSURE

<b>Physikalisch-Technische Bundesanstalt</b>		
Braunschweig und Berlin		
		
<b>(1) EC-TYPE-EXAMINATION CERTIFICATE</b> (Translation)		
(2)	Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - <b>Directive 94/9/EC</b>	
(3)	EC-type-examination Certificate Number: <b>PTB 02 ATEX 1082 U</b>	
(4)	Component: Empty housing, type KEL 94XX.YYY	
(5)	Manufacturer: Rittal-Werk, Rudolf Loh GmbH & Co. KG	
(6)	Address: Auf dem Stützelberg, 35745 Herborn, Germany	
(7)	This component and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.	
(8)	The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this component has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.	
	The examination and test results are recorded in the confidential report PTB Ex 02-12235.	
(9)	Compliance with the Essential Health and Safety Requirements has been assured by compliance with: <b>EN 50014:1997 + A1 + A2                      EN 50019:2000</b>	
(10)	The sign "U" placed behind the certificate number indicates that this certificate should not be confounded with certificates issued for equipment or protective systems. This Component Certificate only serves as a basis for the issuing of certificates for equipment or protective systems.	
(11)	This EC-type-examination Certificate relates only to the design, examination and tests of the specified component in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this component. These are not covered by this certificate.	
(12)	The marking of the component shall include the following:	
	 <b>II 2 G EEx e II</b>	
	Zertifizierungsstelle Explosionsschutz By order:  Dr.-Ing. U. Klausmeyer Regierungsdirektor	Braunschweig, January 13, 2003
		
	sheet 1/2	
<small>EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.</small>		
<small>Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig</small>		

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 1082 U**

(15) Description of component

Empty housing, type KEL 94XX.YYY, made from high-grade steel.

Technical data

Sizes:		Length	Height	Depth
	smallest	200 mm	300 mm	155 mm
	largest	1300 mm	1200 mm	300 mm

Ambient temperature range: -20°C to +40 °C

Shock protection, protection against solid bodies,  
and protection against ingress of water: IP54 according to EN 60529 as a minimum.

(16) Test report PTB Ex 02-12235

(17) Special conditions for safe use

None

Notes for manufacturing and operation

This EC type-examination certificate as well as any future supplements thereto shall at the same time be regarded as supplements for Component Certificate PTB No. Ex-92.C.3106 U.


(18) Essential health and safety requirements

The tests and the favourable results these have produced reveal that the empty housing, type KEL 94XX.YYY, meets the requirements of directive 94/9/EC as well as those of the standards specified on the cover sheet.

Zertifizierungsstelle Explosionsschutz

Braunschweig, January 13, 2003

By order:

  
Dr.-Ing. U. Klausmeyer  
Regierungsdirektor



sheet 2/2

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**1st SUPPLEMENT**  
according to Directive 94/9/EC Annex III.6  
**to EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 1082 U**  
**(Translation)**

Equipment: Empty enclosure, type KEL 94XX.YYY

Marking:  **II 2 G EEx e II**

Manufacturer: Rittal-Werk, Rudolf Loh GmbH & Co. KG

Address: Auf dem Stützelberg , 35745 Herborn, Germany

Description of supplements and modifications

The empty enclosure, type KEL 94XX.YYY, is modified in the following respects:

- 1) The empty enclosure may also be employed in areas in which a potentially explosive atmosphere as a mixture of dust and air can occasionally form.
- 2) The empty enclosure has been re-examined on the basis of standards EN 60079-0 and EN 60079-7.
- 3) The range of ambient temperatures is extended to -30 °C ... +80 °C for enclosures with a silicone gasket.
- 4) The marking will now be:

 **II 2 G Ex e II**

 **II 2 D Ex tD A21 IP66**

Technical data

Overall sizes:		Length	Width	Depth
	Smallest	200 mm	300 mm	120 mm
	Largest	1300 mm	1200 mm	300 mm

Ambient temperatures: -30 °C to +80 °C (with silicone gasket)  
-20 °C to +40 °C (other gaskets)

Shock protection, protection against solid bodies,  
and protection against ingress of water. IP66 in accordance with EN 60529

Normal.dot

Sheet 1/2

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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# Physikalisch-Technische Bundesanstalt



Braunschweig und Berlin

1st SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 1082 U

Applied standards

EN 60079-0:2006    EN 60079-7:2007    EN 61241-0:2006    EN 61241-1:2004

Assessment and test report: PTB Ex 09-19089

Zertifizierungssektor Explosionsschutz

Braunschweig, August 27, 2009

By order:

  
Dr.-Ing. M. Thedens  
Oberregierungsrat



Sheet 2/2

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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**2nd SUPPLEMENT**  
according to Directive 94/9/EC Annex III.6  
**to EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 1082 U**  
**(Translation)**

Equipment: Empty enclosure, type KEL 94XX.YYY

Marking:  II 2 G Ex e II  
 II 2 D Ex tD A21 IP66





Manufacturer: Rittal GmbH & Co. KG

Address: Auf dem Stützelberg , 35745 Herborn, Germany

Description of supplements and modifications

The empty enclosure type KEL 94XX.YYY can optionally be provided with one or more flange plates on the enclosure sides.

The empty enclosure has been re-examined on the basis of standards EN 60079-0:2009, EN 60079-7:2007 and 60079-31:2009. The marking will now be:

 II 2 G Ex e IIC Gb or  II 2 G Ex eb IIC  
 II 2 D Ex tb IIIC Db IP66 or  II 2 D Ex tb IIC IP66

Technical data:

Overall sizes:	Length	Width	Depth
Smallest	200 mm	300 mm	120 mm
Largest	1300 mm	1200 mm	300 mm

Ambient temperatures: -30 °C to +80 °C (with silicone gasket)

Shock protection, protection against solid bodies, and protection against ingress of water. IP66 in accordance with EN 60529


Applied standards

EN 60079-0:2009, EN 60079-7:2007, EN 60079-31:2009

Assessment and test report: PTB Ex 10-19307

Zertifizierungssektor Explosionsschutz

Braunschweig, July 6, 2010

By order:   
Dipl.-Phys. U. Volkel



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EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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**3<sup>rd</sup> SUPPLEMENT**  
according to Directive 94/9/EC Annex III.6  
to EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 1082 U  
(Translation)

Equipment: Empty enclosure type KEL 94XX.YYY

Marking: II 2 G Ex e IIC Gb or Ex e b IIC  
 II 2 D Ex tb IIIC Db IP66 or Ex tb IIIC IP66

Manufacturer: Rittal GmbH & Co. KG

Address: Auf dem Stützelberg , 35745 Herborn, Germany

Description of supplements and modifications

The empty enclosure type KEL 94XX.YYY can optionally be provided with the gasket type Silikon 2.

Technical data

Sizes:	length	width	depth
minimum	200 mm	300 mm	120 mm
maximum	1300 mm	1200 mm	300 mm

Ambient temperature range: ..... - 30 °C up to +80 °C (with Silicone gasket)

Protection against solid foreign objects,

water and contact: ..... IP66 according to EN 60529

Applied standards

EN 60079-0:2009, EN 60079-7:2007, EN 60079-31:2009

Test report: PTB Ex 12-12193

Zertifizierungssektor Explosionsschutz  
On behalf of PTB:

Braunschweig, August 28, 2012

Dr.-Ing. U. Klausmeyer  
Direktor und Professor



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Sheet 1/1

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

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# Rittal Konformitätsbescheinigung Attestation of Conformity

Dri241702800



Wir, / We,

**Rittal GmbH & Co. KG • Auf dem Stützelberg • 35745 Herborn**

erklären, dass die Produkte / declare that the products

**Leergehäuse Typ KEL 94XX.YYY / Empty enclosure type KEL 94XX.YYY**

mit den Bestimmungen der folgenden Richtlinie übereinstimmen: / is conform to the provisions of:

**2014/34/EU**

Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen / Equipment and protective systems intended for use in potentially explosive atmospheres

Zugehörige Baumusterprüfbescheinigung: / Associated EC-Type Examination Certificate:

**EG-Baumusterprüfbescheinigung: / EC-Type Examination Certificate: PTB 02 ATEX 1082 U**

Qualitätssicherung der Produktion: / Production Quality Assessment:

**Mitteilungs-Nr.: / Notification No. : PTB 04 ATEX Q034**  
**Kenn-Nr. der benannten Stelle: / Notified body number: 0102 – Physikalisch Technische Bundesanstalt (PTB)**

Angewandte harmonisierte Normen: / Applied harmonised standards:

**EN IEC 60079-0:2018**

Explosionsgefährdete Bereiche – Teil 0: Betriebsmittel – Allgemeine Anforderungen  
Explosive atmospheres – Part 0: Equipment – General requirements

**EN IEC 60079-7:2015/A1:2018**

Explosionsgefährdete Bereiche – Teil 7: Geräteschutz durch erhöhte Sicherheit  
Explosive atmospheres - Part 7: Equipment protection by increased safety

**EN 60079-31:2014**

Explosionsgefährdete Bereiche – Teil 31: Geräte-Staubexplosionsschutz durch Gehäuse  
Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure

Zusätzlich angewandte harmonisierte Normen: / Additionally applied harmonised standards:

**EN 60529:1991/A2:2013/AC:2019-02**

Schutzarten durch Gehäuse (IP-Code)  
Degrees of protection provided by enclosures (IP Code)

**EN 62208:2012** (soweit anwendbar / where applicable)

Leergehäuse für Niederspannungs-Schaltgerätekombinationen – Allgemeine Anforderungen  
Empty enclosures for low-voltage switchgear and controlgear assemblies – General requirements

Herborn, 22.04.2024

Norbert Krech, RAM, Ex-Beauftragter /  
Ex authorized person

SCHALTSCHRÄNKE

STROMVERTEILUNG

KLIMATISIERUNG

IT-INFRASTRUKTUR

SOFTWARE & SERVICE

FRIEDHELM LOH GROUP

2024 – 000196 – 01

Seite 1 von 1

## 2.5.2.2 POWER SUPPLY




**Certificate of Conformity**

(1)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 2014/34/EU**

(3) Certificate Number:

**EPS 19 ATEX 1 201 X** **Revision 1**

(4) Equipment: Power Supply (built-in):  
CP5.121; CP5.241; CP5.241-S1; CP5.241-S2; CP5.481

(5) Manufacturer: PULS GmbH

(6) Address: Elektrastr. 6  
81925 Muenchen  
Germany

(7) This equipment and any acceptable variation thereto are specified in the schedule to this Certificate of Conformity and the documents therein referred to.

(8) Bureau Veritas Consumer Products Services Germany GmbH certifies based on a voluntary assessment that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II of the Directive 2014/34/EU. The examination and test results are recorded in the confidential documentation under the reference number 19TH0217.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN IEC 60079-0:2018
EN 60079-7:2015 + A1:2018
EN IEC 60079-15:2019

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This Certificate of Conformity relates only to the design and the construction of the specified equipment in accordance with Directive 2014/34/EU. Further requirements of this Directive apply to the manufacture and supply of this equipment. Those requirements are not covered by this certificate.

(12) The marking of the equipment shall include the following:

 II 3G Ex ec nC IIC T4 Gc





Certification department of explosion protection  
Ulrich Feike

Hamburg, 2022-03-07

Page 1 of 2

Certificates without signature and seal are void. This certificate is allowed to be distributed only if not modified. Extracts or modifications must be authorized by Bureau Veritas Consumer Products Services Germany GmbH, EPS 19 ATEX 1 201 X, Revision 1.

**BUREAU VERITAS**  
Consumer Products Services Germany GmbH

Dehleckerling 40, D-22419 Hamburg  
Phone: +49 40 74041-0

cps-hamburg@bureauveritas.com  
www.bureauveritas.de/cps





(13)

### Annexe

(14) **Certificate of Conformity EPS 19 ATEX 1 201 X**

Revision 1

(15) **Description of equipment:**

Power supply (built-in use)

Electrical data:

**CP5.121:**

**Input:**

AC 100-240V<sup>(-15%/+10%)</sup> | 1.6-0.7A | 50-60Hz  
DC 110-150V<sup>(+/-20%)</sup> | 1.4A

**Output:**

DC 12-15V | 12-9.6A (below +45 °C)  
DC 12-15V | 10-8.0A (at +60 °C)  
DC 12-15V | 7.5-6.0A (at +70 °C)  
Derate linearly between +45 °C and +70 °C  
Ambient temperature range: -25 °C to +70 °C

**CP5.241, CP5.241-S1, CP5.241-S2:**

**Input:**

AC 100-240V<sup>(-15%/+10%)</sup> | 1.6-0.7A | 50-60Hz  
DC 110-150V<sup>(+/-20%)</sup> | 1.4A

**Output:**

DC 24-28V | 6.0-5.1A (below +45 °C)  
DC 24-28V | 5.0-4.3A (at +60 °C)  
DC 24-28V | 3.8-3.2A (at +70 °C)  
Derate linearly between +45 °C and +70 °C  
Ambient temperature range: -25 °C to +70 °C

**CP5.481:**

**Input:**

AC 100-240V<sup>(-15%/+10%)</sup> | 1.6-0.7A | 50-60Hz  
DC 110-150V<sup>(+/-20%)</sup> | 1.4A

**Output:**

DC 48-56V | 3.0-2.6A (below +45 °C)  
DC 48-56V | 2.5-2.1A (at +60 °C)  
DC 48-56V | 1.9-1.6A (at +70 °C)  
Derate linearly between +45 °C and +70 °C  
Ambient temperature range: -25 °C to +70 °C

All models optional with suffix "-C1" or "-C2"

- C1: completely coated with protective coating
- C2: partly coated with protective coating

(16) **Reference number:** 19TH0217

(17) **Schedule of Limitations:**

- The equipment shall be installed in an enclosure that provides a minimum ingress protection of IP 54 in accordance with EN 60079-0
- The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN 60664-1
- Ambient temperature range is -25 °C < T<sub>amb</sub> < +70 °C; derating conditions above +45 °C and different mounting orientations must be considered.

(18) **Essential health and safety requirements:**

Met by standards:

Certification department of explosion protection

Hamburg, 2022-03-07



Page 2 of 2  
Certificates without signature and seal are void. This certificate is allowed to be distributed only if not modified. Extracts or modifications must be authorized by Bureau Veritas Consumer Products Services Germany GmbH. EPS 19 ATEX 1 201 X, Revision 1.

### 2.5.2.3 REDUNDANCY MODULE




**Certificate of Conformity**

(1)

(2) Equipment and protective systems intended for use in potentially explosive atmospheres – **Directive 2014/34/EU**

(3) Certificate Number

**EPS 11 ATEX 1 312 X** **Revision 7**

(4) Equipment: MLY02.100, MLY10.241, YR2.DIODE, YRM2.DIODE, YR40.241, YR80.241, YR40.242, YR40.245, YR40.482, YR80.242, YR20.242, YR20.246, PIRD20.241  
(All models optional with suffix "-C1" or "-C2")

(5) Manufacturer: PULS GmbH

(6) Address: Elektrastr. 6,  
81925 München  
Germany

(7) This equipment and any acceptable variation thereto are specified in the annex to this Certificate of Conformity and the documentation therein referred to.

(8) Bureau Veritas Consumer Products Services Germany GmbH certifies based on a voluntary assessment that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II of the Directive 2014/34/EU. The examination and test results are recorded in the confidential documentation under the reference number 10TH0536.

(9) Compliance with the essential health and safety requirements has been assured by compliance with:

<b>EN IEC 60079-0:2018</b>	<b>EN 60079-15:2010</b>
<b>EN IEC 60079-7:2015 + A1:2018</b>	<b>EN IEC 60079-15:2019</b>

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the annex to this certificate.

(11) This Certificate of Conformity relates only to the design and the construction of the specified equipment in accordance with Directive 2014/34/EU. Further requirements of this Directive apply to the manufacture of this equipment and its placing on the market. Those requirements are not covered by this certificate.

(12) The marking of the equipment shall include the following:



II 3G Ex ec IIC T4 Gc  
II 3G Ex ec nC IIC T4 Gc

YRM2.DIODE, YR20.246 only



Certification department of explosion protection  
Ulrich Felke



Tuerkheim, 2022-07-19

Certificates without signature and seal are void. This certificate is allowed to be distributed only if not modified. Extracts or modifications must be authorized by Bureau Veritas Consumer Products Services Germany GmbH.

Bureau Veritas Consumer Products Services Germany GmbH www.bureauveritas.de/cps	Businesspark A96 88842 Tuerkheim	certification.deu@bureauveritas.com Certificate number EPS 11 ATEX 1 312 X, Revision 7
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ZERT-0215-DEU-ZE-EX-V01-TEMP-0092-DEU-ZE-V02 1/5



## Annex

(13)

(14) **Certificate of Conformity EPS 11 ATEX 1 312 X**

Revision 7

(15) Description of equipment:

Redundancy modules are used to isolate the output voltages of the individual power supply of a redundant power supply system. To achieve redundancy, one extra power supply must be installed in order to deliver the required current in case one power supply in the system fails. The redundancy modules have two input channels and one output and utilize diodes or MOSFETs to isolate the two inputs. They can be used to build 1+1 and N+1 redundant systems.

Revision 7: Update from EN 60079-0:2010 to EN IEC 60079-15:2019 (both editions listed, because EN IEC 60079-15:2019 is still pending EU harmonization at issue date)

Electrical data:

### MLY02.100

**Input 1+2:**

DC 12-48V ( $\pm 25\%$ ), 5A continuous, 7.5A up to 5s

**Output:**

10A cont., 15A up to 5s (below 60°C)

7.5A cont., 15A up to 5s (at 70°C)

Derate linearly between +60°C and +70°C

Input to output voltage loss: typ. 0.9V

### MLY10.241

**Input 1+2:**

DC 12-48V ( $\pm 25\%$ ), 5A continuous, 7.5A up to 5s

**Output:**

10A cont., 15A up to 5s (below 60°C)

7.5A cont., 15A up to 5s (at 70°C)

Derate linearly between +60°C and +70°C

Input to output voltage loss: typ. 0.9V

### YR2.DIODE

**Input 1+2:**

1: DC 12-48V ( $\pm 25\%$ ), 10A continuous, 15A up to 5s

2: DC 12-48V ( $\pm 25\%$ ), 10A continuous, 15A up to 5s

**Output:**

20A continuous, 30A up to 5s (below 60°C)

15A continuous, 30A up to 5s (at 70°C)

Derate linearly between +60°C and +70°C

Input to output voltage loss: typ. 0.78V



Certificate of Conformity EPS 11 ATEX 1 312 X

Revision 7

**YRM2.DIODE**

**Input 1+2:**

1: DC 24-48V ( $\pm 25\%$ ), 10A continuous, 15A up to 5s  
2: DC 24-48V ( $\pm 25\%$ ), 10A continuous, 15A up to 5s

**Output:**

20A continuous, 30A up to 5s (below 60°C)  
15A continuous, 30A up to 5s (at 70°C)  
Derate linearly between +60°C and +70°C  
Input to output voltage loss: typ. 0.78V

**YR40.241**

**Input 1+2:**

1: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32.5A up to 5s  
2: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32.5A up to 5s

**Output:**

40A continuous, 65A up to 5s (below 70°C)  
Input to output voltage loss: typ. 0.072V

**YR40.242**

**Input 1+2:**

1: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32.5A up to 5s  
2: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32.5A up to 5s

**Output:**

40A continuous, 65A up to 5s (below 60°C)  
30A continuous, 65A up to 5s (at 70°C)  
Derate linearly between +60°C and +70°C  
Input to output voltage loss: typ. 0.072V

**YR80.241**

**Input 1+2:**

1: DC 12-28V ( $\pm 30\%$ ), 40A continuous, 65A up to 5s  
2: DC 12-28V ( $\pm 30\%$ ), 40A continuous, 65A up to 5s

**Output:**

80A continuous, 130A up to 5s (below 70°C)  
Input to output voltage loss: typ. 0.049V



Certificate of Conformity EPS 11 ATEX 1 312 X

Revision 7

**YR80.242**

**Input 1+2:**

1: DC 12-28V ( $\pm 30\%$ ), 40A continuous, 65A up to 5s  
2: DC 12-28V ( $\pm 30\%$ ), 40A continuous, 65A up to 5s

**Output:**

80A continuous, 130A up to 5s (below 60°C)  
60A continuous, 130A up to 5s (at 70°C)  
Derate linearly between +60°C and +70°C  
Input to output voltage loss: typ. 0.065V

**YR40.245**

**Input:**

DC 12-28V ( $\pm 30\%$ ), 40A continuous, 65A up to 5s

**Output:**

40A continuous, 65A up to 5s (below 60°C)  
30A continuous, 65A up to 5s (at 70°C)  
Derate linearly between +60°C and +70°C  
Input to output voltage loss: typ. 0.15V

**YR40.482**

**Input 1+2:**

1: DC 24-56V ( $\pm 15\%$ ), 20A continuous, 32.5A up to 5s  
2: DC 24-56V ( $\pm 15\%$ ), 20A continuous, 32.5A up to 5s

**Output:**

40A continuous, 65A up to 5s (below 60°C)  
30A continuous, 65A up to 5s (at 70°C)  
Derate linearly between +60°C and +70°C  
Input to output voltage loss: typ. 0.06V

**YR20.242**

**Input 1+2**

1: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32.5A up to 5s  
2: DC 12-28V ( $\pm 30\%$ ), 20A continuous, 32.5A up to 5s

**Output:**

24A continuous, 32.5A up to 5s (below 45°C)  
20A continuous, 32.5A up to 5s (below 70°C)  
Derate linearly between +45°C and +70°C  
Input to output voltage loss: typ. 0.06V





Certificate of Conformity EPS 11 ATEX 1 312 X

Revision 7

**YR20.246**

**Input 1+2**

- 1: DC 24-28V (±25%), 12A continuous, 17A up to 5s
- 2: DC 24-28V (±25%), 12A continuous, 17A up to 5s

**Output:**

- 24A continuous, 32,5A up to 5s (below 45°C)
- 20A continuous, 32,5A up to 5s (below 70°C)
- Derate linearly between +45°C and +70°C
- Input to output voltage loss: typ. 0,06V

**PIRD20.241**

**Input 1+2**

- 1: DC 12-28V (±25%), 10A continuous, 16A up to 5s
- 2: DC 12-28V (±25%), 10A continuous, 16A up to 5s

**Output:**

- 20A continuous, 32A up to 5s (below 55°C)
- 12,5A continuous, 32A up to 5s (below 70°C)
- Derate linearly between +55°C and +70°C
- Input to output voltage loss: typ. 0,56V

(16) Reference number: 10TH0536

(17) Special conditions for safe use:

- The equipment shall be installed in an enclosure that provides a degree of protection not less than IP 54 in accordance with EN 60079-7.
- The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN IEC 60664-1.
- Output power de-rating conditions at high ambient temperatures must be considered according to manufacturer's instructions.

(18) Essential health and safety requirements:

Met by compliance with standards.



Certification for explosion protection

Tuerkheim, 2022-07-19



CERTIFIED

## 2.5.2.4 INDUSTRIAL ETHERNET SWITCH

[1]	<b>TYPE EXAMINATION CERTIFICATE</b>		
[2]	<b>Equipment or Protective System intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU</b>		
[3]	Type Examination Certificate Number: <b>DEMKO 09 ATEX 0812123X Rev. 18</b>		
[4]	Product: <b>Industrial Ethernet Switch Series EDS-305, EDS-316, EDS-516A, EDS-518A, Industrial Media Converter Series IMC-101 and Model IMC-101G</b>		
[5]	Manufacturer: <b>Moxa Inc.</b>		
[6]	Address: <b>4<sup>th</sup> Floor, 135 Lane 235 Baoqiao Road, Xindian District, New Taipei City, 231 Taiwan</b>		
[7]	This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.		
[8]	UL International Demko A/S certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014.		
	The examination and test results are recorded in confidential report no. <b>4789358025.1.1</b>		
[9]	Compliance with the Essential Health and Safety Requirements has been assured by compliance with: <b>EN 60079-0:2012+A11:2013    EN 60079-15:2010    EN 60079-28:2015</b>		
	except in respect of those requirements listed at item 18 of the Schedule.		
[10]	If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate.		
[11]	This Type examination certificate relates only to the design of the specified product, and not to specific items of product subsequently manufactured.		
[12]	The marking of the product shall include the following:		
	 <b>II 3 G Ex nA nC IIC T4 Gc</b> <b>for Series EDS-305, EDS-316, EDS-516A, EDS-518A and IMC-101G</b>		
	 <b>II 3 G Ex nA nC op is IIC T4 Gc</b> <b>for Series IMC-101</b>		
	<b>Certification Manager</b> Jan-Erik Storgaard 	<small>This is to certify that the sample(s) of the Product described herein ("Certified Product") has been investigated and found in compliance with the Standard(s) indicated on this Certificate, in accordance with the ATEX Product Certification Program Requirements. This certificate and test results obtained apply only to the product sample(s) submitted by the Manufacturer. UL did not select the sample(s) or determine whether the sample(s) provided were representative of other manufactured product. UL has not established Follow-Up Service or other surveillance of the product. The Manufacturer is solely and fully responsible for conformity of all product to all applicable Standards, specifications, requirements or Directives. The test results may not be used, in whole or in part, in any other document without UL's prior written approval.</small> <b>Date of issue:</b> 2009-11-03 <b>Re-issued:</b> 2020-06-25	
	<b>Certification Body</b>	UL International Demko A/S, Borupvang 5A, 2750 Ballerup, Denmark Tel. +45 44 85 65 65, <a href="mailto:info.dk@ul.com">info.dk@ul.com</a> , <a href="http://www.ul.com">www.ul.com</a>	
00-IC-F0060-1 – Issue 15.1		This certificate may only be reproduced in its entirety and without any change, schedule included.	
		Page 1 of 3	

[13]

[14]

**Schedule**  
**TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 09 ATEX 0812123X Rev. 18**

[15]

Description of Product:

The models are DIN rail mounted industrial application Ethernet communication devices. They are intended for industrial applications, pollution degree 2 environments. They are microcomputer-based and communicate via interfaces through wire. The models are of the open type and are intended for installation into a suitable enclosure.

The protection methods for all models covered under this certificate are "nA nC" except for Model IMC-101 Series. The protection methods for Model IMC-101 Series are "nA nC op is" or "nA nC".

Industrial Ethernet Switch:

Series EDS-305, maybe followed by -M, -S, or blank, maybe followed by -SC, -ST or blank, maybe followed by -80 or blank, followed by -T, (HPS) or (HPS-C) or blank

Models EDS-305-M-SC (HPS), EDS-305-M-SC-T (HPS), EDS-305-M-SC-T (HPS-C) are similar to Models EDS-305-M-SC(-T) except Model Description.

Models EDS-305-S-SC (HPS), EDS-305-S-SC-T (HPS-C) are similar to Models EDS-305-S-SC(-T) except Model Description.

Series EDS-316, maybe followed by -M, -S, -MM, -SS, -MS or blank, maybe followed by SC, ST, or blank, maybe followed by -40/80, 80 or blank, followed by (-T) or blank or (HPS) or (HPS-C)

Series EDS-516A, maybe followed by -MM or blank, maybe followed by -SC -ST or blank, maybe followed by -80 or blank, followed by (-T) or blank

Series EDS-518A, maybe followed by -MM -SS or blank, maybe followed by -SC -ST or blank, maybe followed by -80 or blank, followed by (-T) or blank

Industrial Media Converter:

Series IMC-101, followed by -S or -M, followed by -SC or -ST, maybe followed by -80 or blank, followed by (-T) or blank, followed by -IEX or blank

Series IMC-101GXXXXX, X can be dash, blank, 0-9, A-Z or any character.

Model Differences:

Model	No. of Ethernet RJ45 Ports	No. of Fiber Port (M.M.)	No. of Fiber Port (S.M.)
EDS-305(-T)	5	-	-
EDS-305-M-SC(-T) (HPS) or (HPS-C)	4	1	-
EDS-305-M-ST(-T)	4	1	-
EDS-305-S-SC(-T) (HPS) or (HPS-C)	4	-	1
EDS-305-S-SC-80(-T)	4	-	1

Model	No. of Ethernet RJ45 Ports	No. of Fiber Port (M.M.)	No. of Fiber Port (S.M.)
EDS-316(-T)	16	-	-
EDS-316-M-SC(-T)	15	1	-
EDS-316-M-ST(-T)	15	1	-
EDS-316-MM-SC(-T) (HPS) or (HPS-C)	14	2	-
EDS-316-MM-ST(-T)	14	2	-
EDS-316-MS-SC(-T)	14	1	1
EDS-316-S-SC(-T)	15	-	1
EDS-316-SS-SC(-T) (HPS) or (HPS-C)	14	-	2
EDS-316-MS-SC-80(-T)	14	1	1
EDS-316-S-SC-80(-T)	15	-	1
EDS-316-SS-SC-80(-T)	14	-	2
EDS-316-SS-SC-40/80(-T)	14	-	2

Model	No. of Ethernet RJ45 Ports	No. of Fiber Port (M.M.)	No. of Fiber Port (S.M.)
EDS-516A(-T)	16	-	-
EDS-516A-MM-SC(-T)	14	2	-
EDS-516A-MM-ST(-T)	14	2	-

Model	No. of Ethernet RJ45 Ports	No. of Fiber Port (M.M.)	No. of Fiber Port (S.M.)	No. of GBIC Module
EDS-518A(-T)	16	-	-	2
EDS-518A-MM-SC(-T)	14	2	-	2
EDS-518A-MM-ST(-T)	14	2	-	2
EDS-518A-SS-SC(-T)	14	-	2	2
EDS-518A-SS-SC-80(-T)	14	-	2	2



[13]

[14]

**Schedule**  
**TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 09 ATEX 0812123X Rev. 18**

Model	No. of Ethernet RJ45 Ports	No. of Fiber Port (M.M.)	No. of Fiber Port (S.M.)
IMC-101-M-SC(-T) (-IEX)	1	1	-
IMC-101-M-ST(-T) (-IEX)	1	1	-
IMC-101-S-SC(-T) (-IEX)	1	-	1
IMC-101-S-SC-80(-T) (-IEX)	1	-	1

Note: S.M. – Single-mode Fiber  
M.M. – Multi-mode Fiber  
SC – SC Fiber connector  
ST – ST Fiber connector  
IEX – Marketing purpose only

For all models except Model IMC-101 Series, the optical radiation output of the product with respect to explosion protection, according to Annex II clause 1.3.1 of the Directive 2014/34/EU is covered in this certificate based on Exception 1) and 3) to the scope of EN 60079-28:2015.

**Temperature range:**

The relation between ambient temperature and the assigned temperature class is as follows:

Ambient temperature range	Temperature class
-40 °C to +75 °C for suffix with –T 0 °C to +60 °C for suffix without –T	T4

**Electrical data:**

Model	Electrical Rating	Relay Output	Protection Method
Series EDS-305	12-48VDC, 0.7A Max.	24VDC, 1A, Resistive	nA nC
Series EDS-316	12-48VDC, 0.6A,	24VDC, 1A, Resistive	nA nC
Series EDS-516A	12-48VDC, 1.6A,	24VDC, 1A, Resistive	nA nC
Series EDS-516A	12-48VDC, 1.6A,	24VDC, 1A, Resistive	nA nC
Series IMC-101	12-45VDC, 0.7A Max.	24VDC, 1A, Resistive	nA nC op is, or nA nC
Series IMC-101G	(For PWB Type A) 12-45VDC, 0.2A (For PWB Type B) 12-48VDC, 0.229-0.068A or 12-48VDC, 0.229A Max. or 24VDC, 0.125A or 45VDC, 0.073A	(For PWB Type A) 24VDC, 1A, Resistive (For PWB Type B) 24VDC, 1A, Resistive or 30VDC, 2A, Resistive	nA nC
For alternate construction Series EDS-316	12/24/48 VDC, 0.86/0.4/0.2A, Class 2 or 12-48Vdc, 0.86-0.2A, Class 2 or 12-48Vdc, 0.86A max., Class 2 or 12Vdc, 0.86A, Class 2 or 24Vdc, 0.4A, Class 2 or 48Vdc, 0.2A, Class 2	24VDC, 1A, Resistive	nA nC

**Routine tests:**

Not required.

[16]

**Descriptive Documents**

The scheduled drawings are listed in the report no. provided under item no. [ 8 ] on page 1 of this Type Examination Certificate.

[17]

**Special Conditions of Use:**

- The equipment shall be installed in a tool accessible only IP54 enclosure in accordance with EN 60079-15 and used in an area of not more than pollution degree 2 as defined in EN 60664-1.
- Transient provisions shall be provided to limit the peak rated voltage to maximum 140% of the peak rated voltage

[18]

**Essential Health and Safety Requirements**

The Essential Health and Safety Requirements (EHSRs) covered by the standards listed at item 9.

**Additional information**

The trademark **MOXA®** will be used as the company identifier on the marking label.

## 2.5.2.5 FEED THROUGH TERMINAL BLOCK, END PLATE AND PROTECTIVE CONDUCTOR TERMINAL BLOCK

[1]	<b>EU-TYPE EXAMINATION CERTIFICATE</b>
	
[2]	<b>Component intended for use on/in Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU</b>
[3]	EU-Type Examination Certificate Number: <b>DEMKO 14 ATEX 1338U Rev. 7</b>
[4]	Component: <b>Feed through and protective conductor terminal blocks, types WDU and WPE</b>
[5]	Manufacturer: <b>Weidmüller Interface GmbH &amp; Co. KG</b>
[6]	Address: <b>Klingenbergstrasse 26, 32758 Detmold, Germany</b>
[7]	This product and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.
[8]	UL International Demko A/S, notified body number 0539 in accordance with Article 17 of the Council Directive 2014/34/EU of the European Parliament and the Council, dated 26 February 2014, certifies that this component has been found to comply with the Essential Health and Safety Requirements relating to design and construction of components intended for use in potentially explosive atmospheres given in Annex II to the Directive.  The examination and test results are recorded in confidential report no. <b>DK/ULD/ExTR14.0004/07</b>
[9]	Compliance with the Essential Health and Safety Requirements has been assured by compliance with: <b>EN IEC 60079-0:2018      EN IEC 60079-7: 2015 +A1:2018</b>
[10]	The sign "U" is placed after the certificate number. It indicates that this certificate must not be mistaken for a certificate intended for an equipment or protective system. This partial certification may be used as a basis for certification of an equipment or protective system.
[11]	This EU-Type Examination Certificate relates only to the design and construction of the specified component. Further requirements of the Directive apply to the manufacturing process and supply of this component. These are not covered by this certificate.
[12]	The marking of the component shall include the following:  <b>II 2 GD    Ex eb IIC Gb</b>
[13]	<b>Certification Manager</b> Jan-Erik Storgaard 
	<small>This is to certify that the sample(s) of the Component described herein ("Certified Component") has been investigated and found in compliance with the Standard(s) indicated on this Certificate, in accordance with the ATEX Product Certification Program Requirements. This certificate and test results obtained apply only to the component sample(s) submitted by the Manufacturer. UL did not select the sample(s) or determine whether the sample(s) provided were representative of other manufactured component. UL has not established Follow-Up Service or other surveillance of the product. The Manufacturer is solely and fully responsible for conformity of all products to all applicable Standards, specifications, requirements or Directives. The test results may not be used, in whole or in part, in any other document without UL's prior written approval.</small> <b>Date of issue:</b> 2014-10-06 <b>Re-issued:</b> 2021-03-26
	<b>Notified Body</b> UL International Demko A/S, Ballerup 5A, 2750 Ballerup, Denmark Tel. +45 44 85 65 65, <a href="mailto:info.dk@ul.com">info.dk@ul.com</a> , <a href="http://www.ul.com">www.ul.com</a>
	<small>00-IC-F0056-2 – Issue 26.0    Accredited by DANAK under registration number 7011 to certification of products. This certificate may only be reproduced in its entirety and without any change, schedule included.</small>
	<small>Page 1 of 6</small>

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[14]

**Schedule**  
**EU-TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1338U Rev. 7**

[15]

Description of Component:

Feed through terminal blocks type WDU and protective conductor terminal blocks type WPE are for the connection of copper conductors in enclosures. The type of protection is increased safety, "e", insulating parts made of Polyamide PA 66, with optional accessories, type WQV screw in cross-connectors, type ZQV plug-in cross-connectors, type LS2.8 shield bus, type WEW end brackets, type WTW partitions and type WAP end plates for fixing on mounting rails.

Types & electrical data:

TYPE	Rated voltage (V)	Rated Current (A)	Resistance across terminals (uΩ)	Strip length for min wire size (mm)	Solid wire size (mm <sup>2</sup> )	Stranded wire size (mm <sup>2</sup> )	Flexible wire size (mm <sup>2</sup> )	2 wires in one terminal (mm <sup>2</sup> )
WDU 1.5/R3.5	275	15	430	7	0,14-1,5	0,14-1,5	0,14-1,5	0,5-0,75
WDU 1.5/ZZ	550	17,5	740	7	0,14-2,5	0,14-2,5	0,13-1,5	0,5 -1,0
WDU 2.5N	440	24	430	10	0,14-4,0	0,14-4,0	0,5-2,5	0,5-1,5
WDU 2.5/1.5/ZR	550	20	720	10	See NTI	See NTI	See NTI	See NTI
WDU2.5**	690	24	369	10	0,14-4,0	0,14-4,0	0,14-4,0	0,5-1,5
WDU 2.5/TC B	55	8	3300	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 2.5/TC E	55	8	8650	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 2.5/TC J	55	8	5808	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 2.5/TC K	55	8	6705	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 2.5/TC N	55	8	9104	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 2.5/TC SR	55	8	2055	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 2.5/TC T	55	8	4611	10	0,14-2,5	0,14-2,5	0,14-2,5	0,5-1,5
WDU 4**	690	32	298	10	0,14-6,0	0,14-6,0	0,14-6,0	0,5-2,5
WDU 4 N	352	31	270	11	0,13-6,0	0,13-6,0	0,13-4,0	0,5-1,5
WDU 4/ZR	690	31	440	10	0,14-6,0	0,14-6,0	0,14-4,0	0,5-1,5
WDU 4/ZZ	690	29,5	560	10	0,14-6,0	0,14-6,0	0,14-4,0	0,5-1,5
WDU 4 SL	440	32,0	300	13	0,14-6,0	0,14-6,0	0,14-4,0	0,5-1,5
WDU 4 SL/EN	690	32,0	300	13	0,14-6,0	0,14-6,0	0,14-4,0	0,5-1,5
WDU 6	690	41	176	12	0,14-10,0	0,14-10,0	0,14-10,0	0,5-2,5
WDU 6 SL	275	40	360	16	0,14-10,0	0,14-10,0	0,14-6,0	0,5-2,5
WDU 6 SL/EN TS 32	440	40	360	16	0,14-10,0	0,14-10,0	0,14-6,0	0,5-2,5
WDU 6 SL/EN TS 35	690	40	360	16	0,14-10,0	0,14-10,0	0,14-6,0	0,5-2,5
WDU 10	690	57	152	12	1,31-16,0	1,31-16,0	1,31-16,0	0,5-6,0

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**Schedule**  
**EU-TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1338U Rev. 7**

TYPE	Rated voltage (V)	Rated Current (A)	Resistance across terminals (uΩ)	Strip length for min wire size (mm)	Solid wire size (mm <sup>2</sup> )	Stranded wire size (mm <sup>2</sup> )	Flexible wire size (mm <sup>2</sup> )	2 wires in one terminal (mm <sup>2</sup> )
WDU 10 SL /EN TS 32	550	55	280	17	1,5-16,0	1,5-16,0	0,5-10,0	1,5-4,0
WDU 10 SL /EN TS 35	690	55	280	17	1,5-16,0	1,5-16,0	0,5-10,0	1,5-4,0
WDU 10 SL	352	55	280	17	1,5-16,0	1,5-16,0	0,5-10,0	1,5-4,0
WDU 16	690	76	161	16	1,5-16,0	1,5-25,0	1,5-25,0	1,5-4,0
WDU 35	690	115	145	18	2,5-16,0	2,5-50,0	2,5-35,0	2,5-16,0
WDU 35N	352	110	122	18	2,5-16,0	2,5-50,0	2,5-35,0	2,5-6,0
WDU 50N	690	126	151	24	5,26-16,0	5,26-70,0	5,26-50,0	6,0-16,0
WDU 70N/35	690	184	142	22	10-16	10-95	10-70	10-25
WDU 70/95	1100	218	53	30	16	16-120	16-95	16-35
WDU 95N/120N	880	221	129	27	16	16-150	16-120	10-35
WDU 120/150	1100	265	44	35	16	35-150	35-150	35-70
WPE 1.5/R3.5	N/A	N/A	1150	7	0,14-1,5	0,14-1,5	0,14-1,5	0,5-0,75
WPE 1.5/ZZ	N/A	N/A		7	0,14-2,5	0,14-2,5	0,13-1,5	0,5-1,0
WPE 2.5/1.5/ZR	N/A	N/A	660	10	See NTI	See NTI	See NTI	See NTI
WPE 2.5	N/A	N/A	833	10	0,14-4,0	0,14-4,0	0,14-4,0	0,5-1,5
WPE 2.5N	N/A	N/A	380	10	0,14-4,0	0,14-4,0	0,5-4,0	0,5-1,5
WPE 4	N/A	N/A	643	10	0,14-6,0	0,14-6,0	0,14-6,0	0,5-2,5
WPE 4/ZZ	N/A	N/A	584	10	0,14-6,0	0,14-6,0	0,14-4,0	0,5-1,5
WPE 4/ZR	N/A	N/A	570	10	0,14-6,0	0,14-6,0	0,14-4,0	0,5-1,5
WPE 4N	N/A	N/A	740	11	0,13-6,0	0,13-6,0	0,13-4,0	0,13-1,5
WPE 6	N/A	N/A	256	12	0,14-10,0	0,14-10,0	0,14-10,0	0,5-2,5
WPE 10	N/A	N/A	221	12	1,31-16,0	1,31-16,0	1,31-16,0	0,5-6,0
WPE 16	N/A	N/A	178	16	1,5-16,0	1,5-25,0	1,5-25,0	1,5-4,0
WPE 35	N/A	N/A	173	18	2,5-16,0	2,5-50,0	2,5-35,0	2,5-16,0

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[14]

**Schedule**  
**EU-TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1338U Rev. 7**

TYPE	Rated voltage (V)	Rated Current (A)	Resistance across terminals ( $\mu\Omega$ )	Strip length for min wire size (mm)	Solid wire size ( $\text{mm}^2$ )	Stranded wire size ( $\text{mm}^2$ )	Flexible wire size ( $\text{mm}^2$ )	2 wires in one terminal ( $\text{mm}^2$ )
WPE 35N	N/A	N/A	147	18	2,5-16,0	2,5-50,0	2,5-35,0	2,5-6,0
WPE 50N	N/A	N/A	189	24	5,26-16,0	5,26-70,0	5,26-50,0	6,0-16
WPE 70/95	N/A	N/A	76	30	16	16-120	16-120	16-35
WPE 70N/35	N/A	N/A	156	22	10-16	10-95	10-70	10-25
WPE 95N/120N	N/A	N/A	126	27	16	16-150	16-120	10-35
WPE 120/150	N/A	N/A	67	35	35	35-150	35-150	35-70
WAP 2.5-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WAP 16+35WTW 2.5-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WEW 35/1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WEW 35/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WTW EN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LS 2.8	See NTI	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ZQV 1.5N/R3.5	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
ZQV 2.5N	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
ZQV 4N	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 2.5	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 4	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 6	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 10	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 16	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 35	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 35N	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 50N	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A



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[14]

**Schedule**  
**EU-TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1338U Rev. 7**

TYPE	Rated voltage (V)	Rated Current (A)	Resistance across terminals (uΩ)	Strip length for min wire size (mm)	Solid wire size (mm <sup>2</sup> )	Stranded wire size (mm <sup>2</sup> )	Flexible wire size (mm <sup>2</sup> )	2 wires in one terminal (mm <sup>2</sup> )
WQV 70/95	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 70N	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 95/120	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A
WQV 120	See NTI	See NTI	N/A	N/A	N/A	N/A	N/A	N/A

\*\*Two alternate constructions under one Cat. No.

NOTE: NTI = Notice to installer

Temperature range  
The ambient temperature range is -60 °C to +70 °C depending of T-Code.  
Refer to [17] Schedule of limitations.  
The service temperature range is -60 °C to +110 °C.

Routine tests  
According to EN 60079-7 clause 7.1 in combination with clause 6.1 a dielectric strength test has to be carried out. The routine tests may be performed on a statistical basis according to ISO 2859-1 with an acceptance quality limit (AQL) of 0.04. Routine test is to be carried out according to Weidmuller procedure "High voltage test" Document -NR: A\_10\_54.

[16] Descriptive Documents  
The scheduled documents are listed in the report no. provided under item no. [ 8 ] on page 1 of this EU-Type Examination Certificate.

[17] Schedule of limitations:

- o The feed through and protective conductor terminal blocks are suitable for use in enclosures in atmospheres with flammable gases and combustible dust. For flammable gases these enclosures must satisfy the requirements according to EN 60079-0 and EN 60079-7. For combustible dust these enclosures must satisfy the requirements according to EN 60079-31.
- o The terminal blocks shall be placed inside a suitable ATEX certified IP54 enclosure for gas atmosphere. For dust atmosphere the terminal blocks shall be mounted inside a suitable ATEX certified 't' enclosure (EN60079-31).
- o The enclosure shall be constructed to block all sun and UV light from affecting the terminal blocks.
- o Under normal operating conditions the temperature rise of the terminal blocks is max 40 K, measured with 110% of the maximum rated current. Due to the above mentioned the terminal blocks may be used in apparatus of temperature classes T6...T1 as long as the terminal block ambient temperature range is not exceeded as shown below. No part of terminal block must exceed 110 °C under any condition.
  - T6 (-60°C ≤ Tamb ≤ +40 °C)
  - T5 (-60°C ≤ Tamb ≤ +55 °C)
  - T4 (-60°C ≤ Tamb ≤ +70 °C)
- o When using the types WDU and WPE with other terminal blocks series or sizes or accessories, the requirements for clearance and creepage distances according to table 1 of EN 60079-7 must be observed. Regarding the use of covers, cross-connectors and end brackets the instructions of the manufacturer must be followed.
- o For terminal jumper accessories current ratings and the resistances across the terminals please refer to the table under "types & electrical rating" above. Details on creepage and clearance values and the required torque values are in the respective "Notice to installers".
- o The terminal can be used with either one or two wires into either side of the terminal. When two wires are used they must be of the same type, and of equal sizes. No other wire sizes or types than the ones specified in instructions must be used. The terminal blocks must either be mounted next to another block of the same type and size or with an end plate.
- o If smaller conductor cross sections than the rated conductor cross sections are used, then the corresponding lower current shall be stated in the Certificate of the complete apparatus

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[14]

**Schedule**  
**EU-TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1338U Rev. 7**


- Unused terminals shall be tightened.

[18]

Essential Health and Safety Requirements

The Essential Health and Safety Requirements (EHSRs) covered by the standards listed at item 9.





Additional information

The trademark **Weidmüller**  will be used as the company identifier on the marking label.

The manufacturer shall inform the notified body concerning all modifications to the technical documentation as described in Annex III to Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014.



## 2.5.2.6 TERMINAL BLOCK WITH FUSE HOLDER

[1]	<h1>TYPE EXAMINATION CERTIFICATE</h1> 
[2]	<b>Component intended for use on/in an Equipment or Protective System Potentially Explosive Atmospheres Directive 2014/34/EU</b>
[3]	Type Examination Certificate Number: <b>DEMKO 14 ATEX 1389U Rev. 3</b>
[4]	Component: <b>Terminal blocks with fuse holder, test disconnect terminals or no additional feature - Terminals Catalog Nos. WMF 2.5 FU SW, WMF 2.5 FU 10-36V SW, WMF 2.5 FU 100-250V SW, WMF 2.5 FU 60-150V SW, WMF 2.5 FU 30-70V SW, WMF 2.5 FU PE SW, WMF 2.5 FU PE 10-36V SW, WMF 2.5 FU PE 100-250V SW, WMF 2.5 FU PE 60-150V SW, WMF 2.5 FU PE 30-70V SW, WSI 4, WSI 4/LD 10-36V AC/DC, WSI 4/LD 30-70V AC/DC, WSI 4/LD 60-150V AC/DC, WSI 4/LD 140-250V AC/DC, WSI 6, WSI 6/LD 250AC LLC, WSI 6/LD 10-36V LLC, WSI 6/LD 30-70V LLC, WSI 6/LD 60-150V LLC, WTR 2.5 STB, WTR 2.5, WTR 4 STB, WTR 4, WMF 2.5 DI, WMF 2.5 DI PE, WMF 2.5 DI PE STB, WMF 2.5</b>
[5]	Manufacturer: <b>Weidmüller Interface GmbH &amp; Co. KG</b>
[6]	Address: <b>Klingenbergstrasse 26, 32758 Detmold Germany</b>
[7]	This Component and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
[8]	UL International Demko A/S certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to Directive 2014/34/EU of 26 February 2014. The examination and test results are recorded in confidential report number: <b>US/UL/ExTR14.0128/03.</b>
[9]	Compliance with the Essential Health and Safety Requirements has been assured by compliance with: <b>EN IEC 60079-0:2018      EN IEC 60079-7: 2015 +A1:2018</b> except in respect of those requirements listed at item 18 of the Schedule.
[10]	The sign "U" is placed after the certificate number. It indicates that this certificate must not be mistaken for a certificate intended for an equipment or protective system. This partial certification may be used as a basis for certification of an equipment or protective system.
[11]	This Type Examination Certificate relates only to the design of the specified component, and not to specific items of component subsequently manufactured.
[12]	The marking of the component shall include the following: 
	<hr/> <b>Certification Manager</b> Jan-Erik Storgaard  <b>Certification Body</b> UL International Demko A/S, Borupvang 5A, 2750 Ballerup, Denmark Tel. +45 44 85 65 65, <a href="mailto:info.dk@ul.com">info.dk@ul.com</a> , <a href="http://www.ul.com">www.ul.com</a> <small>This is to certify that the sample(s) of the Component described herein ("Certified Component") has been investigated and found in compliance with the Standard(s) indicated on this Certificate, in accordance with the ATEX Product Certification Program Requirements. This certificate and test results obtained apply only to the component sample(s) submitted by the Manufacturer. UL did not select the sample(s) or determine whether the sample(s) provided were representative of other manufactured product. UL has not established Follow-Up Service or other surveillance of the component. The Manufacturer are solely and fully responsible for conformity of all product to all applicable Standards, specifications, requirements or Directives. The test results may not be used, in whole or in part, in any other document without UL's prior written approval.</small> <b>Date of issue:</b> 2015-04-10 <b>Re-issued:</b> 2021-06-24
	<hr/> <small>00-IC-F0060-2 – Issue 18.0      This certificate may only be reproduced in its entirety and without any change, schedule included.      Page 1 of 3</small> 



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[14]

[15]

**Schedule**  
**TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1389U Rev. 3**

**Description of Product:**

The devices are Ex Component terminals for use in explosive atmospheres when installed and used in accordance with the specified Schedule of Limitations. The terminal blocks are suitable for snap-on mounting on TS 35 DIN rail. All models have two screw connections. They have features as indicated in the following table:

Model no.	PE connector	test disconnect	fuse holder
WMF 2.5 FU SW			x
WMF 2.5 FU 10-36V SW			x
WMF 2.5 FU 100-250V SW			x
WMF 2.5 FU 60-150V SW			x
WMF 2.5 FU 30-70V SW			x
WMF 2.5 FU PE SW	x		x
WMF 2.5 FU PE 10-36V SW	x		x
WMF 2.5 FU PE 100-250V SW	x		x
WMF 2.5 FU PE 60-150V SW	x		x
WMF 2.5 FU PE 30-70V SW	x		x
WSI 4			x
WSI 4/LD 10-36V AC/DC			x
WSI 4/LD 30-70V AC/DC			x
WSI 4/LD 60-150V AC/DC			x
WSI 4/LD 140-250V AC/DC			x
WSI 6			x
WSI 6/LD 250AC LLC			x
WSI 6/LD 10-36V LLC			x
WSI 6/LD 30-70V LLC			x
WSI 6/LD 60-150V LLC			x
WTR 2.5 STB		x	
WTR 2.5		x	
WTR 4 STB		x	
WTR 4		x	
WMF 2.5 DI		x	
WMF 2.5 DI PE	x	x	
WMF 2.5 DI PE STB	x	x	
WMF 2.5			Feed-through terminal

**Electrical data**

Model	Rated
WMF 2.5 FU SW	250 V, 6.3 A
WMF 2.5 FU 10-36V SW	36 V, 6.3 A
WMF 2.5 FU 100-250V SW	250 V, 6.3 A
WMF 2.5 FU 60-150V SW	150 V, 6.3 A
WMF 2.5 FU 30-70V SW	70 V, 6.3 A
WMF 2.5 FU PE SW	250 V, 6.3 A
WMF 2.5 FU PE 10-36V SW	36 V, 6.3 A
WMF 2.5 FU PE 100-250V SW	250 V, 6.3 A
WMF 2.5 FU PE 60-150V SW	150 V, 6.3 A
WMF 2.5 FU PE 30-70V SW	70 V, 6.3 A
WSI 4	250 V, 6.3 A
WSI 4/LD 10-36V AC/DC	36 V, 6.3 A
WSI 4/LD 30-70V AC/DC	70 V, 6.3 A
WSI 4/LD 60-150V AC/DC	150 V, 6.3 A
WSI 4/LD 140-250V AC/DC	250 V, 6.3 A
WSI 6	500 V, 6.3 A
WSI 6/LD 250AC LLC	250 V, 6.3 A
WSI 6/LD 10-36V LLC	36 V, 6.3 A
WSI 6/LD 30-70V LLC	70 V, 6.3 A
WSI 6/LD 60-150V LLC	150 V, 6.3 A
WTR 2.5 STB	500 V, 24 A
WTR 2.5	500 V, 24 A
WTR 4 STB	400 V, 32 A
WTR 4	400 V, 32 A
WMF 2.5 DI	500 V, 20 A
WMF 2.5 DI PE	500 V, 20 A
WMF 2.5 DI PE STB	500 V, 20 A
WMF 2.5	500 V, 24 A



[13]

[14]

**Schedule**  
**TYPE EXAMINATION CERTIFICATE No.**  
**DEMKO 14 ATEX 1389U Rev. 3**

Routine tests:

According to EN IEC 60079-7, clause 7.1 in combination with clause 6.1 a dielectric strength test has to be carried out. The routine tests may be performed on a statistical basis according to ISO 2859-1 with an acceptance quality limit (AQL) of 0,04. Routine test is to be carried out according to Weidmüller procedure "High voltage test" Document -NR: S\_011.

[16]

Descriptive Documents

The scheduled drawings are listed in the report no. provided under item no. [ 8 ] on page 1 of this Type Examination Certificate.

[17]

Schedule of Limitations:


- These terminal blocks are to be installed within an ATEX certified enclosure with a minimum rating of IP54, suitable for the intended application.
- The enclosure shall bear the following warning dependent on the terminal block model:  
"WARNING – DO NOT REMOVE OR REPLACE THE FUSE/TEST DISCONNECT SWITCH WHEN ENERGIZED!"
- The maximum permitted service temperature of the terminal blocks is 130°C.
- For additional limitations refer to the "Installation instructions & conditions for safe use" of the according models.

[18]

Essential Health and Safety Requirements

The Essential Health and Safety Requirements (EHSRs) are covered by the standards listed at item 9.

Additional information

The trademark  for Weidmueller Interface GMBH & Co KG may be used as the company identifier on the marking label.



### 2.5.2.7 MANUALS


Manuals are not included in the body of this TFM due their size, but a copy of each is held in the NICP's technical file.





## 2.6 NON-CERTIFIED PARTS - DATASHEETS

### 2.6.1 FIBRE OPTIC PANEL

## SNAP<sup>®</sup> Compact Fiber Optic Patch Panel







#### Features & Benefits

- » Compact size perfect for limited space enclosures
- » UL Listed 1863
- » Versatile surface or DIN-Rail mount capability
- » Slide-hinged faceplate aids field termination
- » Patch or fusion splice field termination standard
- » Rugged metal construction with lifetime warranty

#### Product Description

Compact DIN-Rail or surface mount fiber optic patch panel. Compact size allows minimum space requirements within control cabinetry. Device includes a splice tray to allow fusion splicing of field cabling (pigtailed sold separately). Device features a sliding faceplate with capture mechanism to allow patch panel to be kept open "hands-free".

#### Product Variants

Part Number	External Interface	Internal Interface	Supported Cable Types
SNAP-12LC-MM	3ea. LC quad connectors.	3ea. LC quad connectors.	OM1, OM2, OM3, OM4
SNAP-12LC-5M	3ea. LC quad connectors.	3ea. LC quad connectors.	OS1, OS2

Custom fiber optic adapter variations are available via special order. Contact us:

#### Specifications

**Standards:** UL Listed 1863 (Communications-Circuit Accessories), CE  
**Operating temperature:** -40°C to 75°C  
**Storage/transport temperature:** -40°C to 80°C  
**Relative humidity (non-condensing):** 10% to 95%  
**Insertion Loss:** ≤.3dB (Multimode), ≤.2dB (Singlemode)  
**Plug/Unplug Durability:** 1000 times

#### Mechanical Construction

**Dimensions with adapters installed:** (H x D x W) 6.25" x 5.125" x 2.75"  
**Mounting Options:** Rear DIN-Rail, side DIN-Rail or surface mount  
**Weight:** 1.5 lbs.  
**Protection class:** IP20

#### Materials of Construction

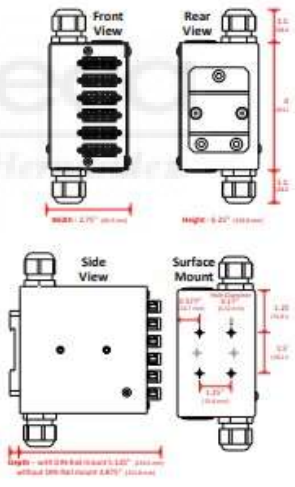
**Patch panel body and faceplate:** 18 gauge powder-coat painted steel  
**Fiber optic adapters:** UL 90 V-0 Thermoplastic  
**Cable Glands:** Plastic with max. cable diameter of 12mm (14mm max. also available)

#### Warranty

Lifetime warranty on materials and workmanship.

#### Scope of Delivery and Accessories

**Scope of delivery:** Patch panel, DIN-Rail mounting adapter, 2ea. cable glands.



Phone: 214-613-0349 | Fax: 866-622-4068 | [www.dinspace.com](http://www.dinspace.com)  
 © DINSpace. All Rights Reserved. Specifications subject to change without notice.

## 2.6.2 DIN RAIL

### Datenblatt



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#### TS 35X7.5/LL 1M/ST/ZN

**Weidmüller Interface GmbH & Co. KG**  
Klingenbergstraße 26  
D-32758 Detmold  
Germany  
[www.weidmueller.com](http://www.weidmueller.com)

---

#### Product image





Similar to illustration  
Steel DIN rails are the most widespread on the market.  
Among metal DIN rails, they have the lowest shortcircuit  
protection, similar to stainless steel.



UNIVERSITAS Miguel Hernández

#### General ordering data

Version	Terminal rail, with slot, Accessories, 35 x 7.5 x 1000 mm, Slot width: 5.20 mm, Slot length: 25.00 mm, Steel, galvanic zinc plated and passivated
Order No.	<a href="#">05.145.10000</a>
Type	TS 35X7.5/LL 1M/ST/ZN
GTIN (EAN)	4008190116620
Qty.	1 m

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Erstellungs-Datum July 11, 2024 6:57:44 PM CEST

Katalogstand 29.06.2024 / Technische Änderungen vorbehalten

1

**TS 35X7.5/LL 1M/ST/ZN**

Weidmüller Interface GmbH & Co. KG  
 Klingenbergstraße 26  
 D-32758 Detmold  
 Germany

www.weidmueller.com

**Technische Daten**

**Dimensions and weights**

Depth	7.5 mm	Depth (inches)	0.295 inch
Height	35 mm	Height (inches)	1.378 inch
Width	1.000 mm	Width (inches)	39.37 inch
Net weight	314 g		

**Mounting rail**

Drill-hole diameter	5.2 mm		
Installation advice	Direct mounting		
Length of the terminal rail	nominal	1,000 mm	
	max.	1,000 mm	
	min.	0 mm	
Material	Steel		
Pre-punched mounting rail	Yes		
Short circuit strength corresponds to E-	16 mm <sup>2</sup>		
Cu wire			
Short-time withstand current per second according to IEC 60947-7-2	1.92 kA		
Slit gap	11 mm		
Slit gap			
Slit length	25 mm		
Slit length			
Slit width	5.2 mm		
Slit width			
Slotted drill holes	Yes		
Solder eyelet hole diameter (D)	5.2 mm		
Spacing of holes, centre-to-centre	36 mm		
Standards	DIN EN 60715		
Surface finish	galvanic zinc plated and passivated		
Thickness	1 mm		

**Classifications**

ETIM 6.0	EC001285	ETIM 7.0	EC001285
ETIM 8.0	EC001285	ETIM 9.0	EC001285
ECLASS 9.0	27-40-06-02	ECLASS 9.1	27-40-06-02
ECLASS 10.0	27-40-06-02	ECLASS 11.0	27-40-06-02
ECLASS 12.0	27-40-06-02	ECLASS 13.0	27-40-06-02

**Environmental Product Compliance**

REACH SVHC	/
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**Approvals**

ROHS	Conform
------	---------

**Downloads**

Engineering Data	<a href="#">CAD data – STEP</a>
Engineering Data	<a href="#">Zuker E3 S</a>
User Documentation	<a href="#">StorageConditionsTerminalBlocks</a>
Catalogues	<a href="#">Catalogues in PDF-format</a>
Brochures	

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## Datenblatt

**TS 35X7.5/LL 1M/ST/ZN**

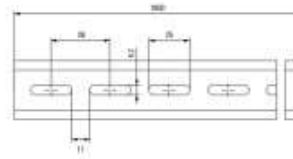
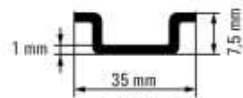
**Weidmüller** 

**Weidmüller Interface GmbH & Co. KG**  
Klingenbergstraße 26  
D-32758 Detmold  
Germany

[www.weidmueller.com](http://www.weidmueller.com)

## Zeichnungen

### Product image



Similar to illustration



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3



## 2.6.3 CABLE DUCT

**TAKE A CLOSER LOOK AT THE...**

# Betaduct PVC Metric Trunking Range (Grey)



**PVC Metric Open Slot**



**PVC Metric Narrow Slot**

### THE BETADUCT PVC METRIC TRUNKING RANGE

Betaduct PVC metric cable trunking is the ideal solution for general applications where cable management is required, and cable protection is essential.

This impact resistant, self-extinguishing PVC trunking provides fast and tidy routing of cables with a high level of mechanical protection, making it ideal for use in control panels, switchboards, production plants and other demanding environments.

Features an innovative design for quick and simple installation.

#### TAKE A LOOK AT THESE KEY FEATURES

- Lightweight and self-extinguishing
- Excellent rigidity and performance characteristics
- Easy installation
- Break points on fingers and base
- Secure clip on lid
- Spare lids available

**feefo** 4.8/5  
"Fantastic service and products."

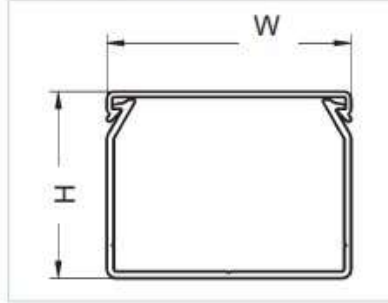
#### SPECIFICATION

<b>Material</b>	Self Extinguishing PVC
<b>Colour</b>	Grey RAL7030
<b>Operating Temp</b>	-15°C to +60°C
<b>Flammability Rating</b>	UL94 V-0
<b>Tensile Strength</b>	To yield point 46.2 MPa Ultimate 37.3 MPa
<b>Elongation</b>	To yield point 25%
<b>Standards</b>	RoHS 2 compliant, UL94 V-0, A Norme EN50084-2-3, CSA, UR, RINA, CE marked

UK: 01582 606033 | Export: +44 1727 849 869 | sales@cablecraft.co.uk | cablecraft.co.uk  
Huge stock availability ready for next working day UK delivery when ordered before 3pm



**BETADUCT. SIMPLY TRUNKING. MADE GREAT.**  
**Betaduct PVC Metric Open Slot**



Part Number	Nominal External (mm)		Lengths Per Pack	Qty Per Pack (m)
	H	W		
10430021	30	25	40	80
10430022	40	25	30	60
10430023	60	25	20	40
10430024	80	25	16	32
10430025	100	25	12	24
10430031	30	40	24	48
10430032	40	40	20	40
10430033	60	40	18	36
10430034	80	40	12	24
10430045	100	40	8	16
10430062	40	60	12	24
10430063	60	60	12	24
10430064	80	60	12	24
10430065	100	60	8	16
10430082	40	80	12	24
10430083	60	80	12	24

Part Number	Nominal External (mm)		Lengths Per Pack	Qty Per Pack (m)
	H	W		
10430084	80	80	12	24
10430085	100	80	8	16
10430102	40	100	8	16
10430103	60	100	10	20
10430104	80	100	8	16
10430105	100	100	8	16
10430107	150	100	4	8
10430122	40	120	10	20
10430123	60	120	8	16
10430124	80	120	8	16
10430125	100	120	4	8
10430127	80	150	6	12
10430128	100	150	4	8
10430129	60	200	4	8
10430130	80	200	4	8
10430131	100	200	4	8



Over 30 years industry experience



Next Day Delivery as standard to UK mainland\*



Platinum Trusted feefo service award

## 2.6.4 END STOP

### Datenblatt

**EW 35 GR 7032**



**Weidmüller Interface GmbH & Co. KG**  
Klingenbergstraße 26  
D-32758 Detmold  
Germany  
[www.weidmueller.com](http://www.weidmueller.com)

---

#### Product image



Weidmüller's range of products includes end brackets that guarantee a permanent, reliable mounting on the terminal rail and prevent sliding. Versions with and without screws are available. The end brackets include marking options, also for group markers, and also a test plug holder.

#### General ordering data

Version	End bracket, Wemid, grey, Rail TS 35, when screwed in
Order No.	<a href="#">0383630000</a>
Type	EW 35 GR 7032
GTIN (EAN)	4008190027322
Qty.	50 Stück

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Erstellungs-Datum July 11, 2024 7:00:51 PM CESTKatalogstand 29.06.2024 / Technische Änderungen vorbehalten

1

## Datenblatt



### EW 35 GR 7032

Weidmüller Interface GmbH & Co. KG  
Klingenbergstraße 26  
D-32758 Detmold  
Germany

www.weidmueller.com

## Technische Daten

### Dimensions and weights

Depth	27 mm	Depth (inches)	1.063 inch
Height	46 mm	Height (inches)	1.811 inch
Width	9 mm	Width (inches)	0.354 inch
Net weight	5.3 g		

### Temperatures

Continuous operating temp., min.	-50 °C	Continuous operating temp., max.	120 °C
----------------------------------	--------	----------------------------------	--------

### Material data

Material	Wemid	Colour	grey
UL 94 flammability rating	V-0		

### System specifications

Version	For the terminals	Rail	TS 35
---------	-------------------	------	-------

### Additional technical data

Installation advice	Direct mounting	Interlock	for screw fixing
Type of mounting	when screwed in		

### Conductors for clamping (rated connection)

Tightening torque, max.	0.6 Nm	Tightening torque, min.	0.5 Nm
-------------------------	--------	-------------------------	--------

### Dimensions

TS 35 offset	22.5 mm
--------------	---------

### General

Installation advice	Direct mounting	Rail	TS 35
---------------------	-----------------	------	-------

### Classifications

ETIM 6.0	EC001041	ETIM 7.0	EC001041
ETIM 8.0	EC001041	ETIM 9.0	EC001041
ECLASS 9.0	27-14-11-35	ECLASS 9.1	27-14-11-35
ECLASS 10.0	27-14-11-35	ECLASS 11.0	27-14-11-35
ECLASS 12.0	27-14-11-35	ECLASS 13.0	27-25-03-02

### Environmental Product Compliance

REACH SVHC	/
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### Approvals

ROHS	Conform
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## Datenblatt

**EW 35 GR 7032**

**Weidmüller** 

**Weidmüller Interface GmbH & Co. KG**  
Klingenbergstraße 26  
D-32758 Detmold  
Germany

[www.weidmueller.com](http://www.weidmueller.com)

## Technische Daten

### Downloads

Approval/Certificate/Document of Conformity	<a href="#">Confirmation of Standards EN 45545-2_2020-10</a>
Engineering Data	<a href="#">CAD data - STEP</a>
User Documentation	<a href="#">StorageConditionsTerminalBlocks</a>
Catalogues	<a href="#">Catalogues in PDF-format</a>
Brochures	



Erstellungs-Datum July 11, 2024 7:00:51 PM CEST

Katalogstand 29.06.2024 / Technische Änderungen vorbehalten

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## 2.6.5 LABEL HOLDER

### Datenblatt



### SCHT 5

**Weidmüller Interface GmbH & Co. KG**

Klingenbergstraße 26  
D-32758 Detmold  
Germany

[www.weidmueller.com](http://www.weidmueller.com)



The SchT 5 S group tag carriers are clipped directly onto the TS 32 mounting rail (G-rail) or the TS 35 mounting rail (top-hat rail). It is therefore possible to label the terminal strip irrespective of the terminal and the type of terminal. SchT 5 and SchT 5 S are fitted with ESO 5, STR 5 protective strips.

The SchT 7 is a hinged group tag carrier for inlay tags which enables easy access to the clamping screw.

The SchT 7 is fitted with ESO 7, STR 7 protective strips or DEK 5.

Inlay tags and protective strips can be found under "Accessories".

#### General ordering data

Version	SCHT, Terminal marker, 44.5 x 19.5 mm, Pitch in mm (P): 5.00 Weidmueller, beige
Order No.	<a href="#">0292460000</a>
Type	SCHT 5
GTIN (EAN)	4008190105440
Qty.	20 Stück

Erstellungs-Datum July 11, 2024 7:02:12 PM CEST

Katalogstand 29.06.2024 / Technische Änderungen vorbehalten

1

## Datenblatt

### SCHT 5

**Weidmüller Interface GmbH & Co. KG**  
Klingenbergstraße 26  
D-32758 Detmold  
Germany

[www.weidmueller.com](http://www.weidmueller.com)

## Technische Daten

### Dimensions and weights

Height	44.5 mm	Height (inches)	1.752 inch
Width	19.5 mm	Width (inches)	0.768 inch
Net weight	7.9 g		

### Temperatures

Operating temperature range	-40... 100 °C
-----------------------------	---------------

### General data

Application/manufacturer	Weidmüller	
Colour	beige	
Material	Polyamide 66	
Number of markers per combination	1 Component part = Terminal marker	
Number of markers per packaging unit	Form of supply	Component part
Operating temperature range	-40... 100 °C	
Operating temperature range, max.	100 °C	
Operating temperature range, min.	-40 °C	
Orientation of print	horizontal and vertical	
UL 94 flammability rating	V-2	
Width	19.5 mm	

### Connector markers

Pitch in mm (P)	5 mm
-----------------	------

### Classifications

ETIM 6.0	EC000761	ETIM 7.0	EC000761
ETIM 8.0	EC000761	ETIM 9.0	EC000761
ECLASS 9.0	27-14-11-37	ECLASS 9.1	27-14-11-37
ECLASS 10.0	27-14-11-37	ECLASS 11.0	27-28-11-01
ECLASS 12.0	27-28-11-01	ECLASS 13.0	27-28-11-01

### Environmental Product Compliance

REACH SVHC	/
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### Approvals

ROHS	Conform
------	---------

### Downloads

Engineering Data	<a href="#">CAD data - STEP</a>
Engineering Data	<a href="#">Zuken E3.S</a>
Catalogues	<a href="#">Catalogues in PDF-format</a>

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Katalogstand 29.06.2024 / Technische Änderungen vorbehalten

2

## 2.6.6 FUSES

**Non resettable fuses**  
[www.schurter.com/PG01\\_2](http://www.schurter.com/PG01_2)

Miniature Fuse, 5 x 20 mm, Time-Lag T, H, 250 VAC, UL: 115 V - 300 VDC



SPT 5x20


---

IEC 60127-2 · 250 VAC · 300 VDC · Time-Lag T







---

**Description**

- IEC Standard Fuse
- H = High Breaking Capacity (Ceramic Tube)

**Standards**

- IEC 60127-2:5
- UL 248-14
- CSA C22.2 no. 248.14

**Approvals**

- VDE Certificate Number: 40014395
- UL File Number: E41599

**Applications**

- Primary Protection in Equipment
- Power Supply Adapter for e.g. laptops
- SMPS (Switching Mode Power Supply) for TV's and DVD's

**References**

Pigtail Type [SPT 5x20 Pigtail](#)  
 Fuse Kit [Fuse Kit SP 5x20 / SPT 5x20](#)

**Weblinks**

[pdf-datasheet](#), [html-datasheet](#), [General Product Information](#), [Approvals](#), [CE declaration of conformity](#), [RoHS](#), [CHINA-RoHS](#), [REACH](#), [e-Shop](#), [SCHURTER-Stock-Check](#), [Distributor-Stock-Check](#), [Detailed request for product](#)

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**Technical Data**

Rated Voltage	250 VAC, 300 VDC
Rated current	0.5 - 16 A
Breaking Capacity	500 A - 1500 A
Characteristic	Time-Lag T
Admissible Ambient Air Temp.	-55 °C to 125 °C
Climatic Category	55/125/21 acc. to IEC 60068-1
Material: Tube	Ceramic
Material: Endcaps	Nickel-Plated Copper Alloy
Unit Weight	1.16 g
Storage Conditions	0 °C to 60 °C, max. 70% r.h.
Product Marking	 Rated current, Rated voltage, Characteristic, Breaking Capacity, Approvals




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**Dimension**



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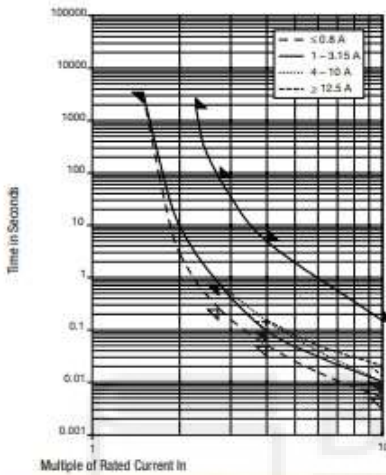




**Pre-Arcing Time**

Rated Current In	1.5 x In min.	2.1 x In max.	2.75 x In min.	2.75 x In max.	4.0 x In min.	4.0 x In max.	10.0 x In min.	10.0 x In max.
0.5 A - 0.8 A	60 min	30 min	250 ms	80 s	50 ms	5 s	5 ms	150 ms
1 A - 3.15 A	60 min	30 min	750 ms	80 s	95 ms	5 s	10 ms	150 ms
4 A - 6.3 A	60 min	30 min	750 ms	80 s	150 ms	5 s	10 ms	150 ms
8 A - 10 A	30 min	30 min	750 ms	80 s	150 ms	5 s	10 ms	150 ms
12.5 A - 16 A	15 min	30 min	750 ms	80 s	150 ms	5 s	20 ms	150 ms

**Time-Current-Curves**



**All Variants**







Rated Current [A]	Rated Voltage [VAC]	Rated Voltage [VDC]	Breaking Capacity	Voltage Drop 1.0 In max. [mV]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.5 I <sub>n</sub> max.	Power Dissipation 1.5 I <sub>n</sub> typ. [mW]	Melting Pt 10.0 In typ. [A <sup>2</sup> s]	UL	IEC	RoHS	REACH	CCC	Order Number
0.5	250	300	1)	850	360	1600	500	0.5	•	•	•	•	•	0001.2501
0.63	250	300	1)	650	330	1600	500	1.55	•	•	•	•	•	0001.2502
0.8	250	300	1)	500	260	1600	500	2.3	•	•	•	•	•	0001.2503
1	250	300	1)	350	180	2500	500	1.1	•	•	•	•	•	0001.2504
1.25	250	300	1)	300	150	2500	500	1.86	•	•	•	•	•	0001.2505
1.6	250	300	1)	200	130	2500	500	4.35	•	•	•	•	•	0001.2506
2	250	300	1)	190	120	2500	600	9.2	•	•	•	•	•	0001.2507
2.5	250	300	1)	180	100	2500	600	11.7	•	•	•	•	•	0001.2508
3.15	250	300	1)	140	100	4000	800	22	•	•	•	•	•	0001.2509
4	250	150	2)	100	90	4000	900	62.4	•	•	•	•	•	0001.2510
5	250	150	2)	100	90	4000	1200	97.5	•	•	•	•	•	0001.2511
6.3	250	150	2)	100	70	4000	1200	171	•	•	•	•	•	0001.2512
8	250	150	3)	100	70	4000	1300	268	•	•	•	•	•	0001.2513
10	250	150	3)	100	70	4000	2100	400	•	•	•	•	•	0001.2514
12.5	250	125	4)	100	70	4000	2500	563	•	•	•	•	•	0001.2515
16	250	125	4)	100	70	4000	3000	1500	•	•	•	•	•	0001.2516

Most Popular

Availability for all products can be searched real-time: <http://www.schurter.com/en/Stock-Check/Stock-Check-SCHURTER>

1) IEC: H = 1600 A @ 250 VAC, p.f. = 0.7 - 0.8



Rated Current [A]	Rated Voltage [VAC]	Rated Voltage [VDC]	Breaking Capacity	Voltage Drop 1.0 In max. [mV]	Voltage Drop 1.0 In typ. [mV]	Power Dissipation 1.5 I <sub>n</sub> max. [mW]	Power Dissipation 1.5 I <sub>n</sub> typ. [mW]	Melting I <sup>2</sup> t <sub>10.0</sub> Intyp. [A <sup>2</sup> s]	     	Order Number
1) UL: 10 kA @ 125 VAC, p.f. = 0.7 - 0.8 / 1500 A @ 250 VAC, p.f. = 0.7 - 0.8 / 1500 A @ 300 VDC										
2) IEC: H = 1500 A @ 250 VAC, p.f. = 0.7 - 0.8										
2) UL: 10 kA @ 125 VAC, p.f. = 0.7 - 0.8 / 1500 A @ 250 VAC, p.f. = 0.7 - 0.8 / 1500 A @ 150 VDC										
3) IEC: 1000 A @ 250 VAC										
3) UL: 1000 A @ 250 VAC, 1500 A @ 150 VDC										
4) IEC: 500 A @ 250 VAC										
4) UL: 500 A @ 125 VAC, p.f. = 0.7 - 0.8 / 1000 A @ 125 VAC / 500 A @ 250 VAC / 1500 A @ 125 VDC										
<b>Packaging Unit</b>	xxxx.xxxx xxxx.xxxx.G									Small Box Pack (10 pcs.) Bulk: 128 x 91 x 60 mm (1000 pcs.)



The specifications, descriptions and illustrations indicated in this document are based on current information. All content is subject to modifications and amendments. Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability and test each product selected for their own applications.

## 2.6.7 LABEL MATERIAL

# 3M Thermal Transfer Polyester Label Material

7871 • 7872 • 7873

Technical Data

March, 2009

**Product Description** 3M™ Thermal Transfer Polyester Label Materials 7871, 7872 and 7873 are gloss polyester label stocks that offer premium durability and moisture resistance. These label products utilize 3M™ Adhesive 350, which is a universal adhesive for label material that offers excellent chemical resistance and holding strength even at high temperatures.

**Construction** (Calipers are nominal values.)

Product	Facestock	Adhesive	Liner
<b>3M Label Material 7871</b>	.002 in. White Polyester Gloss TC (51 microns)	350 Acrylic 1.8 mils (46 microns)	55# Densified Kraft 3.2 mils (81 microns)
<b>3M Label Material 7872</b>	.002 in. Matte Platinum Polyester Gloss TC (51 microns)	350 Acrylic 1.8 mils (46 microns)	55# Densified Kraft 3.2 mils (81 microns)
<b>3M Label Material 7873</b>	.002 in. Bright Silver Polyester Gloss TC (51 microns)	350 Acrylic 1.8 mils (46 microns)	55# Densified Kraft 3.2 mils (81 microns)

- Features**
- Adhesive can permanently bond to high surface energy (HSE) and low surface energy (LSE) plastics, textured and contoured surfaces, powder coatings, and slightly oily metals.
  - Thick adhesive caliper provides for stronger bond on textured surfaces.
  - Facestock is topcoated for thermal transfer printing. Resin ribbons are recommended for optimum durability. The topcoat also provides improved ink anchorage for traditional forms of press printing.
  - UL recognized (File MH16411) and CSA accepted (File 99316). See the UL and CSA listings for details.
  - UL listing includes approval for use on powder coated surfaces.
  - 3M label materials 7871 and 7872 satisfy the requirements of UL-197 for occasional exposure to cooking oil when applied to stainless steel surfaces.
  - 3M label material 7871 meets British Standard BS-5609.

- Application Ideas**
- Barcode labels and rating plates.
  - Property identification and asset labeling.
  - Warning, instruction, and service labels for durable goods.
  - Nameplates and durable goods.

# 3M™ Thermal Transfer Polyester Label Material

7871 • 7872 • 7873

## Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

<b>Adhesive Coat Weight</b>	2.70 to 3.24 g/100 in. <sup>2</sup>	TM-2279
<b>Release Range</b>	5 to 70 g/2 in.	TlMI Method, 180° removal, 300 in./min.
<b>Service Temperature</b>	-40°F to 300°F (-40°C to 149°C)	
<b>Minimum Application Temperature</b>	50°F (10°C)	
<b>Convertability</b>	In order to capture the superior performance properties of 3M™ High Holding Acrylic Adhesive 350, thicker calipers are utilized for LSE or textured substrates. Its higher caliper, while desirable for the end use applications, may require extra care during processing. Please refer to the die cutting/converting section of this data page or the "Guide to Converting and Handling Label Products" technical bulletin for additional information.	

## Typical Peel Adhesion Properties

Adhesion: 180° peel test procedure is ASTM D 3330.

90° peel test procedure is ASTM D 3330 modified for the angle change.

Surface	Initial (10 Minute Dwell/RT)				Conditioned for 3 Days at Room Temperature 72°F (22°C)			
	180° Peel		90° Peel		180° Peel		90° Peel	
	Oz./In.	N/100 mm	Oz./In.	N/100 mm	Oz./In.	N/100 mm	Oz./In.	N/100 mm
Stainless Steel	88	96	63	69	96	105	75	82
Polycarbonate	90	98	65	71	94	103	69	76
Polypropylene	73	80	29	32	83	91	31	34
Glass	93	102	69	76	99	108	77	84
HD Polyethylene	54	59	27	30	58	63	32	35
LD Polyethylene	53	58	30	32	56	61	37	40
Smooth Powder Coating*	85	93	-	-	89	97	-	-
Finely Textured Powder Coating*	49	54	-	-	52	57	-	-

\*Calculated using averages of different powder coated surfaces.

Surface	Conditioned for 3 Days at 120F (49°C)				Conditioned for 24 hours at 90°F (32°C) at 90% Relative Humidity			
	180° Peel		90° Peel		180° Peel		90° Peel	
	Oz./In.	N/100 mm	Oz./In.	N/100 mm	Oz./In.	N/100 mm	Oz./In.	N/100 mm
Stainless Steel	108	118	96	105	99	108	81	89
Polycarbonate	66	72	34	37	77	84	59	64
Polypropylene	81	89	33	16	78	85	47	51
Glass	106	116	86	94	89	97	72	79
HD Polyethylene	56	61	32	35	50	55	38	42
LD Polyethylene	15	16	14	15	43	47	40	44
Smooth Powder Coating*	93	102	-	-	88	96	-	-
Finely Textured Powder Coating*	56	61	-	-	50	55	-	-

\*Calculated using averages of different powder coated surfaces.

# 3M™ Thermal Transfer Polyester Label Material

7871 • 7872 • 7873

## Environmental Performance

**Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.**

The properties defined are based on four hour immersions at room temperature (72°F/22°C) unless otherwise noted. Samples were applied to stainless steel panels 24 hours prior to immersion and were evaluated one hour after removal from the solution for peel adhesion. Adhesion measured at 180° peel angle (ASTM D 3330) at 12 inches/minute.

### Chemical Resistance:

Chemical	Adhesion to Stainless Steel		Appearance	Edge Penetration
	Oz./in.	N/100 mm	Visual	Millimeters
Isopropyl Alcohol	88	96	No change	0.6
Detergent 1% Alconox® Cleaner	92	101	No change	1.3
Engine Oil (10W30) @ 250°F (121°C)	102	112	No change	0.6
Water for 48 hours	67	73	No change	0.1
pH 4	88	96	No change	0.7
pH 10	83	91	No change	1.4
409® Formula	92	101	No change	1.3
Toluene	50	55	No change	5.2
Acetone	59	65	No change	4.9
Brake Fluid	98	107	No change	0.1
Gasoline	56	61	No change	4.6
Diesel Fuel	93	102	No change	0.7
Mineral Spirits	80	88	No change	2.2
Hydraulic Fluid	96	105	No change	0.0

**Temperature Resistance: When applied to stainless steel. Other substrates should be tested per application.**

300°F (149°C) for 24 hours:

no significant visual change  
0.4% MD shrinkage  
0.6% CD shrinkage

-40°F (-40°C) for 10 days:

no significant visual change

**Humidity Resistance:**

24 hours at 100°F (38°C) and 100% relative humidity:

no significant change in appearance or adhesion

**Accelerated Aging:**

ASTM D 3611:

96 hours at 150°F (65°C) and 80% relative humidity

Product	Rate of Removal	Gram/Inch	
		Width	N/100 mm
3M™ Thermal Transfer Polyester Label Material 7871	180° Peel Adhesion from Stainless Steel	12 inches/minute	87 95
3M™ Thermal Transfer Polyester Label Material 7872	180° Peel Adhesion from Stainless Steel	12 inches/minute	87 95
3M™ Thermal Transfer Polyester Label Material 7873	180° Peel Adhesion from Stainless Steel	12 inches/minute	87 95

## 3M™ Thermal Transfer Polyester Label Material

7871 • 7872 • 7873

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### Application Techniques

For maximum bond strength, the surface should be clean and dry. Typical cleaning solvents are heptane and isopropyl alcohol.\*

For best bonding conditions, application surface should be at room temperature or higher. Low temperature surfaces, below 50°F (10°C), can cause the adhesive to become so firm that it will not develop maximum contact with the substrate. Higher initial bonds can be achieved through increased rubdown pressure.

\*When using solvents, read and follow the manufacturer's precautions and directions for use.

---

### Printing

Facestock is topcoated for improved ink receptivity and is designed for thermal transfer printing. It is printable by all standard roll processing methods including flexography, hot stamp, letterpress, and screen printing.

#### UL Recognized thermal transfer ribbons

Advent: 301 Black; 303 Black; 501 Black; 501 Red; 501 Blue; 501 Green

Armor: AXR-7; AXR-7+; AXR-600

Astromed: R5

CP: 5440 Red; 5640 Blue; 5940 Black

Dasco: DR-74; DR-84

Great Ribbon: SDR

ICS: ICS-CC-4099.1

Iimak: SH-36; SP-330; PrimeMark

Intermec: 053258-2; 054048-4

ITW: B324

Japan Pulp and Paper: JP Resin 1; JP Resin 2 Blue; JP Resin 2 Red (suitable for indoor use only); JP Resin 2 Green (suitable for indoor use only)

Kurz: K500; K501

Markem: 716 (suitable for indoor use only)

Mid City Columbia: CGL-80; CGL-80HE

NCR: Matrix Resin; Matrix; PaceSetter; Promark II; Ultra V

Pelikan: T016

Ricoh: B110A; B110C; B110CX

Sato: Premier 1

Sony: 4070; 4072; 4075; 4085; 5070; Signature Series Resin; Signature Series Wax

UBI: HR03; HR04

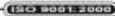
Zebra: 5095; 5099; 5100; 5175



# 3M™ Thermal Transfer Polyester Label Material

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<b>Die Cutting / Converting</b>	Rotary die cutting is recommended. Fanfolding of labels is not recommended. Small labels should be evaluated carefully. Winding tensions should be kept at a minimum to help prevent the adhesive from oozing.
<b>Packaging</b>	Finished labels should be stored in plastic bags.
<b>Storage</b>	Store at room temperature conditions of 72°F (22°C) and 50% relative humidity.
<b>Shelf Life</b>	If stored under proper conditions, product retains its performance and properties for two years from date of manufacture.
<b>Technical Information</b>	The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.
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 This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2000 standards.



## Industrial Adhesives and Tapes Division Converter Markets

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800-422-8116 • 877-722-5072 (fax)  
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Printed in U.S.A.  
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**3M COMPANY**

3M PERFORMANCE LABEL MATERIALS, 1030 LAKE RD, MEDINA OH 44256

**unprinted stock dsg: 7872(x), 7873(x)**

Pressure-sensitive systems

Description: unprinted gloss silver/platinum polyester facestock with adhesive which is protected by a release liner

Suitable for additional printing with one or more of the following inks (in the black color unless otherwise indicated):

Additional Printing Note: Additional Printing Inks are only suitable for indoor and outdoor use, unless otherwise specified

Inkjet cartridge for use with CSAT ITS800 Printers

Agfa Agora G1, Agora G1 (All, Indoor use only), Agora G1 (Blue), Agora G1 (Red)

Inkjet cartridge for use with Durst Tau 150, Tau 150 8C and Tau 330 printers

Durst Tau (All)

Inkjet cartridge for use with Gamma printers

Atlantic Zeiser UV-A 20000 (All, Indoor use only)

Inkjet cartridge for use with Omega printers

Atlantic Zeiser UV-A 10000 (Indoor use only)

Inkjet cartridge with EFI Jettron printers

EFI Jettron Jettron 4000 UV (All)

Thermal transfer ribbon

Armor AXR 600, AXR 7, AXR 7+, AXR 8, AXR 800

Astro-Nova R-S, RAF (Blue), RY

Autronics Co. Ltd. RP

Coding Products 5440 (Red), 5640 (Blue), 5940

Dainippon 4070, R300, R330, R510, R510 (Green), R510 (Red), R510 (White), R510 HF, R511, Signature Series (TM) Resin, Signature Series (TM) Wax, TR4070 (C), TR6070, TR6075 (C), TRX-55

Dasco DR 74, DR 84

Dynic Corp. HL30 (C), HL32

Fujicopian FTX 308, TTM-245

Great Ribbon SDR

Honeywell Safety & TMX3702HR04, TMX3710HR03

Productivity Solutions

ICS CC-4099.1

Imak Primemark, SP330

Intermec Corp. 053258-2, 054048-4

Japan Pulp and Paper JP Resin 1, JP Resin 2 (Blue), JP Resin 2 (Green, Indoor use only), JP Resin 2 (Red, Indoor use only)

Kurz K500, K501

Markem 716 (Indoor use only)

Mid-City Columbia Inc. CGL 80, CGL 80HE, Matrix, MCC-14, MCC-23HE (G), NCR, PaceSetter, Promark II, Ultra V

NCR Matrix, PaceSetter, Promark II, Ultra V

Peak Ultra Extreme, Ultra Premium

Pelikan T016

Ricoh B100C (C), B110A, B110C, B110CX

Sato Corp. Premier 1

Sony Chemicals 4075, 4085, 5070, TR5075

Toppan Printing Co. RP

Zebra Technologies Corp. 5095, 5100

Thermal transfer ribbon applied over Astro-Med "RY" black thermal transfer ribbon

Kurz K8151 (Clear)

Thermal transfer ribbon applied over Astro-Med "RY" black thermal transfer ink

Astro-Nova RRT (Clear)

Application Surface

Acrylic paint

Acrylic powder paint

Alkyd paint

Aluminum

Epoxy paint

Epoxy powder paint

Epoxy powder paint (textured)

Galvanized steel

Polyester paint

Polyester powder paint

Polyester powder paint (textured)

Polyethylene terephthalate

Polyurethane powder paint

Porcelain

Stainless steel

	Max Temp (°C)	Min Temp (°C)	Indoor Use	Outdoor Use	Additional Conditions
Acrylic paint	150	-40	Yes	Yes	-
Acrylic powder paint	150	-40	Yes	Yes	-
Alkyd paint	150	-40	Yes	Yes	-
Aluminum	150	-40	Yes	Yes	-
Epoxy paint	150	-40	Yes	Yes	G
Epoxy powder paint	150	-40	Yes	Yes	-
Epoxy powder paint (textured)	150	-40	Yes	Yes	-
Galvanized steel	150	-40	Yes	Yes	-
Polyester paint	150	-40	Yes	Yes	-
Polyester powder paint	150	-40	Yes	Yes	-
Polyester powder paint (textured)	150	-40	Yes	Yes	-
Polyethylene terephthalate	150	-40	Yes	Yes	-
Polyurethane powder paint	150	-40	Yes	Yes	-
Porcelain	150	-40	Yes	Yes	-
Stainless steel	150	-40	Yes	Yes	C

Nylon - Polyamide	100	-40	Yes	Yes	G
Phenolic - Phenol Formaldehyde	100	-40	Yes	Yes	-
Polybutylene terephthalate	100	-	Yes	No	-
Polycarbonate	100	-	Yes	No	-
Tetrafluoroethylene-hexafluoropropylene-vinylidene fluoride	100	-40	Yes	Yes	-
PTFE coated metal	80	-	Yes	No	-
Polyphenylene oxide/ether	80	-40	Yes	Yes	-
Polypropylene	80	-	Yes	No	-
Polystyrene	80	-40	Yes	Yes	-
Zinc plated metal with chromate	80	-40	Yes	Yes	-
Acrylonitrile butadiene styrene	60	-40	Yes	Yes	-
Polyvinyl chloride	60	-40	Yes	No	-
Sabic "Valox 553"	150	-40	Yes	Yes	-

(X) - Optional code that is replaced by F, FL, HL, NF, or TL representing a flat (non-embossed) release liner

G - Occasional exposure to Cooking Oil (room temp).

G - Occasional exposure to Gasoline splashing.

Report Date: 1995-02-09

Last Revised: 2021-05-18

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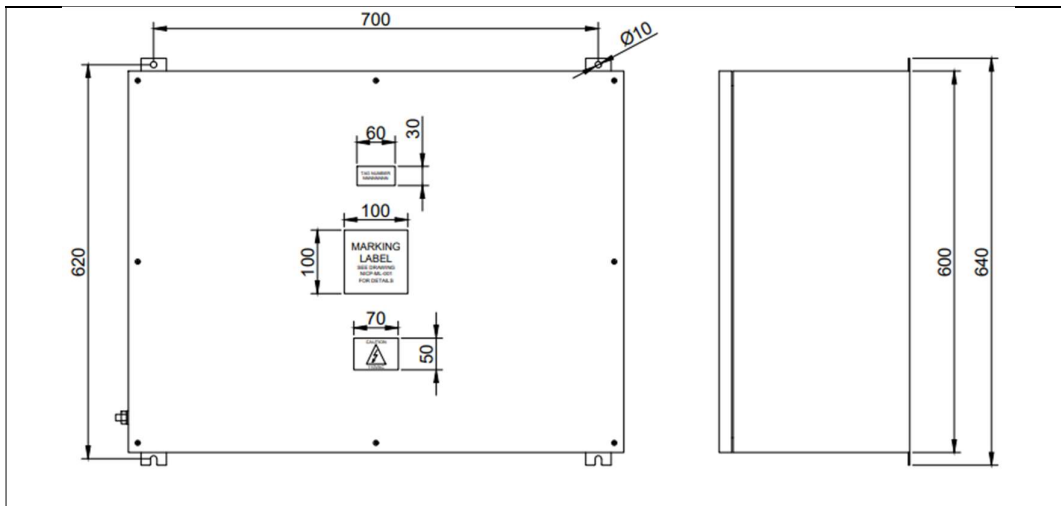


## 2.7 TESTS

### 2.7.1 TEMPERATURE RISE – TR 001

Test report	TR-001	Test date	05/06/2024
Equipment	Network Interface Control Panel	Serial number	NICP-0001
Type of protection	Ex ec, Ex nC	Gas Group	IIC
Ambient temperature range	-20°C to +45°C	Ratings	110Vac 6.3A
Ambient conditions	21.5°C to 27.1°C 43% RH		

Test details
<p>Temperature measurement tests in accordance with clause 26.5.1 of EN IEC 60079-1:2018:</p> <ol style="list-style-type: none"><li>1. The service temperature of the equipment was determined at the rated voltage as specified in clause 26.5.1.2 of EN IEC 60079-0:2018.</li><li>2. The maximum service temperature of the equipment was determined at 90% and 110% of the rated voltage as specified in clause 26.5.1.3 of EN IEC 60079-0:2018.</li></ol> <p>The equipment was mounted vertically as shown in the image below:</p>



### Thermocouple locations

Thermocouples were placed in the following locations:

- Common to service and maximum surface temperature:
  1. External ambient
- Specific to service temperature:
  10. Internal ambient
  11. Entry point of power cable
  12. Branching point of power cable
  13. Cover gasket on top side of enclosure above power supply
  14. Cover gasket on top side of enclosure opposite side of power supply
  15. Cover gasket on side of enclosure next to power supply side
- Specific to maximum surface temperature:
  20. External surface top side of enclosure above power supply
  21. External surface top side of enclosure opposite side of power supply
  22. External surface front cover towards top left-hand side
  23. External surface front cover towards top right-hand side

24. Surface of power supply
25. Surface of feed through terminal block
26. Surface of terminal block with fuse holder

Test equipment		
Test equipment	Serial number	Calibration date
TC-08 data logger	A-0104-281	22/11/2024
TC-08 data logger	A-0085-107	09/04/2025
Digital multimeter	39236545LR	16/12/2024
Power supply	20200518077	05/02/2025
Variac transformer	EVM1018	N/A

Test Results
<p>The highest temperature rise measured for each of the thermocouple locations listed above is shown in the tables below.</p> <p>The maximum service temperature rise was 6.97K, measured on the cover gasket on the top side of the enclosure above the power supply. When corrected for a maximum ambient of +45°C results in a maximum service temperature of 51.97°C.</p> <p>The maximum surface temperature rise was 24.3K, measured on the surface of the power supply. When corrected for a maximum ambient of +45°C results in a maximum surface temperature of 69.3°C.</p>
Service temperature – 110Vac

Thermocouple location	Maximum rise (K)	Temperature corrected for upper ambient (°C)
10	13.81	58.81
11	5.04	50.04
12	5.6	50.6
<b>13</b>	<b>6.97</b>	<b>51.97</b>
14	5.88	50.88
15	4.39	49.39
Maximum surface temperature – 99Vac		
Thermocouple location	Maximum rise (K)	Temperature corrected for upper ambient (°C)
20	14.56	59.56
21	7.43	52.43
22	5.75	50.75
23	5.21	50.21
<b>24</b>	<b>24.3</b>	<b>69.3</b>
25	17.82	62.82
26	10.94	55.94
Maximum surface temperature – 121Vac		
Thermocouple location	Maximum rise (K)	Temperature corrected for upper ambient (°C)
20	12.38	59.08

21	6.99	51.99
22	5.31	50.31
23	4.7	49.7
24	23.68	68.68
25	17.21	62.21
26	10.37	55.37

Notes
<p>Each of the parts fitted was appropriately connected to suitable actuators to simulate working conditions of the equipment.</p> <p>The multimeter was used to verify that the correct current was being drawn during the test.</p> <p>The equipment was run at each of the test voltages until thermal equilibrium was reached, that is, the rate of rise of the temperature rise did not exceed a rate of 2 K/h.</p> <p>Complete test data can be found in the associated spreadsheet TR TP-001.</p>

Signatures		
Test Engineer	John Test	JT 05/06/2024
Approving Engineer	Paul Approving	PA 06/06/2024

### 2.7.2 DIELECTRIC STRENGTH – TR002

Test report	TR-002	Test date	07/06/2024
-------------	--------	-----------	------------

Equipment	Network Interface Control Panel	Serial number	NICP-0001
Type of protection	Ex ec, Ex nC	Gas Group	IIC
Ambient temperature range	-20°C to +45°C	Ratings	110Vac 6.3A
Ambient conditions	20.3°C 52% RH		

#### Test details

Dielectric strength test in accordance with clause 6.1 of EN IEC 60079-7:2015+A1:2018:

The test voltage according to 1. or 2. below shall be maintained for at least 1 minute without dielectric breakdown occurring.

3. For electrical equipment and Ex Components with rated voltages not exceeding 90 V peak or in which working voltages not exceeding 90 V peak are present:  $500 V r. m. s. \cdot 0^{+5} \%$ .
4. For other electrical equipment and Ex Components, where working voltages exceeding 90 V peak are present:  $(1\ 000 + 2U)V r. m. s. \cdot 0^{+5} \%$  or  $1\ 500 V r. m. s. \cdot 0^{+5} \%$ , whichever is greater, where U is the working voltage.

According to points 1 and 2 above, the following test voltages were applied:

- 1500V applied between L and N, L and PE, N and PE on the power input terminals of the power supply.
- 500V applied between + and -, + and PE, - and PE on the power output terminals of the power supply.

Test voltages
<p>The equipment's rated voltage is 110 Vac, which is fed into the power supply. According to 2. above 1500 V r.m.s. shall be applied to the input terminals.</p> <p>The power supply's output voltage is 24Vdc. According to 1. above 500 V r.m.s. shall be applied to the output terminals.</p>

Test equipment		
Test equipment	Serial number	Calibration date
5kV high voltage tester	PE006791	02/10/2024

Test Results				
<p>Test result: Pass. The test voltages were maintained for at least 60 seconds with no breakdown being observed.</p>				
Input terminals				
Tested	Test voltage (V)	Ohm reading	Duration (s)	Breakdown
L – PE	1500	>1000	61	No
N – PE	1500	>1000	63	No
L– N	1500	>1000	61	No
Output terminals				
Tested	Test voltage (V)	Ohm reading	Duration (s)	Breakdown

+ – PE	500	>1000	62	No
- – PE	500	>1000	61	No
+ – -	500	>1000	61	No

Notes	
Parts were wired as per drawing N1CP-WD-001.	

Signatures		
Test Engineer	John Test	JT 07/06/2024
Approving Engineer	Paul Approving	PA 07/06/2024



## 2.8 MANUAL

### 2.8.1 EQUIPMENT DESCRIPTION

The NICP network interface control panel is designed to be mounted in a Zone 2 hazardous location (ATEX Category 3) and is intended for interfacing copper ethernet cables and data into fibre-optic media. The NICP utilises an approved IP66, Ex eb, unpainted stainless steel enclosure to house approved electrical Ex Equipment and Ex Components. Approximate dimensions are 600 mm (height) x 780 mm (width) x 300 mm (depth) with a single door. The panel is supplied as a complete unit, with no assembly required by the end user other than cabling the system. The NICP is provided with 18 x M20 entries on the bottom side of the enclosure.

The NICP uses the following Ex Component parts:

Part	Manufacturer	Part no.	Certificate	Marking
Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb
Feed through terminal blocks	Weidmüller Interface GmbH & Co. KG	WDU 4 WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb
End plates		WAP 4 WAP 2.5		
Protective conductor terminal block		WPE 4 WPE 2.5		
Terminal block with fuse holder	Weidmüller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc

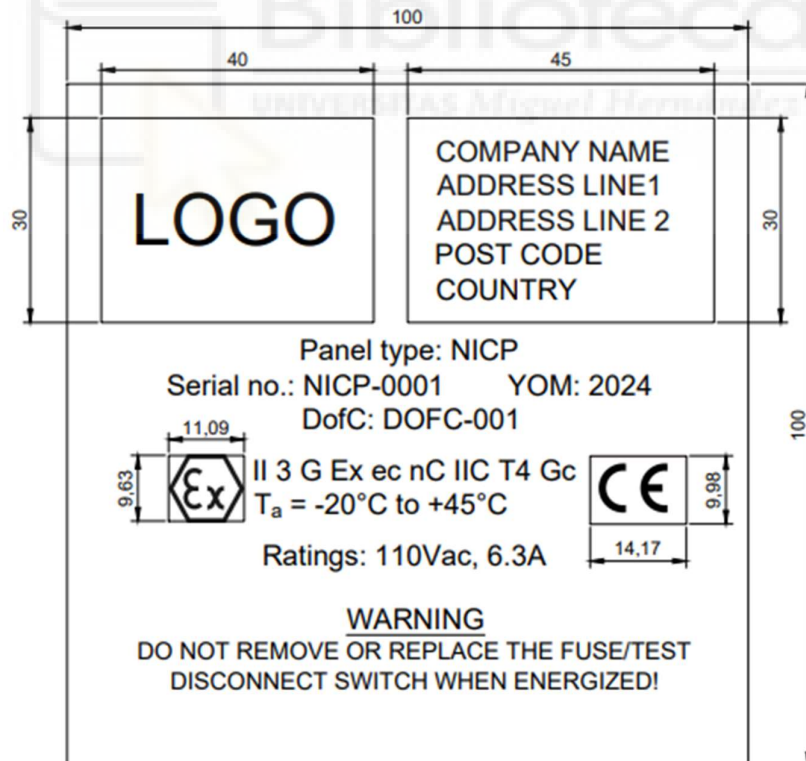
### 2.8.2 EQUIPMENT SPECIFICATIONS

The NICP's specifications are shown below:

Equipment	Network Interface Control Panel
Model	NICP
Approximate weight	23Kg
Approximate dimensions	
Ex marking	II 3 G Ex ec nC T4 IIC Gc
Ambient temperature range	T <sub>a</sub> = -20°C to +45°C
Electrical ratings	110Vac, 6.3A

### 2.8.3 MARKING LABEL

Example marking label shown below:

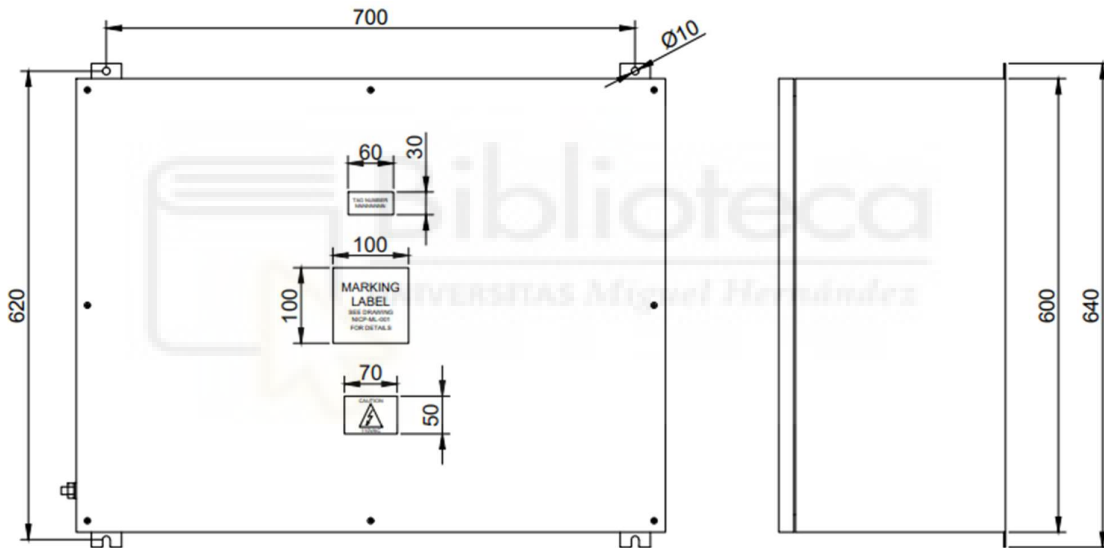


### 2.8.4 INSTALLATION GUIDELINES

The control panel shown in the illustrations below has dimensions of 600 mm (height) x 780 mm (width) x 300 mm (depth) with a single door. The control panel is unpainted and constructed of 1.5mm 316L stainless steel to prevent corrosion. Document number NICP-GA-001 – General Arrangement details the dimensions, layout and physical characteristics of the control panels.

The control panel is designed to be mounted in a Zone 2 hazardous location (ATEX Category 3) and is intended for interfacing copper ethernet cables and data into fibre-optic media.

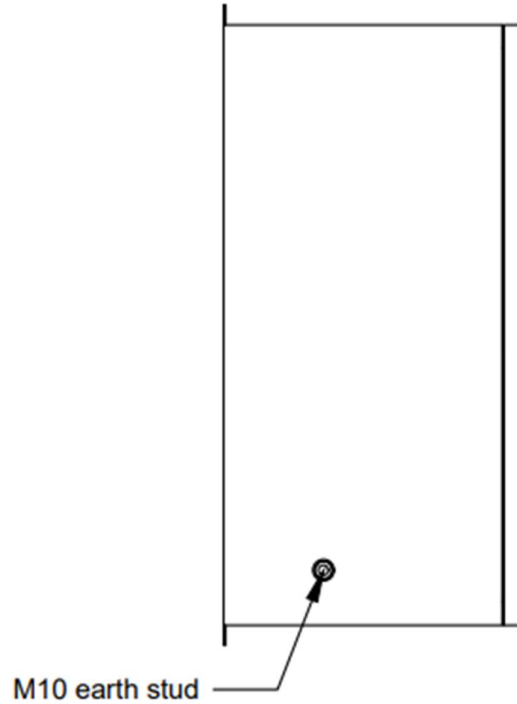
The cabinet has four attachment lugs for fixing to a wall, a unistrut frame or similar arrangement. The control panel shall only be installed in an upright position as shown on the image below:



The lugs should be checked that they are securely fastened to the cabinet before attaching.

Appropriate circuit protection for the power supply must be provided. Field wiring for input power ( $6\text{mm}^2$ ) connects to the common'd L and N terminals, outgoing power (24VDC) connections connect to terminals 3 and 4, terminals 1 and 2 provide power condition monitoring to external equipment via a volt-free contact.

The external Protective Earth ( $6\text{mm}^2$  minimum) connects to the earth stud on the outside of the enclosure. No other electrical terminations are required.



For detailed enclosure wiring, please refer to NICP-WD-001 Wiring Diagram drawing.

When installed in a zone 2 hazardous location (ATEX Category 3) the installation and wiring must be in accordance with EN 60079-14 and any regulations specific to the country of installation must be adhered to.

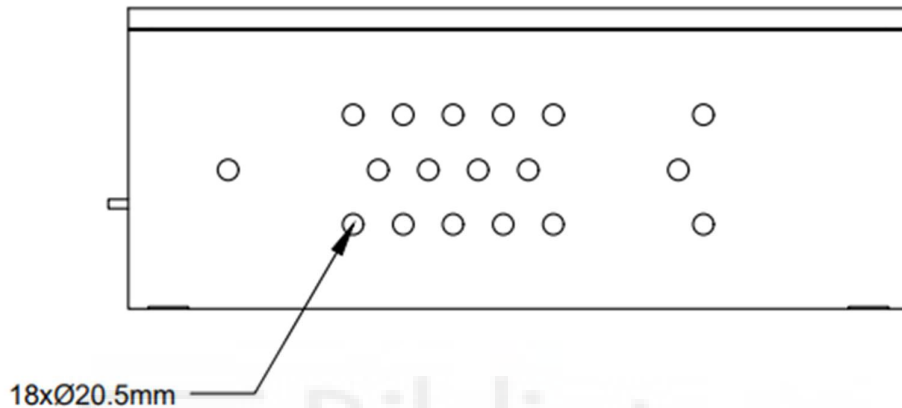
The tightening torque for the equipment terminals are:

- Power supply: 1Nm.
- Redundancy module: 1Nm.
- Industrial ethernet switch: 05.Nm.
- Terminals:
  - WDU 2.5: 0.4 to 0.8Nm
  - WPE 2.5: 0.4 to 0.6Nm
  - WDU 4: 0.5 to 1Nm
  - WPE 4: 0.5 to 1Nm
- Fuse holder: 0.8 to 1.6 Nm.

Unused terminals shall be tightened.

The control panel is provided with 18 x Ø20.5 mm plain entries on the bottom of the enclosure. Only suitably certified IP66 rated M20 cable glands or blanking elements.

Ensure that the control panel door is closed (sealing the cabinet from explosive gases) during normal operation.



## 2.8.5 OPERATION

Ensure the area is gas free prior to energization from external source.

The incoming and outgoing connections shall be checked and certified correct prior to energization.

The assembly contains no operator controls.

## 2.8.6 REPAIR AND MAINTENANCE INSTRUCTIONS

### 2.8.6.1 ACTIVITIES UNDER OPERATION

Do not open the control panel door when energised.

### 2.8.6.2 GENERAL MAINTENANCE

Routine maintenance inspections must be performed under safe conditions to ensure that the integrity of the Network Interface Control Panel is maintained.

Maintenance and repair must only be performed by authorised personnel.

In the event of component failure, replacement parts must be identical to those specified in the supporting documentation. If replacement parts are no longer

available or have been superseded, further verification will be required. Contact the manufacturer for guidance on the replacement of parts.

Ensure control panel labels remain in place.

#### 2.8.6.3 CLEANING

Any contamination should be carefully removed with a slightly damp cloth or a purpose designed, non-corrosive cleaning agent certified for this purpose. Flammable, solvent type cleaning agents shall not be used.

#### 2.8.6.4 FUSE REPLACEMENT

THE ENCLOSURES SHALL ONLY BE OPENED IN THE ABSENCE OF FLAMMABLE GASES.

Only replacement fuses provided by the manufacturer shall be used. Contact the manufacturer if replacement of fuses is required.

For terminal block fuses, power OFF the enclosure by isolating the enclosure supply at external feeder.

Open the fused terminal, exposing the fuse. Replace the fuse with a fuse of the same type, value and characteristics. Do not replace with larger amperage capacity fuses. Fuses are 5 x 20 mm, ceramic, sand-filled, and fast acting in accordance with IEC 60127-2. Close the fused terminal after replacing the fuse.

#### 2.8.6.5 OTHER PERIODIC MAINTENANCE

Terminations shall be periodically checked for tightness noting the torque limits specified in section 3.

Glands and cables shall be periodically inspected to ensure no damage to washers, shrouds or insulation has occurred.

### 2.8.7 SPECIAL CONDITIONS OF SAFE USE

- Provisions shall be made, either in the equipment or external to the equipment, to provide the transient protection device to be set at a level not exceeding 140% of the peak rated voltage.
- Only replacement fuses provided by the manufacturer shall be used. Contact the manufacturer if replacement of fuses is required.

- Only suitably certified IP66 rated cable glands and blanking elements shall be used.

## 2.8.8 NETWORK INTERFACE CONTROL PANEL PARTS

### 2.8.8.1 BILL OF MATERIALS

Bill of materials - Major parts							
Item	Quantity	Part	Manufacturer	Model no.	Certificate	Marking	Notes
1	1	Enclosure	Rittal-Werk, Duolph Loh GmbH & Co. KG	KEL 9407.600	PTB 02 ATEX 1082 U	II 2 G Ex e IIC Gb	Marking updated to Ex eb IIC Gb, refer to Appendix 2
2	2	Power supply	Puls GmbH	CP5.241	EPS 19 ATEX 1 201 X	II 3G Ex ec nC IIC T4 Gc	-
3	1	Redundancy module	Puls GmbH	YR20.242	EPS 11 ATEX 1 312 X	II 3G Ex ec IIC T4 Gc	-
4	1	Industrial ethernet switch	Moxa Inc.	EDS-516A-MM-SC	DEMKO 09 ATEX 0812123X	II 3 G Ex nA nC IIC T4 Gc	Marking updated to Ex ec nC IIC T4 Gc, refer to Appendix 2
5	3	4 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
6	2	4 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
7	2	4 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 4	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
8	3	Terminal block with fuse holder	Weidmuller Interface GmbH & Co. KG	WSI 6	DEMKO 14 ATEX 1339U	II 3 G Ex ec IIC Gc	-
9	4	2.5 mm <sup>2</sup> feed through terminal block	Weidmuller Interface GmbH & Co. KG	WDU 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
10	2	2.5 mm <sup>2</sup> end plate	Weidmuller Interface GmbH & Co. KG	WAP 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
11	1	2.5 mm <sup>2</sup> earth terminal	Weidmuller Interface GmbH & Co. KG	WPE 2.5	DEMKO 14 ATEX 1338U	II 2 GD Ex eb IIC Gb	-
12	2	Fiber optic patch panel	Dinspace	SNAP-12LC-MM-0M3	N/A	N/A	-
13	As required	DIN rail	Weidmuller Interface GmbH & Co. KG	TS35	N/A	N/A	-
14	As required	80 x 40 cable duct	Betaduct	10430034	N/A	N/A	-
15	As required	80 x 25 cable duct	Betaduct	10430024	N/A	N/A	-
16	10	End stop	Weidmuller Interface GmbH & Co. KG	EW 35	N/A	N/A	-
17	3	Label holder	Weidmuller Interface GmbH & Co. KG	SCHT 5	N/A	N/A	-
18	2	6.3A fuse	Schurter	0001.2512	N/A	N/A	-
19	1	2A fuse	Schurter	0001.2507	N/A	N/A	-
20					N/A	N/A	-

### 2.8.8.2 SUPPORTING DOCUMENTATION

For further information and specific details of the parts installed in the Network Interface Control Panel refer to the relevant instruction manual listed below:

- Enclosure: 9407600\_Instructions\_DE\_EN
- Power supply: pu\_cp5\_241\_2
- Redundancy module: pu\_yr20\_242\_1
- Industrial ethernet switch: moxa-eds-316-series-qig-v6.2
- Feed through terminals: NTI WDU 2.5\_WPE2.5 and NTI\_ IECEx\_WDU-WPE 4
- Terminal block with fuse holder: NTI\_Ex ec WSI 6
- Fiber optic patch panel: SNAP-Installation

The documents listed above are supplied with each Network Interface Control Panel.





## 2.9 EU DECLARATION OF CONFORMITY

### EU DECLARATION OF CONFORMITY (DOFC-001)

1. Equipment:

Network Interface Control Panel model NICP.

2. Name and address of manufacturer:

COMPANY NAME

ADDRESS LINE 1

ADDRESS LINE 2

POST CODE

COUNTRY

3. This declaration of conformity is issued under the sole responsibility of the manufacturer.

4. Object of the declaration:

The NICP network interface control panel is designed to be mounted in a Zone 2 hazardous location (ATEX Category 3) and is intended for interfacing copper ethernet cables and data into fibre-optic media. The NICP utilises an approved IP66, Ex eb, unpainted stainless steel enclosure (PTB 02 ATEX 1082 U) to house approved electrical Ex Equipment and Ex Components. Approximate dimensions are 600 mm (height) x 780 mm (width) x 300 mm (depth) with a single door. The panel is supplied as a complete unit, with no assembly required by the end user other than cabling the system. The NICP is provided with 18 x M20 entries on the bottom side of the enclosure.

5. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/34/EU (ATEX)	Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.
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2014/35/EU (LV)	directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
2011/65/EU (RoHS)	Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) Text with EEA relevance

6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

ATEX harmonised standards applied	
EN IEC 60079-0:2018	Explosive atmospheres - Part 0: Equipment - General requirements
EN IEC 60079-7:2015+A1:2018	Explosive atmospheres - Part 7: Equipment protection by increased safety 'e'
EN 60079-15:2019	Explosive atmospheres - Part 15: Equipment protection by type of protection "n"

7. Signatures

CITY, 04/06/2024

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Managing Director at COMPANY NAME

### **3 DESIGN OF ATEX CATEGORY 2 ENCLOSURE FOR CERTIFICATION AS AN EX COMPONENT**

#### **3.1 INTRODUCTION**

The design and manufacture of the Network Interface Control Panel highlighted a common issue in the world manufacture of equipment for use in explosive atmospheres, that is the long lead times for sourcing certified enclosures. Standard lead times in many cases are between 12 and 18 weeks, but it is not uncommon for them to be up to 6 months!

This of course causes big problems to both clients and manufacturers, as these lead times will no doubt cause delays in, for example, starting up production plants. This leads to the client choosing the manufacturer with the shortest lead time.

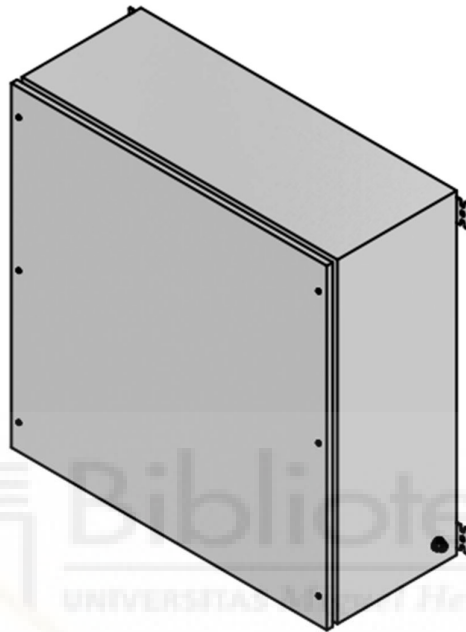
For this reason, more and more manufacturers are deciding to design this type of product themselves and have it certified, solving the sourcing issue. It has to be noted that for this option to be economically viable the manufacturer has to produce and sell a number that will allow them to cover the certification and quality audit costs associated with the certification, as for zone 1 certified equipment there are yearly audits to consider.

In this case, and to allow for flexibility in future projects, the manufacturer decides to design an empty enclosure to have it certified as an Ex Component enclosure for use in zone 1 (EPL Gb and Db) and shall comply with the Directive 2014/34/EU and the standards EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 y EN 60079-31:2014.

It can be seen that for the empty enclosure certification we are also going for dust certification, as this is quite a common requirement and will allow to offer a wider range of products. Adding this to the certification is relatively simple from a technical file point of view as the dust standard isn't particularly long or complex, and only adds a positive pressure test to the certification process.

The empty enclosure will be stainless steel 316L, with overall dimensions of 800mm x 800mm x 330mm (H x Lx D). It will have up to 20 entries provided via a gland plate on the bottom side of the enclosure. Entries will be via plain holes,

and shall be suitable for fitting M20 or M25 cable glands, or a mixture of both. Silicone foam HT-800 gaskets shall be used on the cover and gland plate to maintain an IP66 rating. The gaskets shall be held in place to the cover and gland plate by means of 'Sil-Poxy' adhesive. the enclosure shall be provided with M10 internal and external earth studs:



In the following chapters I proceed to evaluate the empty enclosure for compliance with the Directive and compile its technical file, which is made up of the following parts:

- Equipment summary
- Drawings.
- Conformity checklists.
- Material datasheets.
- Tests requirements.
- Manual.
- EU Declaration of Conformity

## 3.2 EQUIPMENT SUMMARY (APPENDIX 1)

### 3.2.1 TECHNICAL FILE OVERVIEW

This technical file is the basis for certification of the empty enclosure ENC\_V01 as an Ex Component. As the ENC\_V01 is intended for ATEX Category 2 applications, EPLs Gb and Db, certification must be obtained from a Notified Body. The contents of this technical file shall be submitted to the selected Notified Body for review and issue of the ATEX EU-Type certification. A Quality Assurance Notification shall also be obtained from the selected Notified Body

### 3.2.2 MANUFACTURER NAME AND ADDRESS

COMPANY NAME  
ADDRESS LINE 1  
ADDRESS LINE 2  
POST CODE  
COUNTRY

### 3.2.3 PRODUCT NAME AND MODEL NUMBER

Network Interface Control Panel model NICP

### 3.2.4 LEGISLATION AND ASSESSMENT STANDARDS:

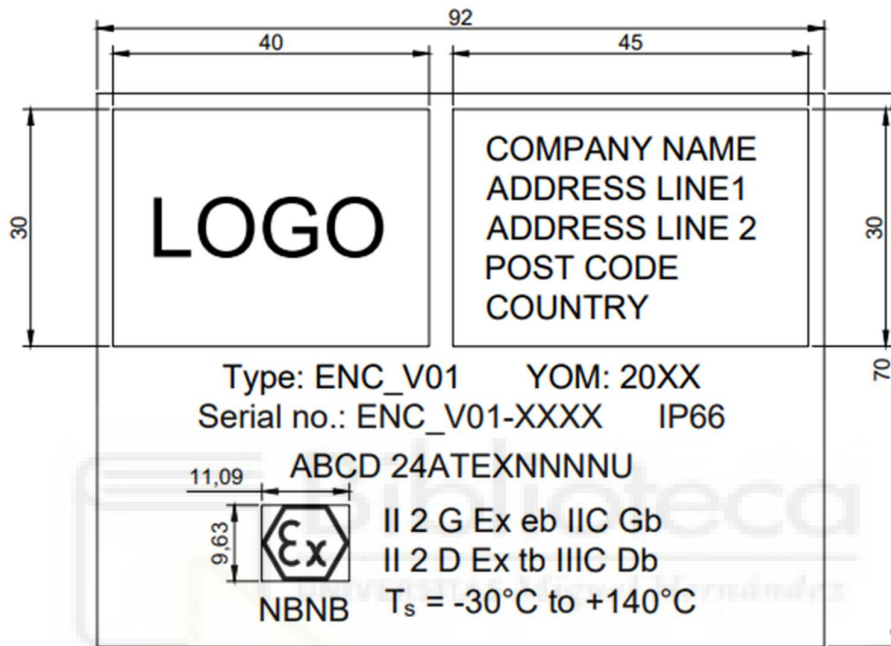
Assessment standards

Directive 2014/34/EU	Equipment and protective systems intended for use in potentially explosive atmospheres
EN IEC 60079-0:2018	Explosive atmospheres - Part 0: Equipment - General requirements
EN IEC 60079-7:2015+A1:2018	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
EN 60079-31:2014	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"

Checklists against the requirements of Annex II of the Directive and of each of the above listed standards have been carried out and are held in the technical file associated with Empty Enclosure model ENC\_V01.

### 3.2.5 MARKING

The ECN\_v01 is internally marked as shown below:



### 3.2.6 PRODUCT DESCRIPTION

The ENC\_V01 is an empty Ex Component enclosure. It consists of an enclosure body and hinged cover and is constructed entirely of stainless steel 316L, and utilises silicone foam gaskets to maintain ingress protection rating of IP66. Its overall dimensions are 800mm x 800mm x 330mm (H x Lx D). Entry into the enclosure is via a stainless steel gland plate provided on the bottom side of the enclosure body. Up to 20 plain holes can be provided, sizes are Ø20.5mm, Ø25.5mm, or a combination of both. External and internal earth facilities are provided by means of M10 studs located on the walls of the enclosure. The ENC\_V01 has four attachment lugs for fixing to a wall, metal frame or similar structure.

### 3.2.7 TECHNICAL DOCUMENTATION

Title	Drawing	Rev.	Date
ENC_V01 – GENERAL ARRANGEMENT	ENC_V01-GA-001	A	17.06.2024
ENC_V01 – OPEN ENCLOSURE	ENC_V01-OE-001	A	17.06.2024
ENC_V01 – ENCLOSURE BODY	ENC_V01-EB-001	A	17.06.2024
ENC_V01 – ENCLOSURE COVER	ENC_V01-EC-001	A	17.06.2024
ENC_V01 – GLAND PLATE	ENC_V01-GP-001	A	17.06.2024
ENC_V01 – COVER GASKET	ENC_V01-CG-001	A	17.06.2024
ENC_V01 – GLAND PLATE GASKET	ENC_V01-GG-001	A	17.06.2024
ENC_V01 – HINGE SUPPORT	ENC_V01-HS-001	A	17.06.2024
ENC_V01 – COVER HINGE	ENC_V01-CH-001	A	17.06.2024
ENC_V01 – MARKING LABEL	ENC_V01-ML-001	A	17.06.2024

### 3.2.8 SCHEDULE OF LIMITATIONS

- Installation of electrical components requires a further assessment by a Notified Body.
- Only suitably certified IP66 rated cable glands and blanking elements shall be used.

It is noted that the Notified Body conducting the certification of the ENC\_V01 may deem necessary additional conditions.

### 3.2.9 CONDITIONS OF MANUFACTURE

- The ENC\_V01 empty enclosure shall only be marked internally.

### **3.2.10 CONCLUSION**

The assessment conducted demonstrates that Empty Enclosure ENC\_V01 meets the requirements of the listed standards and the Directive 2014/34/EU. It is therefore considered that its technical file, along with representative samples, can be submitted for certification to the selected Notified Body.



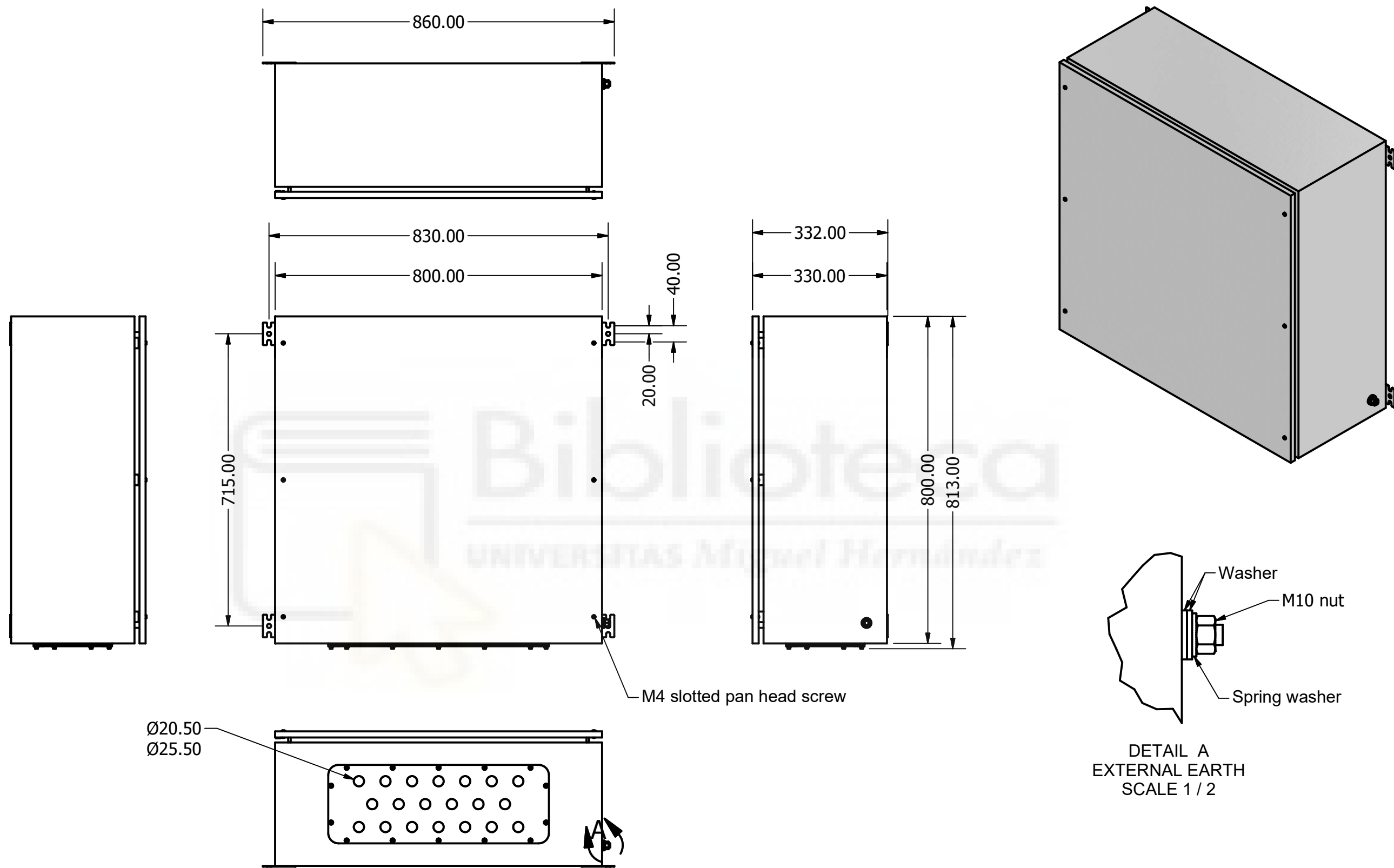


### 3.3 DRAWINGS

Below are the 10 certification drawings that define the characteristics of the ENC\_V01 empty enclosure. These are shown in the following order:

1. ENC\_V01-GA-001: General arrangement drawing.
2. ENC\_V01-OE-001: General arrangement – Open enclosure drawing.
3. ENC\_V01-EB-001: Enclosure body drawing.
4. ENC\_V01-EC-001: Enclosure cover drawing.
5. ENC\_V01-GP-001: Gland plate drawing.
6. ENC\_V01-CG-001: Cover gasket drawing.
7. ENC\_V01-GG-001: Gland plate gasket drawing.
8. ENC\_V01-HS-001: Hinge support drawing.
9. ENC\_V01-CH-001: Cover hinge drawing.
10. ENC\_V01-ML-001: Marking label drawing.



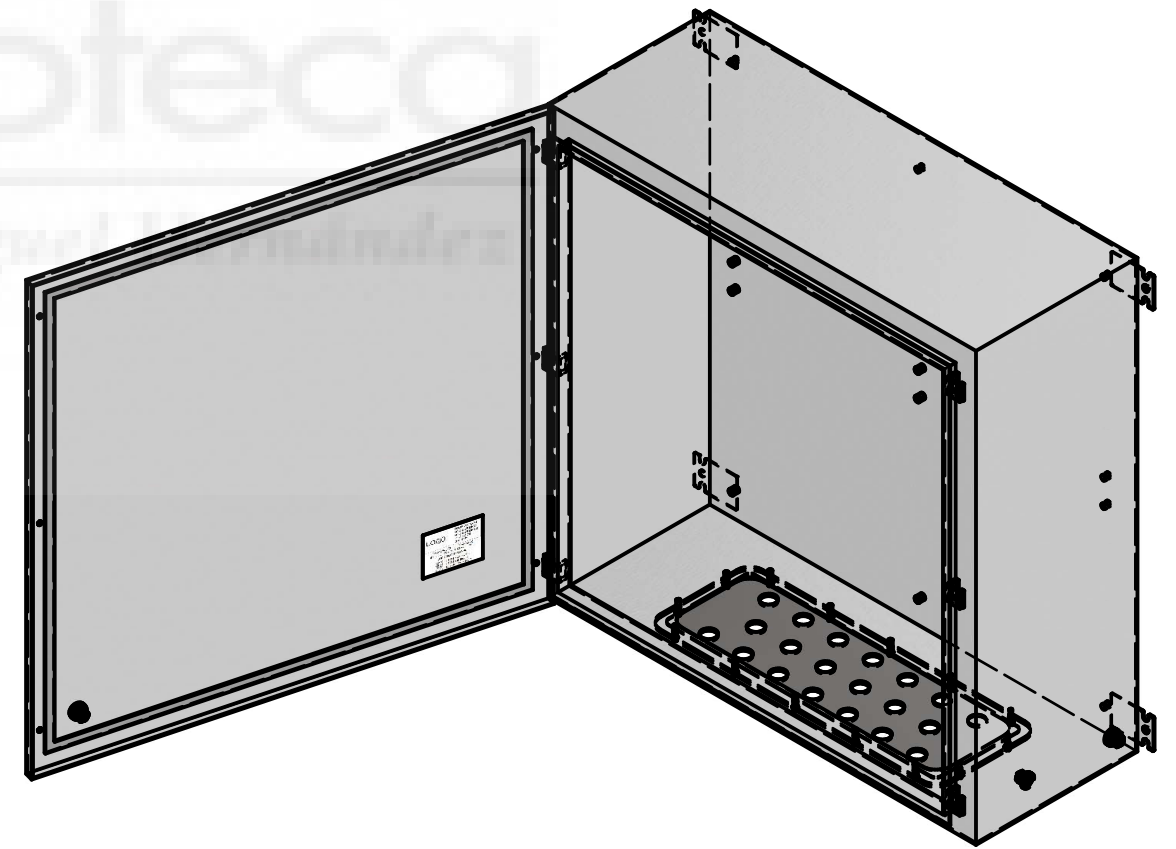
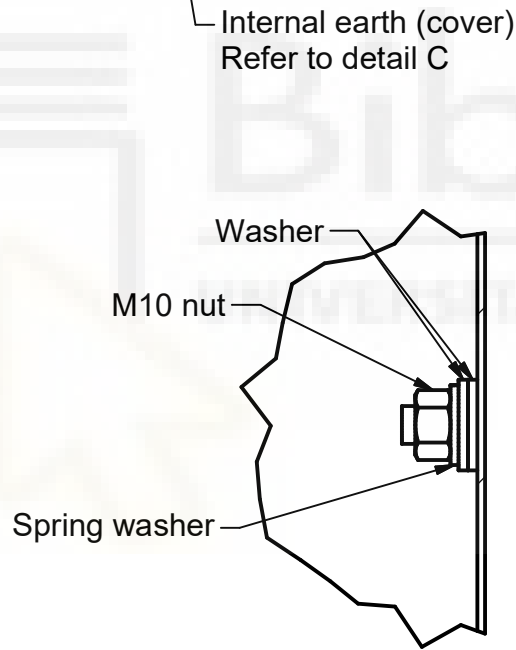
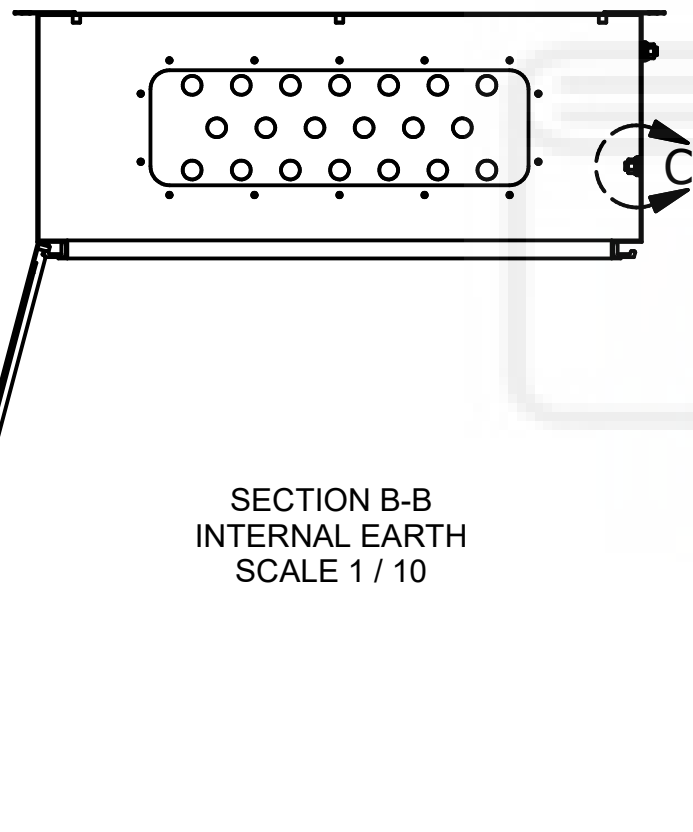
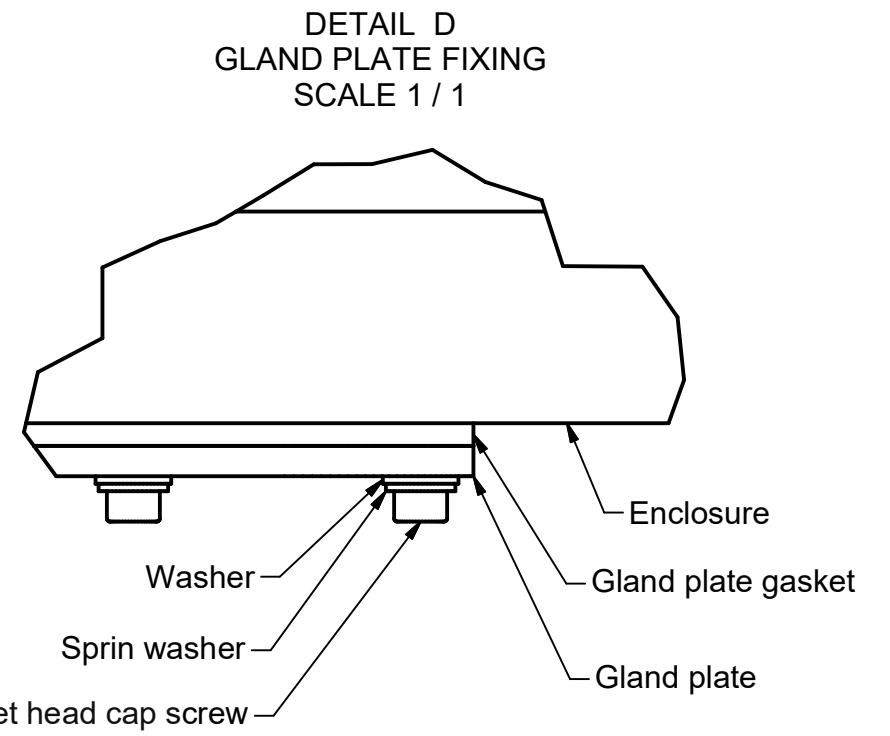
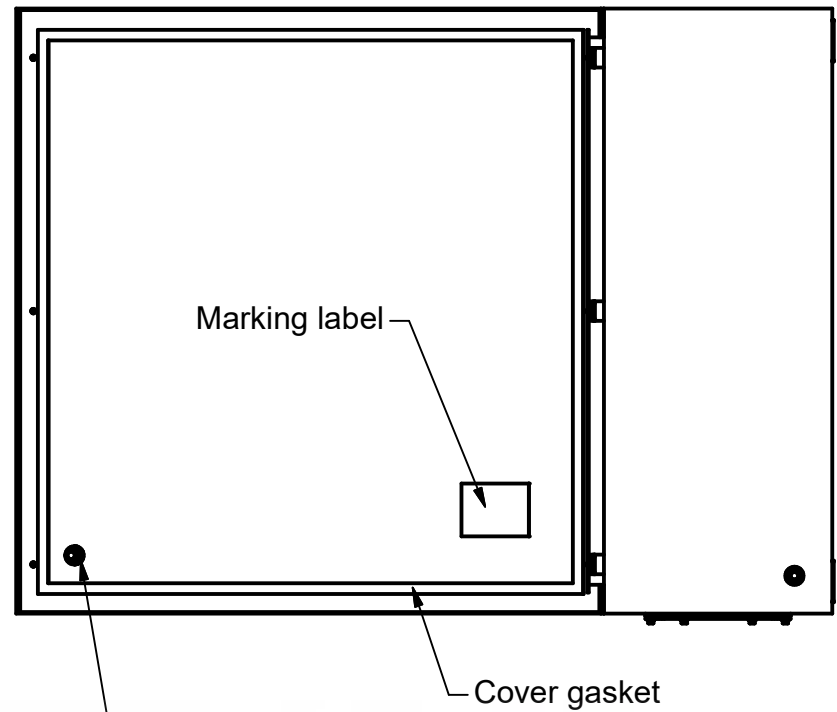
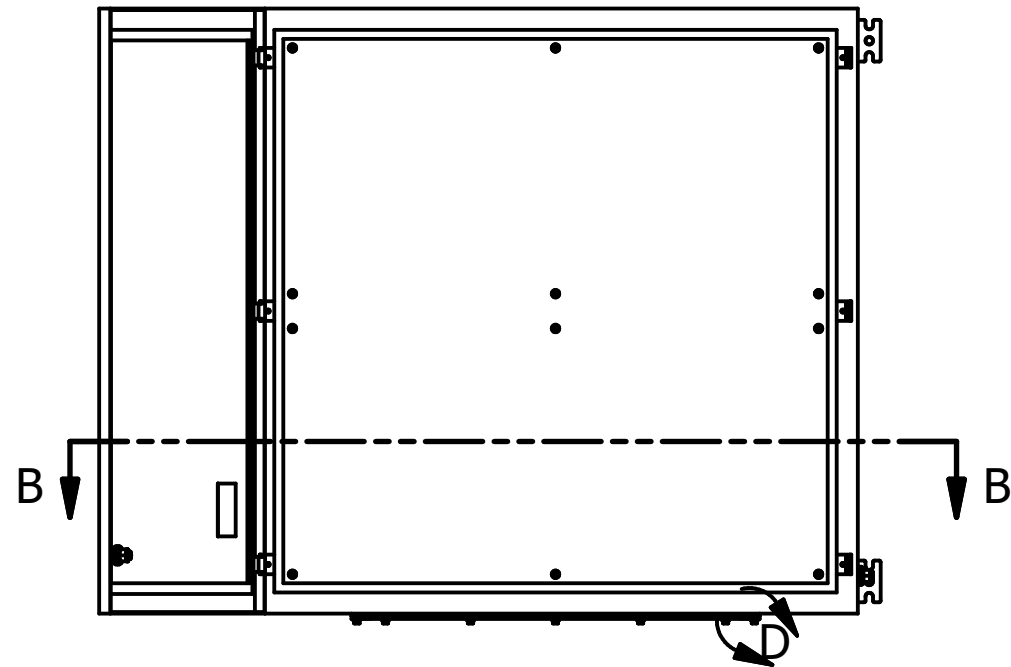


**NOTES:**

1. Tolerance is  $\pm 2.00$  mm on all dimensions unless otherwise stated.
2. All metal parts are stainless steel 316L.
3. All parts contain, by mass, less than 7.5% in total of magnesium, titanium or zirconium.
4. Copper or copper alloys are not used.
5. No paint or coating applied.
6. No markings shall be externally applied.
7. Up to 20 off entries may be provided in the gland plate. Sizes can be  $\text{Ø}20.5\text{mm}$ ,  $\text{Ø}25.5\text{mm}$  or a combination of both.
8. Only suitably certified IP66 rated cable glands and blanking elements shall be used.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection		LOGO	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3	Title: ENC_V01 - GENERAL ARRANGEMENT		
Scale: 1 : 10	Drawing No.: ENC_V01-GA-001	Sheet: 1 OF 1	Rev: A	

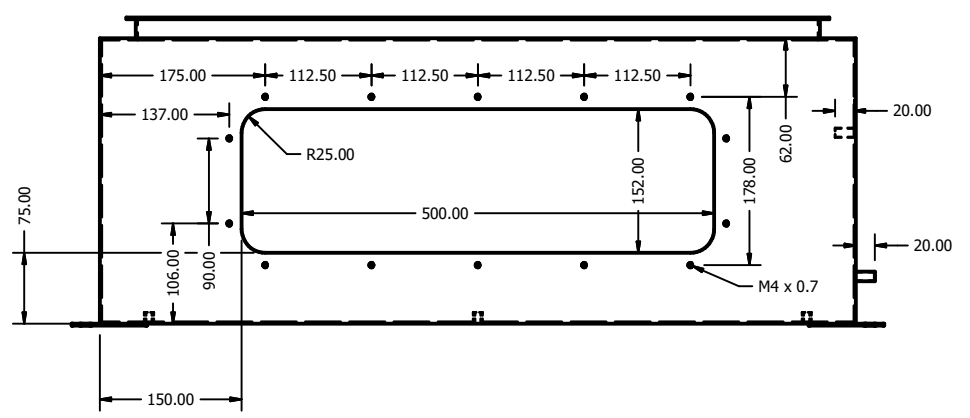
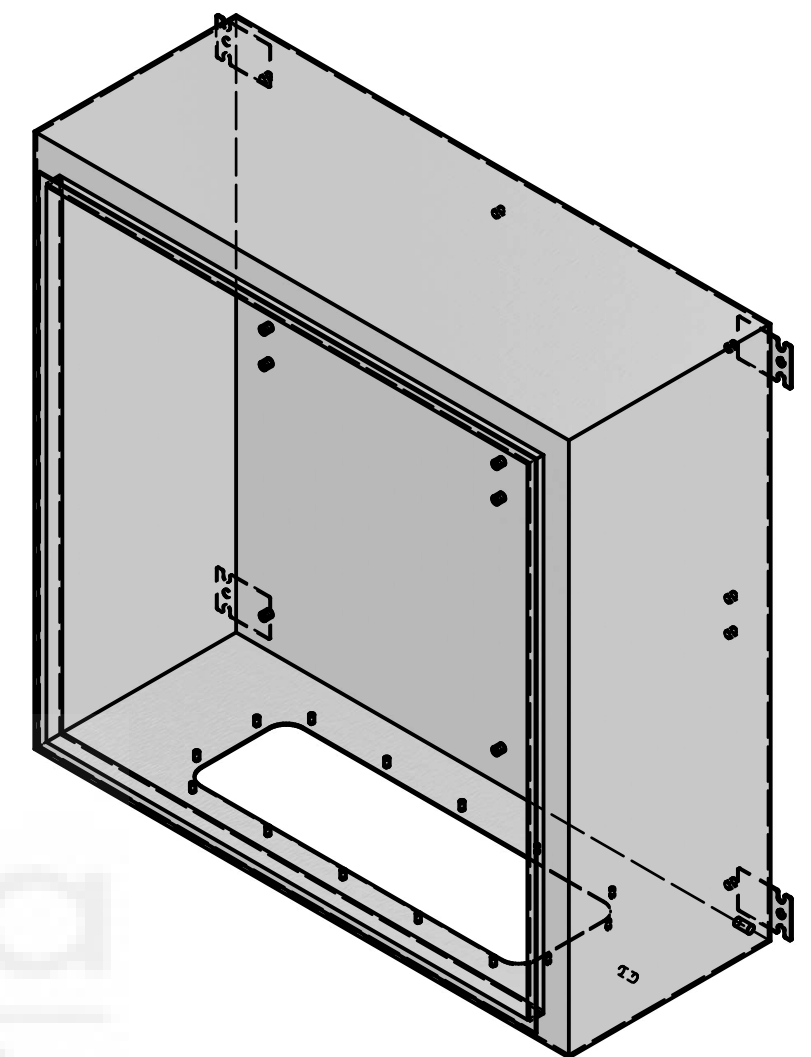
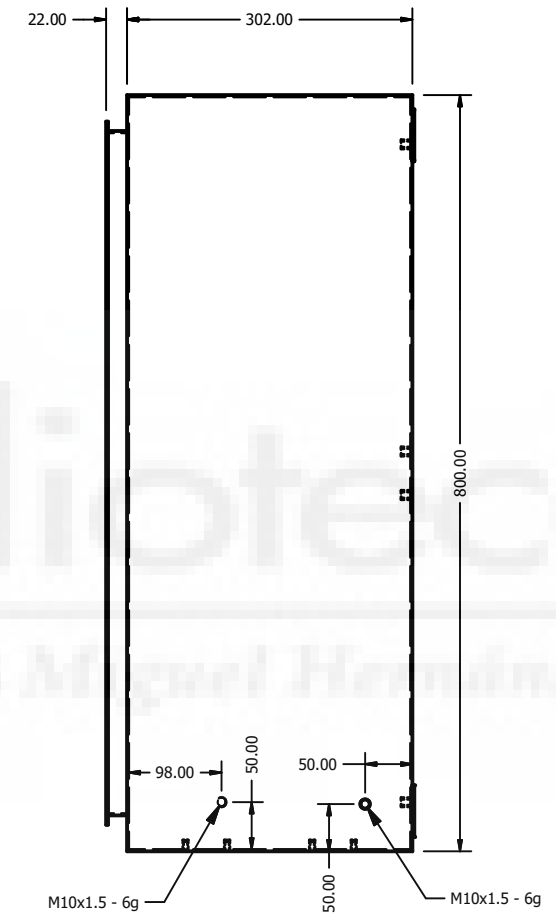
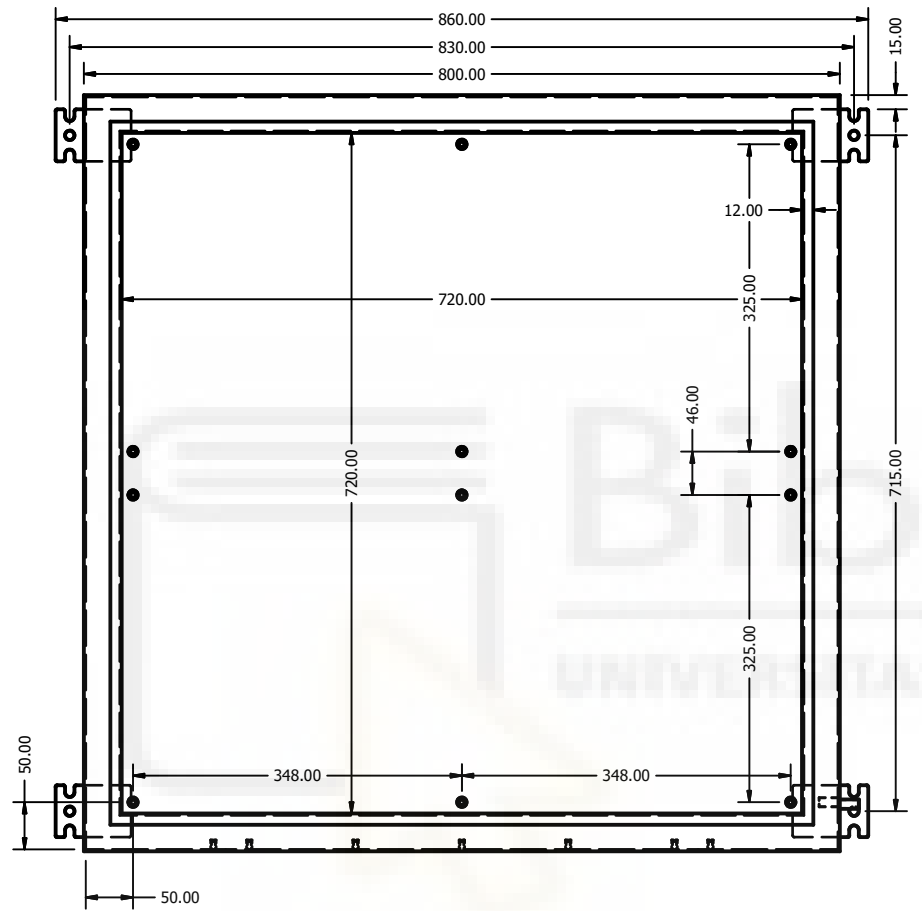
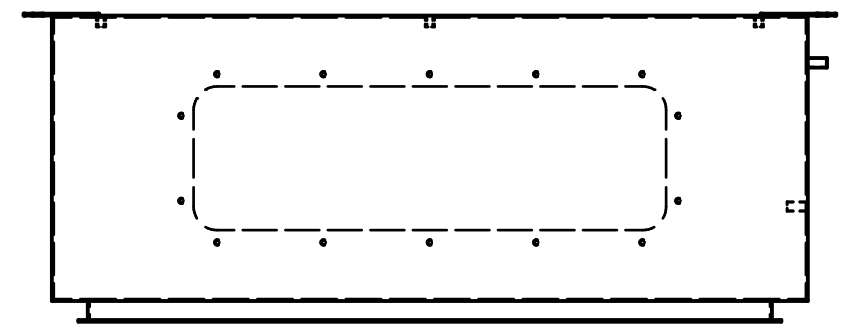
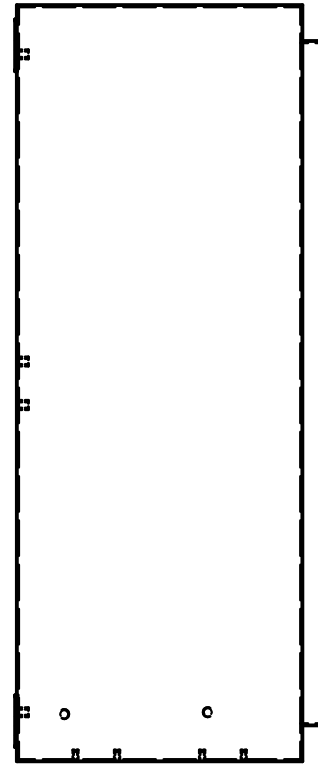


**NOTES:**

1. Cover and gland plate gasket material is HT 800 silicone foam. Refer to drawings ENC\_V01-CG-001 and ENC\_V01-GG-001 for details.
2. The following adhesive is used to secure the gaskets to the cover and gland plate:
  - Name or registered trademark: Smooth-On
  - Identification: Sil-Poxy
  - Continuous operating temperature: -41°C to +260°C
3. Marking label shall only be fitted internally to the cover.

Initial release of drawing	CJGB	JSM	DGA	17.06.2024	
Rev.	Notes	Drawn	Check	Appr.	Date

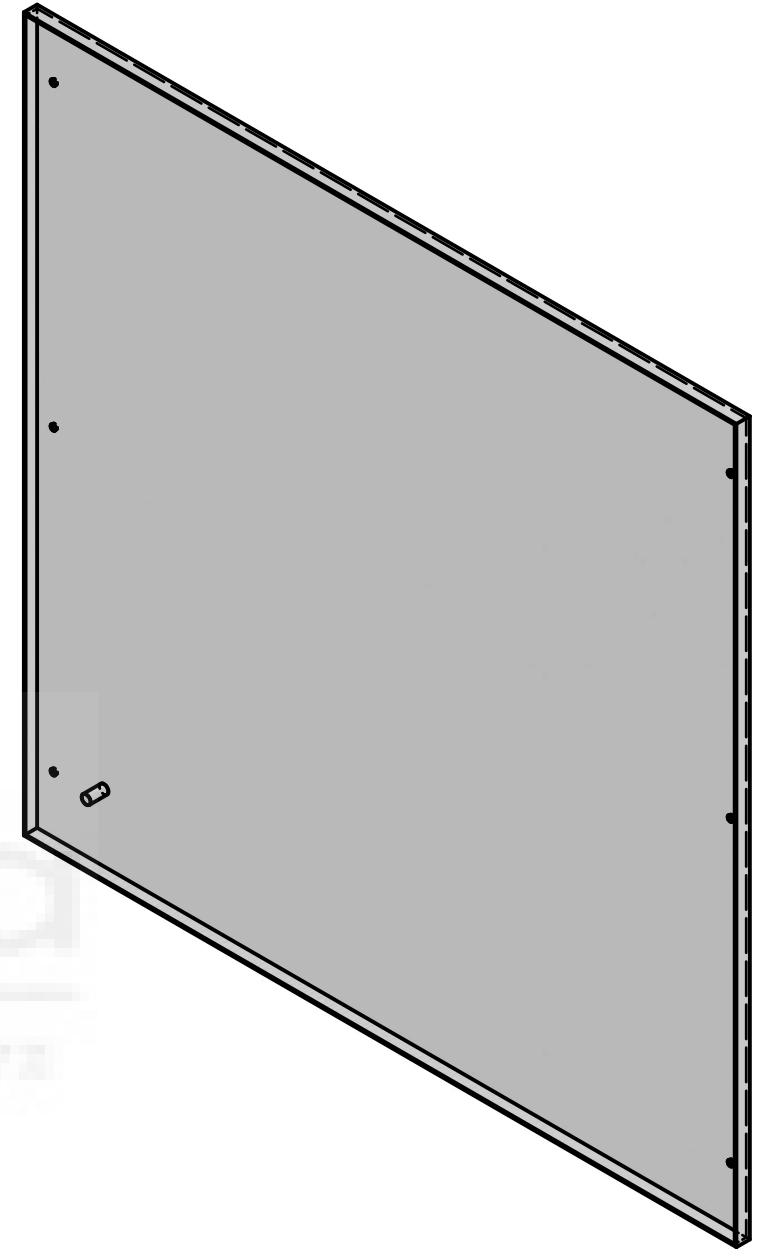
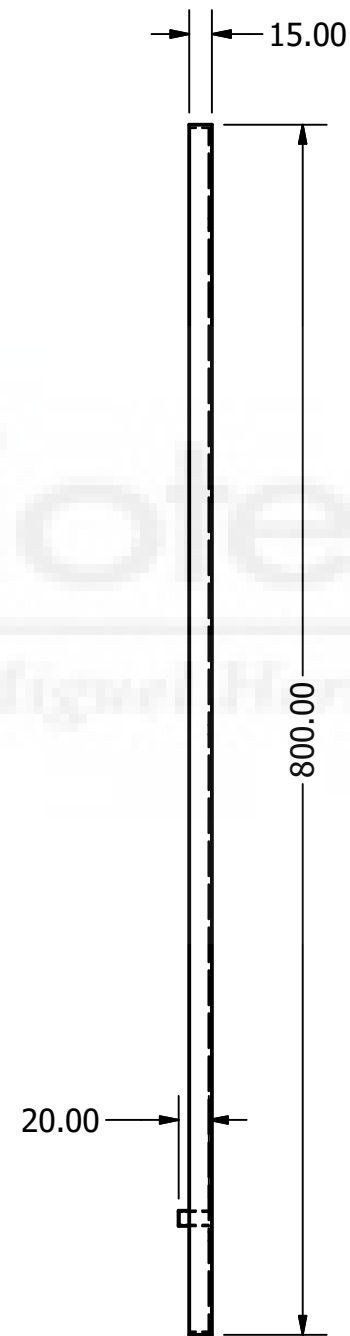
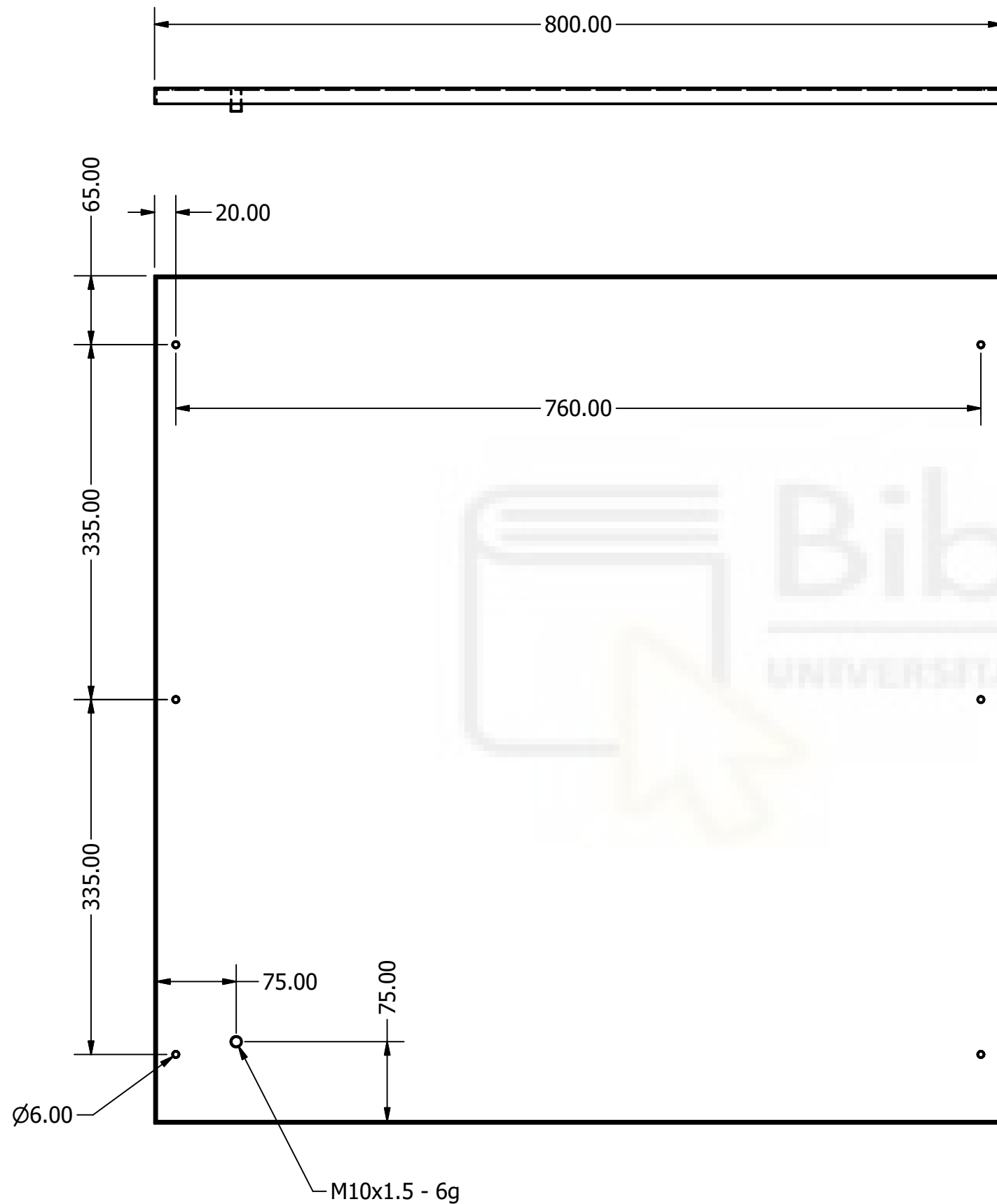
Third angle projection		LOGO	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3	Title: ENC_V01 - OPEN ENCLOSURE		
Scale: 1 : 10	Drawing No.: ENC_V01-OE-001	Sheet: 1 OF 1	Rev: A	



**NOTES:**  
 1. Material is stainless steel 316L, 2 mm thick.  
 2. Remove all burrs and sharp edges.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

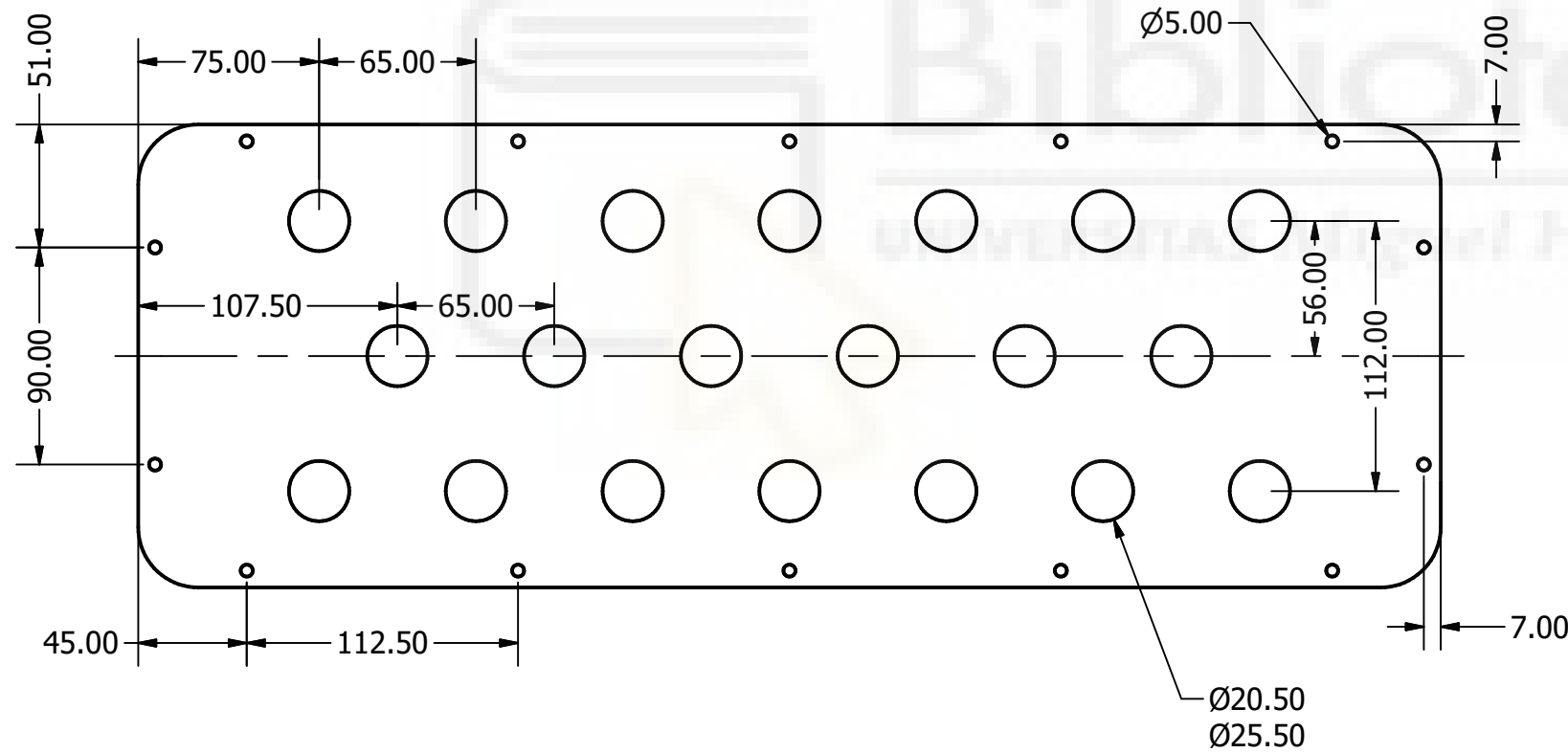
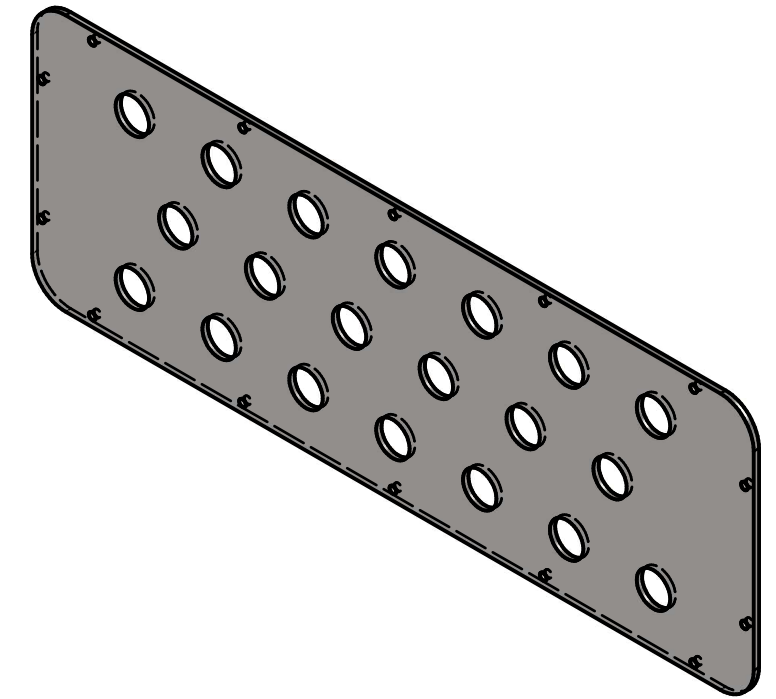
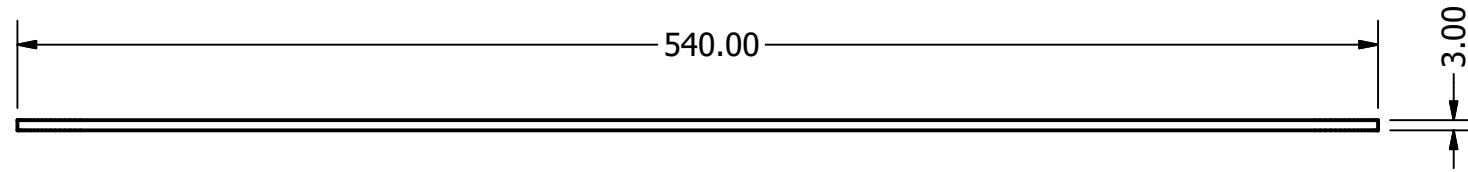
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All dimensions are in mm unless otherwise specified	Paper size: A3	Title: ENC_V01 - ENCLOSURE BODY		
Scale: 1 / 8	Drawing No.: ENC_V01-EB-001	Sheet: 1 OF 1	Rev: A	



- Notes:**
1. Material is stainless steel 316L, 2mm thick.
  2. Remove burrs and sharp edges.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection		LOGO	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: A3	Title: ENC_V01 - ENCLOSURE COVER		
	Scale: 1 / 5	Drawing No.: ENC_V01-EC-001	Sheet: 1 OF 1	Rev: A

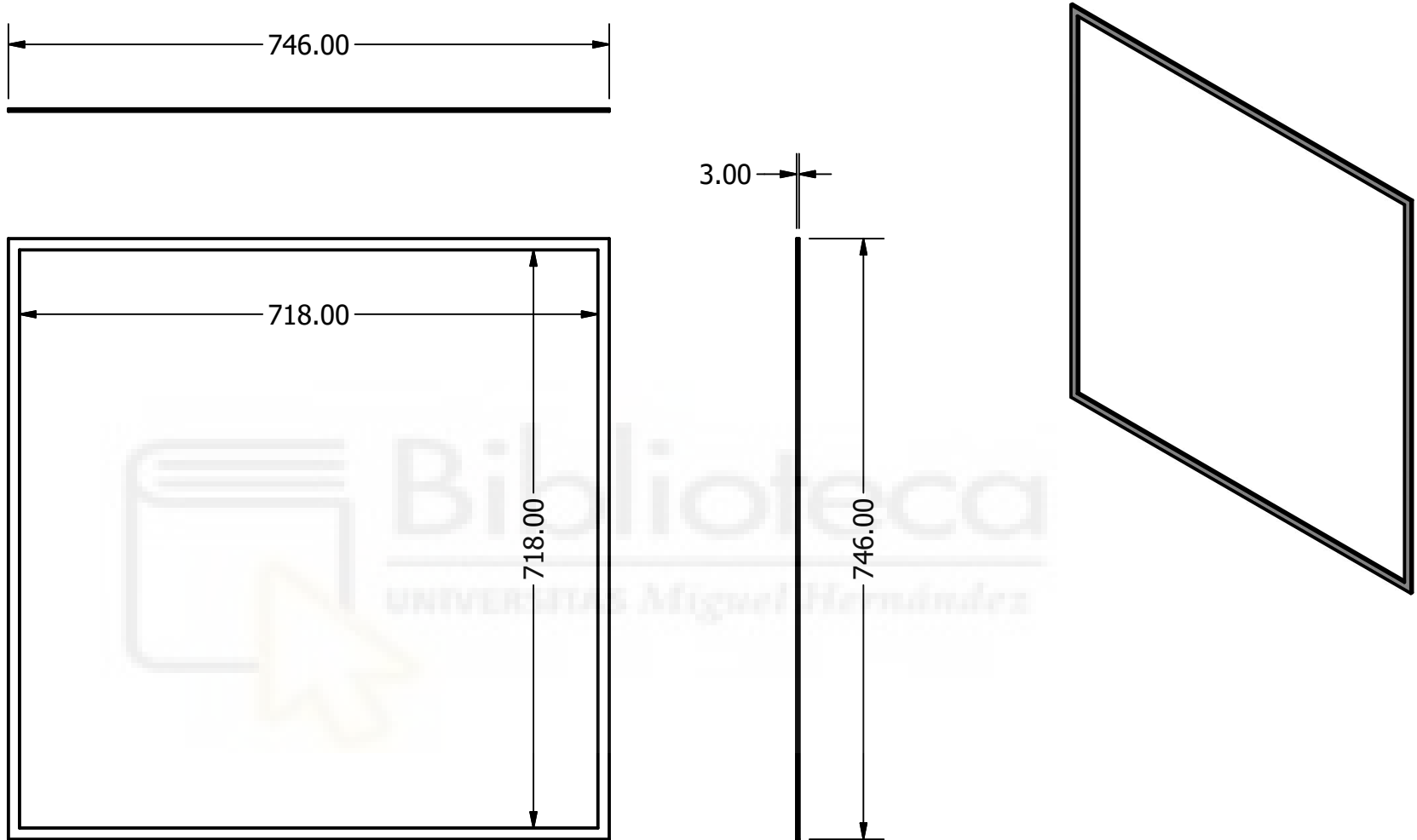


**NOTES:**

1. Material is stainless steel 316L, 3 mm thick.
2. Holes can be Ø20.5mm, Ø25.5mm or a combination of both, up to a maximum of 20 as shown on this drawing.
3. Deburr and remove sharp edges.

Rev.	Notes	Drawn	Check	Appr.	Date
A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024

Third angle projection		LOGO	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: <b>A3</b>	Title: <b>ENC_V01 - GLAND PLATE</b>		
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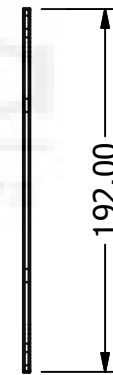
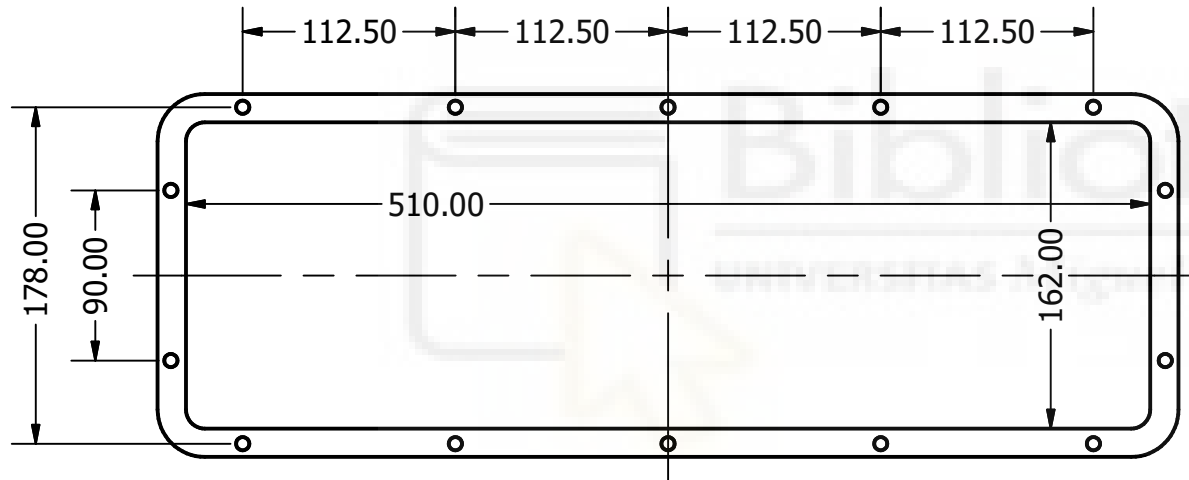
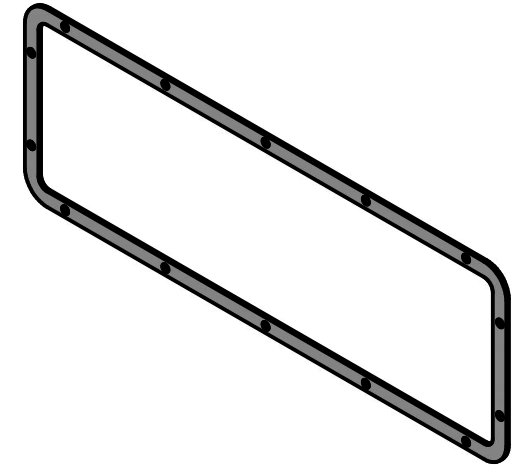
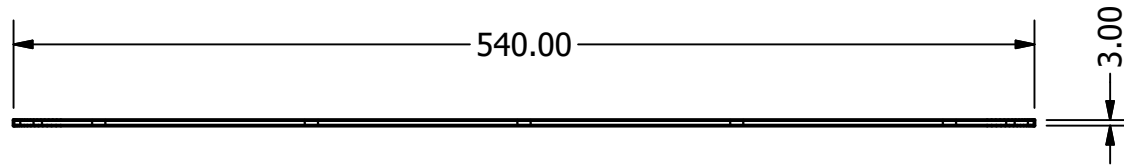


**NOTES:**

- Material specifications are as follows:
  - Mfr. name / registered trademark: Rogers Bisco or RH Nuttall Limited
  - Identification of material: HT 800 grey silicone foam
  - Surface treatments: None
  - COT: -55°C to +200°C
  - UV resistance: N/A, not exposed to light

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection		<b>LOGO</b>	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: <b>A4</b>	Title: <b>ENC_V01 - COVER GASKET</b>		
	Scale: <b>1 / 8</b>	Drawing No.: <b>ENC_V01-CG-001</b>	Sheet: <b>1 OF 1</b>	Rev: <b>A</b>



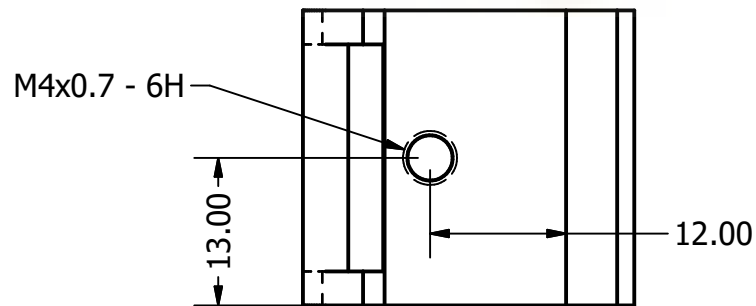
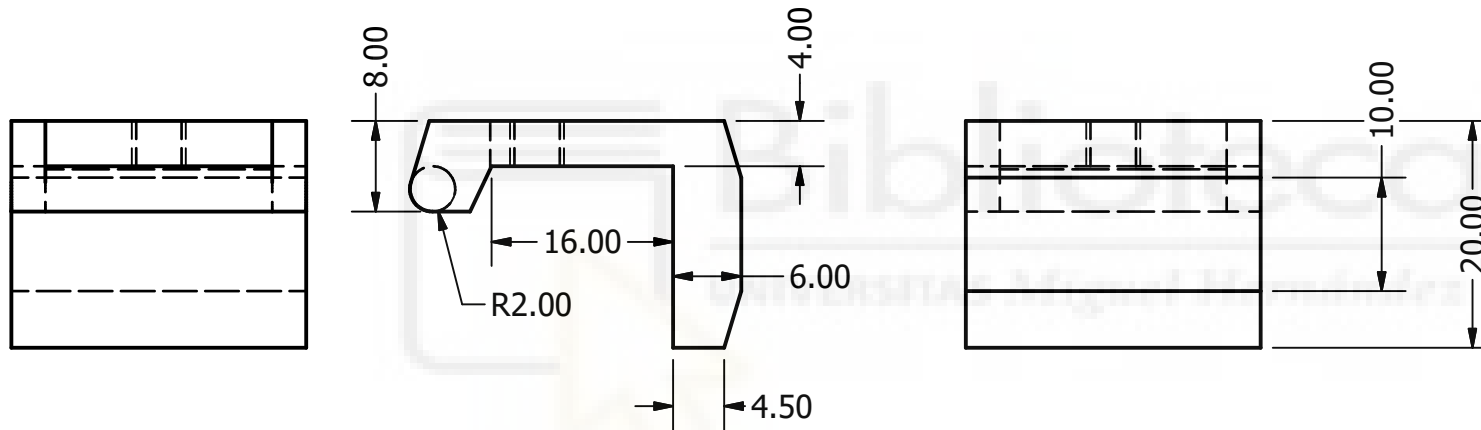
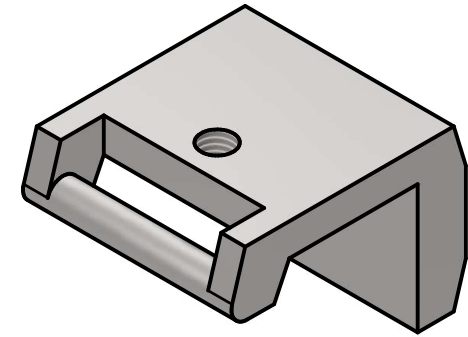
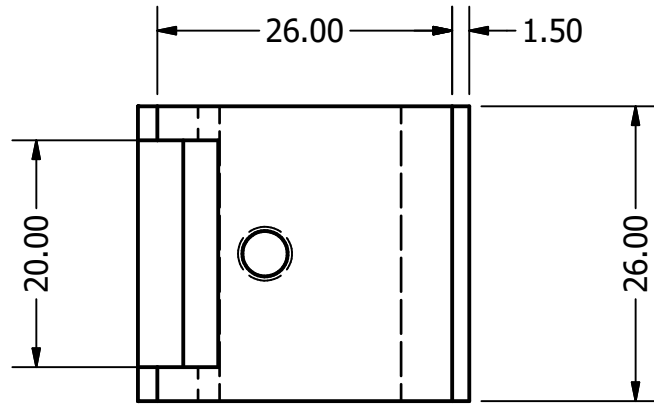
**NOTES:**

- Material specifications are as follows:
  - Mfr. name / registered trademark: Rogers Bisco or RH Nuttall Limited
  - Identification of material: HT 800 grey silicone foam
  - Surface treatments: None
  - COT: -55°C to +200°C
  - UV resistance: N/A, not exposed to light

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection			COMPANY NAME		t: +44 (0)NNNNNNNNNN
			ADDRESS LINE 1		
All dimensions are in mm unless otherwise specified	Paper size: A4	Title: ENC_V01 - GLAND PLATE GASKET		e: email@company.com	
	Scale: 1 : 4	Drawing No.: ENC_V01-GG-001	Sheet: 1 OF 1	Rev: A	

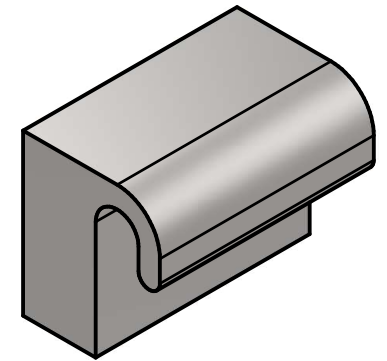
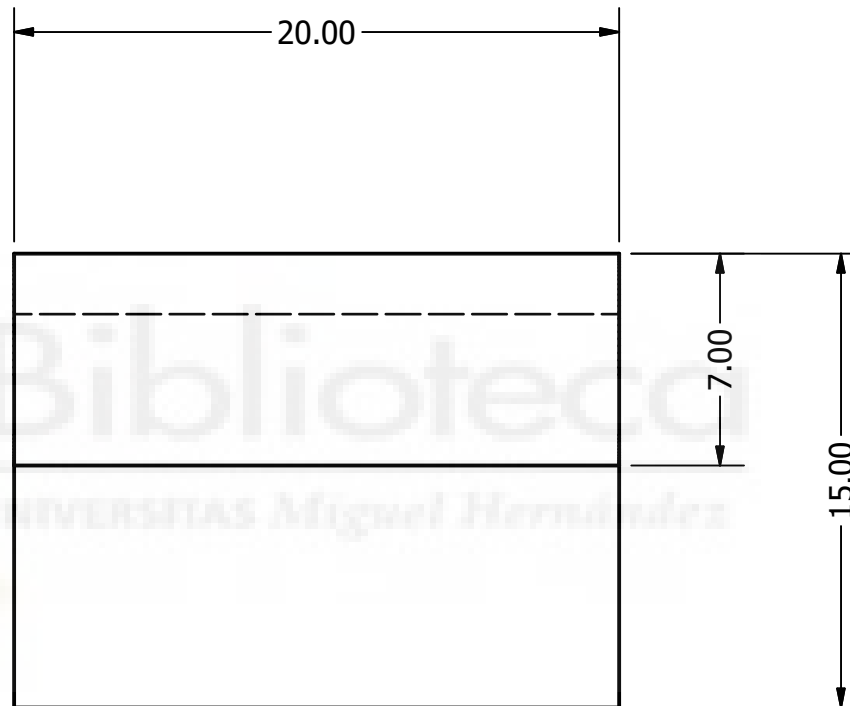
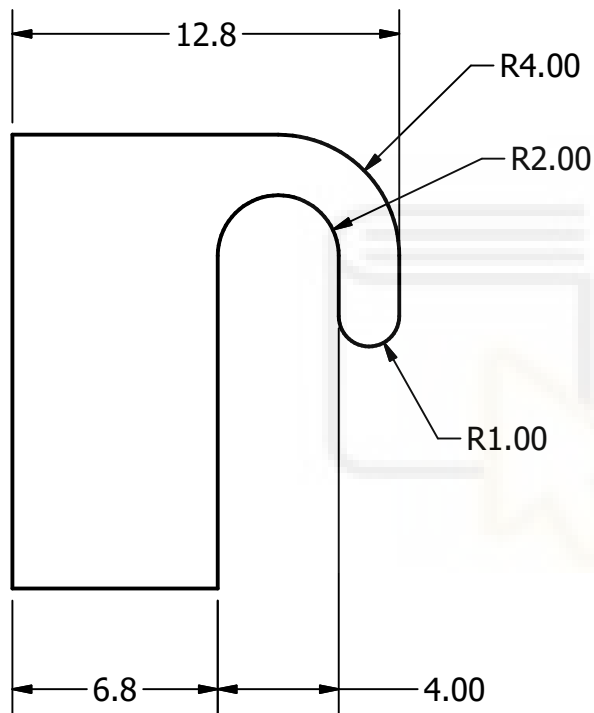




- NOTES:**
1. Material is stainless steel 316L.
  2. Remove burrs and sharp edges.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

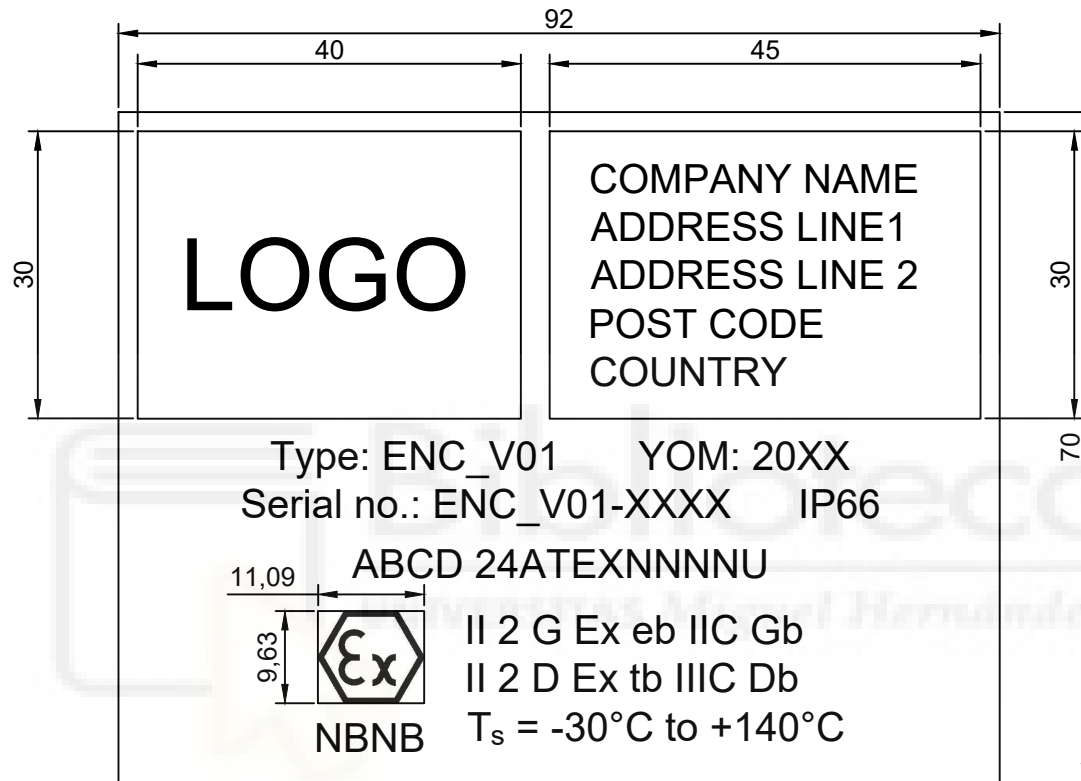
Third angle projection		LOGO	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: <b>A4</b>	Title: <b>ENC_V01 - HINGE SUPPORT</b>		
	Scale: <b>1.5 / 1</b>	Drawing No.: <b>ENC_V01-HS-001</b>	Sheet: <b>1 OF 1</b>	Rev: <b>A</b>



- NOTES:**
1. Material is stainless steel 316L.
  2. Deburr and remove sharp edges.

A	Initial release of drawing	CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date

Third angle projection		<b>LOGO</b>	COMPANY NAME ADDRESS LINE 1 ADDRESS LINE 2	t: +44 (0)NNNNNNNNNN e: email@company.com
All dimensions are in mm unless otherwise specified	Paper size: <b>A4</b>	Title: <b>ENC_V01 - COVER HINGE</b>		
	Scale: <b>4 : 1</b>	Drawing No.: <b>ENC_V01-CH-001</b>	Sheet: <b>1 OF 1</b>	Rev: <b>A</b>



**NOTES**

1. This is a certification drawing. No changes are permitted without approval from the Certification Manager.
2. This marking label shall only be fixed internally on the enclosure cover.
3. Label material: 3M label material 7872 (self-adhesive metalized polyester), 0.178 mm thick.
4. Black lettering on white background. Minimum character height is 3 mm.
5. ABCD 24ATEXNNNNU shall be replaced with the certificate number provided by the Notified Body issuing the certification.
6. NBNB represents the Notified Body number of the Notified Body issuing the QAN.

A		Initial release of drawing		CJGB	JSM	DGA	17.06.2024
Rev.	Notes	Drawn	Check	Appr.	Date		
Third angle projection			COMPANY NAME	ADDRESS LINE 1	t: +44 (0)NNNNNNNNNN		
			ADDRESS LINE 2	e: email@company.com			
All dimensions are in mm unless otherwise specified	Paper size: A4	Title: ENC_V01 - MARKING LABEL					
	Scale: NTS	Drawing No.: ENC_V01-ML-001		Sheet: 1 of 1	Rev: A		

### 3.4 CHECKLISTS

#### 3.4.1 EN IEC 60079-0:2018 CHECKLIST

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
1	Scope		
2	Normative references		
3	Terms and definitions		
4	Equipment grouping		
4.1	General	The enclosure is intended for Group II and Group III applications.	Pass
4.2	Group I	The enclosure is not intended for Group I applications.	N/A
4.3	Group II	The enclosure is intended for Group IIC applications.	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
4.4	Group III	The enclosure is intended for Group IIIC applications.	Pass

4.5	Equipment for a particular explosive gas atmosphere	The enclosure is not intended for use in a particular gas atmosphere.	N/A
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5	Temperatures		
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5.1	Environmental influences		
5.1.1	Ambient temperature	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The ambient temperature shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
5.1.2	External source of heating or cooling	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. External sources of heating or cooling shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

5.2	Service temperature	A service temperature range of -30°C to +140°C has been selected based on experience and on the COTs of the silicone gasket and adhesive.  To be confirmed by test.	TBT
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5.3	Maximum surface temperature		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
5.3.1	Determination of maximum surface temperature	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The maximum surface temperature requirements shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
5.3.2	Limitation of maximum surface temperature		
5.3.2.1	Group I electrical equipment	The enclosure is not intended for Group I applications.	N/A
5.3.2.2	Group II electrical equipment	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The maximum surface temperature requirements shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
5.3.2.3	Group III electrical equipment		
5.3.2.3.1	Maximum surface temperature for EPL Da	The enclosure's EPL is not Da.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
5.3.2.3.2	Maximum surface temperature for EPL Db	The enclosure's EPL is Db. It is being assessed as an Ex Component. The maximum surface temperature requirements shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	
5.3.2.3.3	Maximum surface temperature determined without a layer of dust for EPL Dc	The enclosure's EPL is not Dc.	N/A
5.3.3	Small component temperature for Group I or Group II electrical equipment	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The maximum surface temperature requirements shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A



EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
5.3.4	Component temperature of smooth surfaces for Group I or Group II electrical equipment	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The maximum surface temperature requirements shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

6	Requirements for all electrical equipment
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6.1	General	The enclosure complies with the applicable requirements of this standard, IEC 60079-7 and IEC 60079-31.	Pass
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6.2	Mechanical strength of equipment	The enclosure was subjected to the tests of clause 26.4 with satisfactory results.  <b>To be confirmed by test.</b>	<b>TBT</b>
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<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
6.3	Opening times	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The requirements for opening times shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

6.4	Circulating currents in enclosures (e.g. of large electric machines)	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The requirements for circulating currents shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
6.5	Gasket retention	<p>The degree of protection provided by the enclosure relies on gasketed joints which are intended to be opened during installation (enclosure cover and gland plate).</p> <p>An adhesive is used to hold the gaskets in place. The adhesive complies with the requirements for cements of clause 7.1.2.4 and is used within its COT.</p>	Pass

6.6	Electromagnetic and ultrasonic energy radiating equipment		
6.6.1	General	<p>The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The requirements for electromagnetic and ultrasonic energy radiating equipment shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.</p>	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
6.6.2	Radio frequency sources	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The requirements for radio frequency sources shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
6.6.3	Ultrasonic sources	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The requirements for ultrasonic sources shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
6.6.4	Lasers, luminaires, and other non-divergent continuous wave optical sources	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The requirements for lasers, luminaires or other non-divergent continuous wave optical sources shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

7	Non-metallic enclosures and non-metallic parts of enclosures		
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7.1	General		
7.1.1	Applicability	The requirements of this clause have been applied to the cover and gland plate gaskets and to the adhesive.	Pass
7.1.2	Specification of materials		
7.1.2.1	General	The documents according to clause 24 correctly identify the non-metallic materials on which the type of protection relies upon.	Pass
7.1.2.2	Plastic materials	The enclosure does not comprise plastic materials.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
7.1.2.3	Elastomers	<p>The cover and gland plate gaskets are silicon foam and are therefore classed as an elastomer.</p> <p>a) Manufacturer name or registered trademark: Rogers Bisco or RH Nuttall Limited</p> <p>b) Identification of material: HT 800 grey silicone foam</p> <p>c) Surface treatments: None</p> <p>d) COT: -55°C to +200°C</p> <p>e) UV resistance: N/A, not exposed to light</p> <p>A copy of each datasheet from which the above information has been extracted is held in the ENC_V01's technical file.</p>	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
7.1.2.4	Materials used for cementing	<p>The adhesive used to secure the cover and gland plate gaskets in place is assessed as a cement.</p> <p>d) Name or registered trademark: Smooth-On</p> <p>e) Identification: Sil-Poxy</p> <p>f) Continuous operating temperature: -41°C to +260°C</p> <p>A copy of the adhesive datasheet from which the above information has been extracted is held in the ENC_V01's technical file.</p>	Pass

7.2	Thermal endurance		
7.2.1	Tests for thermal endurance	<p>Tests for thermal endurance are required to verify the suitability of the gasket material and adhesive. These shall be conducted in accordance with clauses 26.8 and 26.9.</p>	TBT

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
7.2.2	Material selection	<p>The silicone foam gasket material and the adhesive have a minimum continuous operating temperature of -55°C and -41°C respectively. These are below the ENC_V01's minimum service temperature of -30°C.</p> <p>The silicone foam gasket material and the adhesive have a maximum continuous operating temperature of +200°C and +260°C respectively. These exceed the ENC_V01 maximum service temperature of +140°C by more than the required 20K.</p>	Pass
7.2.3	Alternative qualification of elastomeric sealing O-rings	Alternative qualification of elastomeric sealing O-rings relaxation is not applied to the gaskets used by the enclosure.	N/A

7.3	Resistance to ultraviolet light	<p>The cover gasket is not exposed to light.</p> <p>Only the outer edge of the gland plate gasket is exposed to light, therefore the ultraviolet light requirements are not applicable.</p>	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

7.4	Electrostatic charges on external non-metallic materials		
7.4.1	Applicability	The ENC_V01 has no external non-metallic parts or coatings. It is an unpainted stainless steel box.	N/A
7.4.2	Avoidance of a build-up of electrostatic charge for Group I or Group II	See clause 7.4.1.	N/A
7.4.3	Avoidance of a build-up of electrostatic charge for Group III	See clause 7.4.1.	N/A

7.5	Attached external conductive parts	The enclosure is metallic.	N/A
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8	Metallic enclosures and metallic parts of enclosures		
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8.1	Material composition	The documents according to clause 24 specify the material of construction of the enclosure.	Pass
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<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
8.2	Group I	The enclosure is not intended for Group I applications.	N/A

8.3	Group II	<p>The enclosure is intended for EPL Gb and is constructed of stainless steel 316L, which does not contain, by mass, more than 7.5% in total of magnesium, titanium or zirconium.</p> <p>A copy of the stainless steel datasheet is held in the enclosure's technical file.</p>	Pass
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8.4	Group III	<p>The enclosure is intended for EPL Db and is constructed of stainless steel 316L, which does not contain, by mass, more than 7.5% in total of magnesium, titanium or zirconium.</p> <p>A copy of the stainless steel datasheet is held in the enclosure's technical file.</p>	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
8.5	Copper Alloys	The enclosure is intended for gas group IIC applications and is constructed of stainless steel 316L. Its copper content is therefore below the 65% limit stipulated by this clause.	Pass

9	Fasteners		
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9.1	General	The enclosure cover and gland plate may only be released with the aid of a tool. Stainless steel screws are used, which are compatible with the enclosure material.	Pass
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9.2	Special fasteners	Special fasteners are not required by the types of protection applied (increased safety and dust protection by enclosure).	N/A
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9.3	Holes for special fasteners		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
9.3.1	Thread engagement	Special fasteners are not required by the types of protection applied (increased safety and dust protection by enclosure).	N/A
9.3.2	Tolerance and clearance	Special fasteners are not required by the types of protection applied (increased safety and dust protection by enclosure).	N/A

9.4	Hexagon socket set screws	The cover is not threaded, therefore this clause does not apply.	N/A
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10	Interlocking devices	Interlocking devices are not used.	N/A
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11	Bushings	Bushings are not used.	N/A
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12	(Reserved for future use)		
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13	Ex Components		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
13.1	General	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. It meets the requirements given in Annex B of this standard.	Pass

13.2	Mounting	The product being assessed is an empty enclosure, therefore the requirements of this clause do not apply to it.	N/A
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13.3	Internal mounting	The product under evaluation is being assessed as an empty enclosure, therefore the requirements of this clause do not apply to it.	N/A
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13.4	External mounting	The product under evaluation is being assessed as an empty enclosure, therefore the requirements of this clause do not apply to it.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
13.5	Ex Component certificate	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. A “U” suffix and a schedule of limitations shall be applied to its certificate to specify specific conditions of use.	Pass

14	Connection facilities		
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14.1	General	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. Connection facilities shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
14.2	Type of protection	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. Connection facilities shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

14.3	Creepage and clearance	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. Connection facilities shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A
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15	Connection facilities for earthing or bonding conductors		
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15.1	Equipment requiring earthing or bonding		
15.1.1	Internal earthing	A connection facility for the connection of an earthing conductor is provided inside the enclosure.	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
15.1.2	External bonding	An external connection facility for an equipotential bonding conductor is provided on the enclosure. It is electrically in contact with the internal earthing of clause 15.1.1 via the metallic enclosure wall.	Pass

15.2	Equipment not requiring earthing	The enclosure requires earthing.	N/A
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15.3	Size of protective earthing conductor connection	The internal earth conductor connection facility is M10, which allows for effective connection of at least one conductor as per table 12 of this standard.	Pass
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15.4	Size of equipotential bonding conductor connection	The external connection for equipotential bonding is M10 and is therefore suitable for the connection of a conductor with a cross sectional area of at least 4mm <sup>2</sup> .	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
15.5	Protection against corrosion	The connection facilities are stainless steel 3161L and are therefore considered to be suitably protected against corrosion.	Pass
15.6	Secureness of electrical connections	A stainless steel spring washer is used to apply tension and prevent loosening of the nut.	Pass
15.7	Internal earth continuity plate	The enclosure is metallic, an internal earth continuity plate is not required.	N/A
16	Entries into enclosures		
16.1	General	Entries into the enclosure are via plane holes located on a gland plate fitted to the bottom side of the enclosure.	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
16.2	Identification of entries	<p>The documents according to clause 24 adequately specify the entries, their position and the maximum number permitted.</p> <p>20mm or 25mm diameter holes, or a combination of both, are permitted up to a maximum of 20 in total as shown on general arrangement drawing ENC_V01-GA-001.</p>	Pass
16.3	Cable glands	Only suitably certified IP66 cable glands are to be used. A schedule of limitation applies to this effect.	Pass
16.4	Blanking elements	Only suitably certified IP66 blanking elements are to be used. A schedule of limitation applies to this effect.	Pass
16.5	Thread adapters	Thread adaptors are not used.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
16.6	Temperature at branching point and entry point	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The temperature at branching point and entry point shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

16.7	Electrostatic charges of cable sheaths	Informative only.	-
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17	Supplementary requirements for electric machines		
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17.1	General	The product under evaluation is not an electric machine.	N/A
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17.2	Ventilation		
17.2.1	Ventilation openings	See clause 17.1.	N/A
17.2.2	Materials for external fans	See clause 17.1.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
17.2.3	Cooling fans of rotating electric machines	See clause 17.1.	N/A
17.2.3.1	Fans and fan hoods	See clause 17.1.	N/A
17.2.3.2	Construction and mounting of the ventilating systems	See clause 17.1.	N/A
17.2.3.3	Clearances for the ventilating system	See clause 17.1.	N/A
17.2.4	Auxiliary motor cooling fans	See clause 17.1.	N/A
17.2.5	Room ventilating fans		
17.2.5.1	Applicability	See clause 17.1.	N/A
17.2.5.2	General	See clause 17.1.	N/A
17.2.5.3	Fan and fan hoods	See clause 17.1.	N/A
17.2.5.4	Construction and mounting	See clause 17.1.	N/A
17.2.5.5	Clearances for rotating parts	See clause 17.1.	N/A
17.3	Bearings	See clause 17.1.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
18	Supplementary requirements for switchgear		
18.1	Flammable dielectric	The product under evaluation is not switchgear.	N/A
18.2	Disconnectors	See clause 18.1.	N/A
18.3	Group I – Provisions for locking	See clause 18.1.	N/A
18.4	Doors and covers	See clause 18.1.	N/A
19	Reserved for future use		
20	Supplementary requirements for external plugs, socket outlets and connectors for field wiring connection		
20.1	General	The product under evaluation is not a plug, socket outlet or connector for field wiring connection.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
20.2	Explosive gas atmospheres	See clause 20.1.	N/A
20.3	Explosive dust atmospheres	See clause 20.1.	N/A
20.4	Energized plugs	See clause 20.1.	N/A
21	Supplementary requirements for luminaires		
21.1	General	The product under evaluation is not a luminaire.	N/A
21.2	Covers for luminaires of EPL Mb, EPL Gb, or EPL Db	See clause 21.1.	N/A
21.3	Covers for luminaires of EPL Gc or EPL Dc	See clause 21.1.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
21.4	Sodium lamps	See clause 21.1.	N/A

22	Supplementary requirements for caplights and handlights		
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22.1	Group I caplights	The product under evaluation is not a caplight or handlight.	N/A
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22.2	Group II and Group III caplights and handlights	See clause 22.1.	N/A
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23	Equipment incorporating cells and batteries		
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23.1	General	The product under evaluation does not contain cells or batteries.	N/SA
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23.2	Interconnection of cells to form batteries	See clause 23.1.	N/A
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23.3	Cell types	See clause 23.1.	N/A
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<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
23.4	Cells in a battery	See clause 23.1.	N/A
23.5	Ratings of batteries	See clause 23.1.	N/A
23.6	Interchangeability	See clause 23.1.	N/A
23.7	Charging of primary batteries	See clause 23.1.	N/A
23.8	Leakage	See clause 23.1.	N/A
23.9	Connections	See clause 23.1.	N/A
23.10	Orientation	See clause 23.1.	N/A
23.11	Replacement of cells or batteries	See clause 23.1.	N/A



EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
23.12	Replaceable battery pack	See clause 23.1.	N/A

24	Documentation	The documents prepared give a full and correct specification of the explosion safety aspects of the Ex Component enclosure. Refer to appendix 1 of the ENC_V01's technical file for list of documents.	Pass
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25	Compliance of prototype or sample with documents	The samples provided for testing have been manufactured according to the documents referred to in clause 24.	Pass
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26	Type tests		
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26.1	General	Four samples are required for testing.	Pass
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26.2	Test configuration	Tests will be performed in the most unfavourable configuration.	Pass
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.3	Tests in explosive test mixtures	Tests in explosive gas mixtures are not required.	N/A

26.4	Tests of enclosures		
26.4.1	Order of tests		
26.4.1.1	Metallic enclosures, metallic parts of enclosures and glass parts of enclosures	<p>The following tests are required:</p> <ul style="list-style-type: none"> <li>- Thermal conditioning to hot and cold.</li> <li>- Impact at hot and cold.</li> <li>- Pressure test of EN 60079-31.</li> <li>- Ingress protection, target is IP66.</li> </ul>	Pass
26.4.1.2	Non-metallic enclosures or non-metallic parts of enclosures		
26.4.1.2.1	General	The ENC_V01 incorporates non-metallic parts on which the type of protection relies upon. The orders of tests specified by this clause, and modified as per EN 60079-31, has been followed.	Pass
26.4.1.2.2	Group I equipment	The product under evaluation is not intended for Group I applications.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.4.1.2. 3	Group II and Group III equipment	<p>All four samples shall be subjected to the thermal endurance tests.</p> <p>Two samples shall then be subjected to impact tests at the upper test temperature, and the other two samples shall be subjected to impact tests at the lower test temperature.</p> <p>The enclosure cover and gland plate shall be opened and re-closed.</p> <p>Subsequently, all four samples shall be subjected to the pressure test of EM 60079-31 and to the tests of degree of protection.</p>	Pass
26.4.2	Resistance to impact	<p>Resistance to impact shall be carried out at the following test temperatures:</p> <ul style="list-style-type: none"> <li>- Upper temperature: +150°C to +155°C.</li> <li>- Lower temperature: -35°C to -40°C.</li> </ul> <p>Each sample shall be subject to two 7J impacts. Impact locations shall be selected by the notified Body conducting the certification.</p>	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.4.3	Drop test	The product under evaluation is not portable or hand-held.	N/A
26.4.4	Acceptance criteria	Tests shall be satisfactory if no damage that invalidates the type of protection is observed on the samples.  To be confirmed by test.	TBT
26.4.5	Degree of protection (IP) by enclosures		
26.4.5.1	Test procedure	Test to be performed in accordance with EN 60529:1992+A2:2013.	Pass
26.4.5.2	Acceptance criteria	Tests shall be satisfactory if no ingress of dust or water is observed in the samples.  To be confirmed by test.	TBT

26.5	Thermal tests		
26.5.1	Temperature measurement		
26.5.1.1	General	The product under evaluation is an empty enclosure being evaluated as an Ex Component, therefore thermal tests are not required as indicated in annex B.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
26.5.1.2	Service temperature	See clause 26.5.1.1	N/A
26.5.1.3	Maximum surface temperature	See clause 26.5.1.1	N/A
26.5.2	Thermal shock test	See clause 26.5.1.1	N/A
26.5.3	Small component ignition test (Group I and Group II)		
26.5.3.1	General	The product under evaluation is not considered a small component.	N/A
26.5.3.2	Procedure	See clause 26.5.3.1.	N/A
26.5.3.3	Acceptance criteria	See clause 26.5.3.1.	N/A

26.6	Torque test for bushings		
26.6.1	Test procedure	The product under evaluation is not a bushing.	N/A
26.6.2	Acceptance criteria	See clause 26.6.1.	N/A

26.7	Non-metallic enclosures or non-metallic parts of enclosures		
26.7.1	General	The applicable tests of 26.8 to 26.15 have been conducted.	Pass

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.7.2	Test temperatures	<p>The following test temperature have been applied:</p> <ul style="list-style-type: none"> <li>- Upper temperature: +150°C to +155°C.</li> <li>- Lower temperature: -35°C to -40°C.</li> </ul>	Pass

26.8	Thermal endurance to heat	<p>All four samples shall be subjected to 504<sub>0</sub><sup>+30</sup> h at (90 ± 5)% RH at (90 ± 2)°C followed by 336<sub>0</sub><sup>+30</sup> h dry at 160°C ± 2K.</p> <p>At the conclusion the four samples shall be subjected to (20 ± 2)°C at between (50 ± 10)% relative humidity for 24<sub>0</sub><sup>+48</sup> h.</p> <p>To be confirmed by test.</p>	TBT
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26.9	Thermal endurance to cold	<p>All four samples shall be subjected to 24<sub>0</sub><sup>+2</sup> h at between -35°C to -40°C.</p> <p>To be confirmed by test.</p>	TBT
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26.10	Resistance to UV light		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.10.1	General	There are no non-metallic parts on which the type of protection relies upon exposed to light see clause 7.3.	N/A
26.10.2	Light exposure	See clause 26.10.1.	N/A
26.10.3	Acceptance criteria	See clause 26.10.1.	N/A

26.11	Resistance to chemical agents for Group I equipment	The product under evaluation is not intended for Group I applications.	N/A
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26.12	Earth continuity	The enclosure is metallic, therefore this test is not required.	N/A
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26.13	Surface resistance test of parts of enclosures of non-metallic materials	The enclosure is metallic, therefore this test is not required.	N/A
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26.14	Measurement of capacitance		
26.14.1	General	The enclosure is metallic, therefore this test is not required.	N/A

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
26.14.2	Test procedure	See clause 26.14.1.	N/A

26.15	Verification of ratings of ventilating fans	The product under evaluation is not a ventilating fan.	N/A
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26.16	Alternative qualification of elastomeric sealing O-rings	Alternative qualification of elastomeric sealing O-rings method not applied.	N/A
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26.17	Transferred charge test		
26.17.1	Test equipment	The enclosure is metallic, therefore this test is not required.	N/A
26.17.2	Test sample	See clause 26.17.1.	N/A
26.17.3	Test procedure	See clause 26.17.1.	N/A

27	Routine tests	Routine tests are not required on the product under evaluation by any of the standards applied.	N/A
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28	Manufacturer's responsibility		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict

28.1	Conformity with the documentation	The manufacturer shall carry out the appropriate verifications as required by this clause.	Pass
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28.2	Certificate	Certificate to be prepared by the appropriate Certification/Notified Body under manufacturer's instructions.	Pass
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28.3	Responsibility for marking	The manufacturer is aware of their responsibility for marking.	Pass
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29	Marking		
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29.1	Applicability	The product under evaluation complies with the applicable standards for the types of protection listed in Clause 1 and is marked appropriately.	Pass
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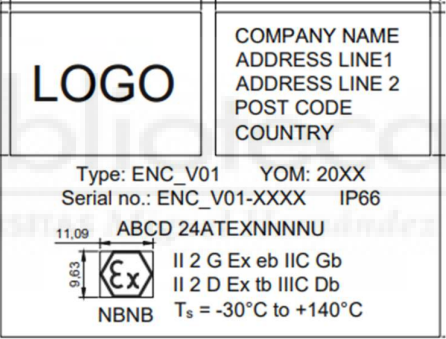
EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
29.2	Location	The product under evaluation is an empty Ex Component enclosure. The marking label is therefore fitted on the inside of the cover.	Pass
29.3	General	The product under evaluation is an empty enclosure evaluated as an Ex Component, clause 29.10 is applied in place of clause 29.3.	N/A
29.4	Ex marking for explosive gas atmospheres	The ENC_V01 is marked: II 2 G Ex eb IIC Gb	Pass
29.5	Ex marking for explosive dust atmospheres	The ENC_V01 is marked: II 2 D Ex tb IIIC Db	Pass
29.6	Combined types (or levels) of protection	Combined types of protection are not applied.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
29.7	Multiple types of protection	Multiple types of protection are applied, increased safety and dust protection by enclosure.	Pass

29.8	Ga equipment using two independent Gb types (or levels) of protection	The product under evaluation is not Ga.	N/A
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29.9	Boundary wall	The product under evaluation is not intended to be installed on a boundary wall between an area requiring EPL Ga or Da and a less hazardous area.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
29.10	Ex Components	<p>The ENC_V01 empty enclosure is marked as required by this clause as shown on the marking label below:</p> <p>The certificate number and Notified Body number relating to quality shall be updated once a certificate is issued by the selected Notified Body.</p>  <p>The marking label includes the following information:</p> <ul style="list-style-type: none"> <li>Logo: LOGO</li> <li>COMPANY NAME</li> <li>ADDRESS LINE 1</li> <li>ADDRESS LINE 2</li> <li>POST CODE</li> <li>COUNTRY</li> <li>Type: ENC_V01 YOM: 20XX</li> <li>Serial no.: ENC_V01-XXXX IP66</li> <li>ABCD 24ATEXNNNU</li> <li>Ex symbol with dimensions: 11.09 (width), 9.63 (height)</li> <li>II 2 G Ex eb IIC Gb</li> <li>II 2 D Ex tb IIIC Db</li> <li>NB NB T<sub>s</sub> = -30°C to +140°C</li> </ul>	Pass

29.11	Small Ex Equipment and small Ex Components	The product under evaluation is not small Ex Equipment or a small Ex Component.	N/A
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29.12	Extremely small Ex Equipment and extremely small Ex Components	The product under evaluation is not extremely small Ex Equipment or an extremely small Ex Component.	N/A
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
29.13	Warning markings	The product under evaluation is an empty enclosure and is being assessed as an Ex Component. The need for warning markings shall be assessed at the time of the approval of the equipment in which the enclosure is used. A schedule of limitation applies to this effect.	N/A

29.14	Cells and batteries	The product under evaluation does not incorporate cells or batteries.	N/A
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29.15	Electric machines operated with a converter	The product under evaluation is not an electric machine operated with a converter.	N/A
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29.16	Examples of marking	Informative only.	-
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30	Instructions		
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<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
30.1	General	A set of instructions has been prepared. These are in compliance with the minimum requirements specified in this clause. A Copy of these instructions is held in the enclosure's technical file.	Pass
30.2	Cells and batteries	The product under evaluation does not incorporate cells or batteries.	N/A
30.3	Electrical machines	The product under evaluation is not an electrical machine.	N/A
30.4	Ventilating fans	The product under evaluation is not a ventilating fan.	N/A
30.5	Cable glands	The product under evaluation is not a cable gland.	N/A
Annex A (Normative)	Supplementary requirements for cable glands		

EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
A.1	General	The product under evaluation is not a cable gland.	N/A
A.2	Constructional requirements		
A.2.1	Cable sealing	See clause A.1.	N/A
A.2.2	Filling compounds	See clause A.1.	N/A
A.2.3	Clamping		
A.2.3.1	General	See clause A.1.	N/A
A.2.3.2	Group II or III cable glands	See clause A.1.	N/A
A.2.4	Lead-in of cable		
A.2.4.1	Sharp edges	See clause A.1.	N/A
A.2.4.2	Point of entry	See clause A.1.	N/A
A.2.5	Released by a tool	See clause A.1.	N/A
A.2.6	Fixing	See clause A.1.	N/A
A.2.7	Degree of protection	See clause A.1.	N/A
A.3	Type tests		
A.3.1	Tests of clamping of non-armoured and braided cables		
A.3.1.1	Cable glands with clamping by the sealing ring	See clause A.1.	N/A

<b>EN IEC 60079-0:2018</b>			
<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
A.3.1.2	Cable glands with clamping by filling compound	See clause A.1.	N/A
A.3.1.3	Cable glands with clamping by means of a clamping device	See clause A.1.	N/A
A.3.1.4	Clamping test	See clause A.1.	N/A
A.3.1.5	Mechanical strength	See clause A.1.	N/A
A.3.2	Tests of clamping of armoured cables		
A.3.2.1	Tests of clamping where the armourings are clamped by a device integral to the gland		
A.3.2.1.1	General	See clause A.1.	N/A
A.3.2.1.2	Clamping test	See clause A.1.	N/A
A.3.2.1.3	Mechanical strength	See clause A.1.	N/A
A.3.2.2	Tests of clamping where the armourings are not clamped by a device integral to the gland	See clause A.1.	N/A
A.3.3	Type test for resistance to impact	See clause A.1.	N/A



EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
A.3.4	Test for degree of protection (IP) of cable glands	See clause A.1.	N/A
A.4	Marking		
A.4.1	Marking of cable glands	See clause A.1.	N/A
A.4.2	Identification of cable-sealing rings	See clause A.1.	N/A
A.5	Instructions	See clause A.1.	N/A

Annex B (Normative)	Requirements for Ex Components		
Table B.1	Applicability of clauses to Ex Components	The product under evaluation is an empty enclosure and has been evaluated according to the requirement so this annex.	Pass

Annex C (Informative)	Example of rig for resistance to impact test		
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EN IEC 60079-0:2018			
Clause	Requirement – Test	Result – Remark	Verdict
Annex D (Informat ive)	Electric machines connected to converters		

Annex E (Informat ive)	Temperature evaluation of electric machines		
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Annex F (Informat ive)	Guideline flowchart for tests of non-metallic enclosures or non-metallic parts of enclosures (26.4)		
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Annex G (Informat ive)	Guidance flowchart for tests of cable glands		
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Annex H (Informat ive)	Shaft voltages resulting in motor bearing or shaft brush sparking Discharge energy calculation		
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<b>Measurement Section, including Additional Narrative Remarks (as deemed applicable)</b>			
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It is noted that the ENC\_V01 may not fit in the Notified Body's environmental chambers due to its size. The standards account for this by stipulating that representative samples may be used for testing. If required, the samples shall be scaled down to fit in the test chambers.

Tests are to be carried out by the Notified Body conducting the certification.

### 3.4.2 EN IEC 60079-7:2015+A1:2018 CHECKLIST

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict
1	Scope		
2	Normative references		
3	Terms and definitions		
4	Constructional requirements		
4.1	Level of Protection	The ENC_V01's level of protection is "eb".	Pass
4.2	Electrical connections		

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.2.1	General	The ENC_V01 is evaluated as an empty Ex Component enclosure, connections are therefore not provided. Requirements for connections shall be evaluated when the enclosure is assessed for its end application.	N/A
4.2.2	Field wiring connections		
4.2.2.1	General	See clause 4.2.1.	N/A
4.2.2.2	Connections made using terminals conforming to IEC 60947-7-1, IEC 60947-7-2, IEC 60947-7-4, IEC 60999-1, or IEC 60999-2	See clause 4.2.1.	N/A
4.2.2.3	Integral field wiring connection facilities	See clause 4.2.1.	N/A
4.2.2.4	Connections designed to be used with cable lugs and similar devices	See clause 4.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.5	Connections using permanent arrangements	See clause 4.2.1.	N/A
4.2.3	Factory connections		
4.2.3.1	General	See clause 4.2.1.	N/A
4.2.3.2	Twist-on connectors for Level of Protection “ec”	See clause 4.2.1.	N/A
4.2.3.3	Permanent connections	See clause 4.2.1.	N/A
4.2.3.4	Pluggable connections for Level of Protection “eb”	See clause 4.2.1.	N/A
4.2.3.5	Pluggable connections for Level of Protection “ec”	See clause 4.2.1.	N/A
4.2.3.6	Pluggable terminal bridging connections	See clause 4.2.1.	N/A
4.2.4	External plug and socket connections for field wiring connection	See clause 4.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.3	Clearances	The ENC_V01 is evaluated as an empty Ex Component enclosure, connections are therefore not provided. Requirements for clearances shall be evaluated when the enclosure is assessed for its end application.	N/A
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4.4	Creepage distances		
4.4.1	General	The ENC_V01 is evaluated as an empty Ex Component enclosure, connections are therefore not provided. Requirements for clearance distances shall be evaluated when the enclosure is assessed for its end application.	N/A
4.4.2	Creepage between differing voltages	See clause 4.4.1.	N/A
4.4.3	Determining creepage distances	See clause 4.4.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.5	Printed wiring boards with conformal coating, Level of Protection “ec”	The ENC_V01 is evaluated as an empty Ex Component enclosure, printed wiring boards are therefore not provided. Requirements for printed wiring boards with conformal coating shall be evaluated when the enclosure is assessed for its end application.	N/A
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4.6	Solid electrical insulating materials		
4.6.1	Specification	The ENC_V01 is evaluated as an empty Ex Component enclosure, there are no solid electrical insulating materials to consider. Requirements for solid electrical insulating materials shall be evaluated when the enclosure is assessed for its end application.	N/A
4.6.2	Long-term thermal stability	See clause 4.6.1.	N/A

4.7	Windings		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.7.1	General	The ENC_V01 is evaluated as an empty Ex Component enclosure, windings are therefore not provided. Requirements for solid electrical insulating materials shall be evaluated when the enclosure is assessed for its end application.	N/A
4.7.2	Insulated conductors	See clause 4.7.1.	N/A
4.7.3	Winding impregnation	See clause 4.7.1.	N/A
4.7.4	Conductor dimensions	See clause 4.7.1.	N/A
4.7.5	Sensing elements	See clause 4.7.1.	N/A

4.8	Temperature limitations		
4.8.1	General	The ENC_V01 is evaluated as an empty Ex Component enclosure. Temperature limitations shall be evaluated when the enclosure is assessed for its end application.	N/A
4.8.2	Conductors	See clause 4.8.1.	N/A
4.8.3	Insulated windings	See clause 4.8.1.	N/A



EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

4.9	Wiring internal to equipment	The ENC_V01 is evaluated as an empty Ex Component enclosure, there is no internal wiring. Wiring internal to equipment shall be evaluated when the enclosure is assessed for its end application.	N/A
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4.10	Degrees of protection provided by enclosures		
4.10.1	Enclosure requirements	<p>Tests to determine the degree of protection provided by the enclosure shall be carried out by the Notified Body performing the certification of the ENC_V01.</p> <p>The target ingress protection rating is IP66, although IP54 would suffice to comply with the increased safety requirements.</p> <p>To be confirmed by test.</p>	TBT

**EN IEC 60079-7:2015+A1:2018**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
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4.10.2	Enclosures with drain holes or ventilation	The ENC_V01 is evaluated as an empty Ex Component enclosure, with no drain holes or ventilation being provided. There is no internal wiring. Drain holes or ventilation (breathers) shall be evaluated when the enclosure is assessed for its end application.	N/A
4.10.3	Enclosures with apparatus protected with Protection type “i”	The ENC_V01 is evaluated as an empty Ex Component enclosure, no apparatus is fitted inside it. Apparatus with type of protection “i” may be installed in the empty enclosure and shall be evaluated when the enclosure is assessed for its end application.	N/A

4.11	Fasteners	The ENC_V01 is not intended for Group I (mining) applications.	N/A
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5	Supplementary requirements for specific electrical equipment		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.1	General	The ENC_V01 is evaluated as an empty Ex Component enclosure and as such is not subject to the requirements of clause 5 of this standard.	N/A
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5.2	Electrical machines		
5.2.1	General	The ENC_V01 is not an electrical machine.	N/A
5.2.2	Degrees of protection provided by electrical machines, Level of Protection “eb”	See clause 5.2.1.	N/A
5.2.3	Degrees of protection provided by electrical machines, Level of Protection “ec”	See clause 5.2.1.	N/A
5.2.4	Connection facilities for external conductors	See clause 5.2.1.	N/A
5.2.5	Internal fans	See clause 5.2.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.2.6	Minimum air gap	See clause 5.2.1.	N/A
5.2.7	Rotating electrical machines with cage rotors		
5.2.7.1	General	See clause 5.2.1.	N/A
5.2.7.2	Rotor cages		
5.2.7.2.1	Rotor cages built from bars connected to end rings	See clause 5.2.1.	N/A
5.2.7.2.2	Cast rotor cages	See clause 5.2.1.	N/A
5.2.7.3	Assessment for possible air gap sparking	See clause 5.2.1.	N/A
5.2.8	Limiting temperature		
5.2.8.1	Limiting temperature of rotor	See clause 5.2.1.	N/A
5.2.8.2	Limiting temperature by current-dependent safety device	See clause 5.2.1.	N/A
5.2.8.3	Limiting temperature by temperature and other sensors	See clause 5.2.1.	N/A
5.2.8.4	Operation with a converter or a non-sinusoidal supply		

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.2.8.4.1	General	See clause 5.2.1.	N/A
5.2.8.4.2	Type test with a converter	See clause 5.2.1.	N/A
5.2.8.4.3	Alternative type verification by calculation	See clause 5.2.1.	N/A
5.2.9	Machines with permanent magnet rotors		
5.2.9.1	Construction	See clause 5.2.1.	N/A
5.2.9.2	Operating from fixed frequency sinusoidal supply	See clause 5.2.1.	N/A
5.2.9.3	Operation with a converter	See clause 5.2.1.	N/A
5.2.10	Stator winding insulation system	See clause 5.2.1.	N/A
5.2.11	Supplemental winding requirements Level of Protection “eb”	See clause 5.2.1.	N/A
5.2.12	Bearing seals and shaft seals		

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.2.12.1	Machines of Levels of Protection “eb” and “ec”	See clause 5.2.1.	N/A
5.2.12.2	Non-rubbing seals and labyrinths	See clause 5.2.1.	N/A
5.2.12.3	Rubbing seals	See clause 5.2.1.	N/A
5.2.13	Neutral point connections	See clause 5.2.1.	N/A

5.3	Luminaires, hand lights, or caplights		
5.3.1	General	The ENC_V01 is not a luminaire, caplight or hand light.	N/A
5.3.2	Light source		
5.3.2.1	General	See clause 5.3.1.	N/A
5.3.2.2	Lamps	See clause 5.3.1.	N/A
5.3.2.3	Lamps for rated voltages not greater than 50 V	See clause 5.3.1.	N/A
5.3.2.4	Lamps for rated voltages not greater than 12 V	See clause 5.3.1.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

5.3.2.5	Light Emitting Diodes (LED)	See clause 5.3.1.	N/A
5.3.3	Minimum distance between lamp and protective cover	See clause 5.3.1.	N/A
5.3.4	Electrical spacings		
5.3.4.1	General	See clause 5.3.1.	N/A
5.3.4.2	Creepage distances and clearances at peak values of pulse voltages greater than 1,5 kV	See clause 5.3.1.	N/A
5.3.4.3	Light Emitting Diodes (LEDs) for Level of Protection “ec”	See clause 5.3.1.	N/A
5.3.5	Lampholders and lamp caps		
5.3.5.1	General	See clause 5.3.1.	N/A
5.3.5.2	Screw lampholders and lamp caps		
5.3.5.2.1	General	See clause 5.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.3.5.2.2	Screw lampholders and lamp caps in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.5.2.3	Screw lampholders for screw lamp caps in Level of Protection “ec”	See clause 5.3.1.	N/A
5.3.5.3	Lampholders for bi pin lamps		
5.3.5.3.1	General	See clause 5.3.1.	N/A
5.3.5.3.2	Lampholders for bi-pin lamps in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.5.3.3	Lampholders for bi-pin lamps in Level of Protection “ec”	See clause 5.3.1.	N/A
5.3.5.4	Other lampholders and lamp caps		
5.3.5.4.1	Single pin lampholder and lamp caps in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.5.4.2	Bayonet lamp holders	See clause 5.3.1.	N/A



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Clause	Requirement – Test	Result – Remark	Verdict

5.3.5.5	Requirements for electrical contact between the lampholder and lamp cap in Level of Protection “eb”	See clause 5.3.1.	N/A
5.3.6	Auxiliaries for Luminaires in Level of Protection “ec”		
5.3.6.1	Glow-type starters	See clause 5.3.1.	N/A
5.3.6.2	Electronic starters and ignitors	See clause 5.3.1.	N/A
5.3.6.3	Starter holders	See clause 5.3.1.	N/A
5.3.6.4	Ballasts	See clause 5.3.1.	N/A
5.3.7	Surface temperatures		
5.3.7.1	Luminaires	See clause 5.3.1.	N/A
5.3.7.2	Lamp	See clause 5.3.1.	N/A
5.3.7.3	LEDs	See clause 5.3.1.	N/A
5.3.7.4	Temperature of lamp caps for tungsten-filament and tungsten-halogen lamps	See clause 5.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.3.8	Limiting temperatures	See clause 5.3.1.	N/A
5.3.9	Luminaires for tubular fluorescent bi-pin lamps		
5.3.9.1	General	See clause 5.3.1.	N/A
5.3.9.2	Maximum ambient temperature	See clause 5.3.1.	N/A
5.3.9.3	Temperature class	See clause 5.3.1.	N/A
5.3.9.4	Disconnection device	See clause 5.3.1.	N/A
5.3.9.5	Starting voltage for Level of Protection “eb” lamps	See clause 5.3.1.	N/A
5.3.9.6	Starting voltage for Level of Protection “ec” lamps	See clause 5.3.1.	N/A
5.3.10	Tests for resistance to impact	See clause 5.3.1.	N/A

5.4	Analog measuring instruments and instrument transformers		
5.4.1	General	The ENC_V01 is not an analog measuring instrument or instrument transformer.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.4.2	Limiting temperature	See clause 5.4.1.	N/A
5.4.3	Short-circuit currents	See clause 5.4.1.	N/A
5.4.4	Short time thermal current		
5.4.5	Measuring instruments supplied by current transformers	See clause 5.4.1.	N/A
5.4.6	Moving coils	See clause 5.4.1.	N/A
5.4.7	External secondary circuits	See clause 5.4.1.	N/A

5.5	Transformers other than instrument transformers	The ENC_V01 is not a transformer other than an instrument transformer.	N/A
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5.6	Supplementary requirements for equipment incorporating cells and batteries		
5.6.1	Type of cells and batteries		
5.6.1.1	General	The ENC_V01 does not incorporate cells or batteries.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.1.2	Sealed cells	See clause 5.6.1.1.	N/A
5.6.1.3	Valve-regulated cells and batteries	See clause 5.6.1.1.	N/A
5.6.1.4	Vented cells and batteries	See clause 5.6.1.1.	N/A
5.6.2	Requirements for cells and batteries $\leq 25$ Ah		
5.6.2.1	Encapsulation of cells or batteries	See clause 5.6.1.1.	N/A
5.6.2.2	Use of secondary cells or batteries	See clause 5.6.1.1.	N/A
5.6.2.3	Cell connection	See clause 5.6.1.1.	N/A
5.6.2.4	Discharge mode		
5.6.2.4.1	General		
5.6.2.4.1.1	Connecting cells in series	See clause 5.6.1.1.	N/A
5.6.2.4.1.2	Deep discharge protection	See clause 5.6.1.1.	N/A
5.6.2.4.2	Discharge conditions for Level of Protection “eb”	See clause 5.6.1.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.2.4.3	Discharge conditions for Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.2.5	Service temperature	See clause 5.6.1.1.	N/A
5.6.2.6	Creepage and clearance		
5.6.2.6.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.2.6.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.2.7	Connections	See clause 5.6.1.1.	N/A
5.6.2.8	Replaceable battery packs	See clause 5.6.1.1.	N/A
5.6.2.9	Replaceable battery pack connections	See clause 5.6.1.1.	N/A
5.6.2.10	Release of electrolyte		
5.6.2.10.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.2.10.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.2.11	Disconnection and transportation	See clause 5.6.1.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.3	Requirements for valve-regulated or vented cells or batteries >25 Ah		
5.6.3.1	Types of permissible batteries	See clause 5.6.1.1.	N/A
5.6.3.2	Battery containers		
5.6.3.2.1	Internal surfaces	See clause 5.6.1.1.	N/A
5.6.3.2.2	Mechanical requirements	See clause 5.6.1.1.	N/A
5.6.3.2.3	Creepage distances		
5.6.3.2.3.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.3.2.3.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.3.2.4	Cover	See clause 5.6.1.1.	N/A
5.6.3.2.5	Cell assembly	See clause 5.6.1.1.	N/A
5.6.3.2.6	Liquid extraction	See clause 5.6.1.1.	N/A
5.6.3.2.7	Ventilation	See clause 5.6.1.1.	N/A
5.6.3.2.8	Plugs and sockets	See clause 5.6.1.1.	N/A
5.6.3.2.9	Polarity marking	See clause 5.6.1.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.3.2.1 0	Other equipment	See clause 5.6.1.1.	N/A
5.6.3.2.1 1	Insulation resistance	See clause 5.6.1.1.	N/A
5.6.3.3	Cells		
5.6.3.3.1	Lids	See clause 5.6.1.1.	N/A
5.6.3.3.2	Support	See clause 5.6.1.1.	N/A
5.6.3.3.3	Electrolyte maintenance	See clause 5.6.1.1.	N/A
5.6.3.3.4	Expansion space	See clause 5.6.1.1.	N/A
5.6.3.3.5	Filling and vent plugs	See clause 5.6.1.1.	N/A
5.6.3.3.6	Electrolyte seals	See clause 5.6.1.1.	N/A
5.6.3.4	Connections		
5.6.3.4.1	Intercell connections	See clause 5.6.1.1.	N/A
5.6.3.4.2	Temperature assessment		
5.6.3.4.2 .1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.3.4.2 .2	Level of Protection “ec”	See clause 5.6.1.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

5.6.3.4.3	Connector protection	See clause 5.6.1.1.	N/A
5.6.4	Charging of cells and batteries		
5.6.4.1	Charger specifications		
5.6.4.1.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.4.1.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A
5.6.4.2	Outgassing during charging of valve-regulated or vented cells or batteries		
5.6.4.2.1	Level of Protection “eb”	See clause 5.6.1.1.	N/A
5.6.4.2.2	Level of Protection “ec”	See clause 5.6.1.1.	N/A

5.7	General purpose connection and junction boxes	The ENC_V01 is not a general purpose connection or junction box.	N/A
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5.8	Resistance heating equipment (other than trace heating systems)		
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Clause	Requirement – Test	Result – Remark	Verdict

5.8.1	General	The ENC_V01 is not resistance heating equipment other than a trace heating system.	N/A
5.8.2	Heating resistors	See clause 5.8.1.	N/A
5.8.3	Temperature coefficient	See clause 5.8.1.	N/A
5.8.4	Insulating material	See clause 5.8.1.	N/A
5.8.5	Cold-start current	See clause 5.8.1.	N/A
5.8.6	Electrical safety device		
5.8.6.1	General	See clause 5.8.1.	N/A
5.8.6.2	Method of protection		
5.8.6.2.1	General	See clause 5.8.1.	N/A
5.8.6.2.2	TT and TN systems	See clause 5.8.1.	N/A
5.8.6.2.3	IT system	See clause 5.8.1.	N/A
5.8.7	Electrically conductive covering	See clause 5.8.1.	N/A
5.8.8	Exclusion of explosive atmosphere	See clause 5.8.1.	N/A

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<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
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5.8.9	Conductor cross-section	See clause 5.8.1.	N/A
5.8.10	Limiting temperature	See clause 5.8.1.	N/A
5.8.11	Safety device	See clause 5.8.1.	N/A

5.9	Supplementary requirements for fuses		
5.9.1	General	The ENC_V01 does not incorporate fuses.	N/A
5.9.2	Temperature class of equipment	See clause 5.9.1.	N/A
5.9.3	Fuse mounting	See clause 5.9.1.	N/A
5.9.4	Fuse enclosures	See clause 5.9.1.	N/A
5.9.5	Replacement fuse identification	See clause 5.9.1.	N/A

5.10	Other electrical equipment	The ENC_V01 is not considered “other electrical equipment”.	N/A
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6	Type verifications and type tests		
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Clause	Requirement – Test	Result – Remark	Verdict

6.1	Dielectric strength	The ENC_V01 is an empty Ex Component enclosure. As such, it does not incorporate electrical connections or wiring. Dielectric strength tests are therefore not applicable.	N/A
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6.2	Rotating electrical machines		
6.2.1	Determination of starting current ratio $I_A / I_N$ and the time $t_E$	The ENC_V01 is not a rotating electrical machine.	N/A
6.2.2	Mounting of machine for test	See clause 6.2.1.	N/A
6.2.3	Additional tests for machines		
6.2.3.1	Stator winding insulation system		
6.2.3.1.1	Test samples	See clause 6.2.1.	N/A
6.2.3.1.2	Impulse ignition test for Level of Protection “eb” stator insulation systems	See clause 6.2.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

6.2.3.1.3	Steady state ignition test for Levels of Protection “eb” and “ec” stator insulation systems	See clause 6.2.1.	N/A
6.2.3.2	Cage rotor		
6.2.3.2.1	General requirements	See clause 6.2.1.	N/A
6.2.3.2.2	Locked Rotor Tests	See clause 6.2.1.	N/A
6.2.3.2.3	Explosive test mixture	See clause 6.2.1.	N/A
6.2.3.2.4	Test parameters	See clause 6.2.1.	N/A
6.2.4	Overspeed test of cemented magnets	See clause 6.2.1.	N/A

6.3	Luminaires		
6.3.1	Battery operated luminaires	The ENC_V01 is not a luminaire.	N/A
6.3.2	Impact and drop tests		
6.3.2.1	General	See clause 6.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

6.3.2.2	Tests for resistance to impact (portable and transportable luminaires and handlights)	See clause 6.3.1.	N/A
6.3.3	Mechanical tests for screw lampholders other than E10		
6.3.3.1	Testing the force on the bottom contact of the lamp/lampholder	See clause 6.3.1.	N/A
6.3.3.2	Testing the minimum removal torque of the lamp/lampholder	See clause 6.3.1.	N/A
6.3.4	Abnormal operation of luminaires		
6.3.4.1	Abnormal operations of ballasts for discharge lamps		
6.3.4.1.1	Level of Protection “eb”, rectification test	See clause 6.3.1.	N/A
6.3.4.1.2	Level of Protection “ec”	See clause 6.3.1.	N/A
6.3.4.2	Abnormal operation of luminaires with tubular fluorescent lamps		
6.3.4.2.1	Level of Protection “eb”		
6.3.4.2.1.1	Rectification test	See clause 6.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

6.3.4.2.1 .2	Inoperative lamp test	See clause 6.3.1.	N/A
6.3.4.2.2	Level of Protection “ec”	See clause 6.3.1.	N/A
6.3.4.3	Power dissipation of cathodes of lamps supplied by electronic ballasts		
6.3.4.3.1	Luminaires in Level of Protection “eb”	See clause 6.3.1.	N/A
6.3.4.3.2	Luminaires in Level of Protection “ec”	See clause 6.3.1.	N/A
6.3.5	Sulphur dioxide test for Level of Protection “eb” for the connection of bi- pin lamp caps to lampholders	See clause 6.3.1.	N/A
6.3.6	Vibration test for Level of Protection “eb” for luminaires with bi-pin lamps	See clause 6.3.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

6.3.7	Test for wiring of luminaires subject to high-voltage impulses from ignitors	See clause 6.3.1.	N/A
6.3.8	Tests for electronic starters for tubular fluorescent lamps and for ignitors in Level of Protection “ec” for discharge lamps		
6.3.8.1	General	See clause 6.3.1.	N/A
6.3.8.2	Cut-out device test	See clause 6.3.1.	N/A
6.3.8.3	Life test (failed lamp)		
6.3.8.3.1	Ignitor thermal endurance test	See clause 6.3.1.	N/A
6.3.8.3.2	Evaluation criteria	See clause 6.3.1.	N/A
6.3.9	Test for starter holders for luminaires in Level of Protection “ec”	See clause 6.3.1.	N/A

6.4	Measuring instruments and instrument transformers	The ENC_V01 is not a measuring instrument or instrument transformer.	N/A
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Clause	Requirement – Test	Result – Remark	Verdict

6.5	Transformers other than instrument transformers	The ENC_V01 is not a transformer other than an instrument transformer.	N/A
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6.6	Verification and tests for cells and batteries of Level of Protection “eb”		
6.6.1	General	The ENC_V01 does not incorporate cells or batteries.	N/A
6.6.2	Insulation resistance	See clause 6.6.1.	N/A
6.6.3	Mechanical shock test		
6.6.3.1	General	See clause 6.6.1.	N/A
6.6.3.2	Test conditions	See clause 6.6.1.	N/A
6.6.3.3	Test procedure	See clause 6.6.1.	N/A
6.6.3.4	Acceptance criteria	See clause 6.6.1.	N/A
6.6.4	Test for ventilation of Level of Protection “eb” battery container	See clause 6.6.1.	N/A



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<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
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6.7	Verification and tests for cells and batteries of Level of Protection “ec”		
6.7.1	General	The ENC_V01 does not incorporate cells or batteries.	N/A
6.7.2	Insulation resistance	See clause 6.7.1.	N/A
6.7.3	Mechanical shock test	See clause 6.7.1.	N/A
6.7.4	Test for ventilation of Level of Protection “ec” battery container	See clause 6.7.1.	N/A

6.8	General purpose connection and junction boxes		
6.8.1	General	The ENC_V01 is not a general purpose connection or junction box.	N/A
	Maximum dissipated power method	See clause 6.8.1.	N/A
6.8.3	Defined arrangement method	See clause 6.8.1.	N/A

6.9	Resistance heating equipment		
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Clause	Requirement – Test	Result – Remark	Verdict

6.9.1	Test sample	The ENC_V01 is not resistance heating equipment.	N/A
6.9.2	Verification of the electrical insulation	See clause 6.9.1.	N/A
6.9.3	Thermal stability of the electrical insulation	See clause 6.9.1.	N/A
6.9.4	Resistance to impact	See clause 6.9.1.	N/A
6.9.5	Test for cold start current	See clause 6.9.1.	N/A
6.9.6	Tests for specific forms of resistance heaters	See clause 6.9.1.	N/A

6.10	Terminal insulating material tests	The ENC_V01 is not a terminal.	N/A
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7	Routine verifications and routine tests		
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Clause	Requirement – Test	Result – Remark	Verdict

7.1	Dielectric tests	The ENC_V01 is an empty Ex Component enclosure. As such, it does not incorporate electrical connections or wiring. Dielectric strength tests are therefore not applicable.	N/A
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7.2	Dielectric tests for batteries	The ENC_V01 does not incorporate cells or batteries.	N/A
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7.3	Inter-turn overvoltage tests	The ENC_V01 is an empty Ex Component enclosure and is therefore not subjected to inter-turn overvoltage tests.	N/A
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8	Ex Component certificates		
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Clause	Requirement – Test	Result – Remark	Verdict

8.1	General	The ENC_V01 is an empty Ex Component enclosure, there is therefore no creepage and clearance or temperature information required to appear on the certificate other than the enclosure's service temperature range of -30°C to +140°C .	Pass
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8.2	Terminals	The ENC_V01 is not a terminal.	N/A
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9	Marking and instructions		
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9.1	General marking	The ENC_V01 empty Ex Component enclosure's level of protection is "eb" and is marked accordingly.	Pass
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9.2	Ex Component enclosures	The marking label is fixed on the inside of the enclosure cover. No external marking is provided.	Pass
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Clause	Requirement – Test	Result – Remark	Verdict

9.3	Instructions for use		
9.3.1	Battery operated equipment	The ENC_V01 is not battery operated.	N/A
9.3.2	Terminals	The ENC_V01 is not a terminal nor does it incorporate them.	N/A
9.3.3	Luminaires	The ENC_V01 is not a luminaire.	N/A
9.3.4	Machines	The ENC_V01 is not an electrical machine.	N/A

9.4	Warning markings	No warnings are required.	N/A
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10	Documentation	The documentation has been prepared in accordance with EN IEC 60079-0 and includes the information required by this standard.	Pass
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Annex A (Normative)	Temperature determination of electrical machines – Methods of test and of calculation		
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Clause	Requirement – Test	Result – Remark	Verdict

A.1	General	The ENC_V01 is not an electrical machine.	N/A
A.2	Determination of maximum service temperatures		
A.2.1	Rotor temperature – normal operation	See clause A.2.1.	N/A
A.2.2	Winding temperature – normal operation	See clause A.2.1.	N/A
A.3	Determination of maximum surface temperatures		
A.3.1	General	See clause A.2.1.	N/A
A.3.2	Locked rotor tests		
A.3.2.1	Test conditions	See clause A.2.1.	N/A
A.3.2.2	Optional testing at reduced voltage	See clause A.2.1.	N/A
A.3.2.3	Rotor temperature	See clause A.2.1.	N/A
A.3.2.4	Determination of starting current $I_A$	See clause A.2.1.	N/A
A.3.2.5	Stator temperature	See clause A.2.1.	N/A
A.4	Optional calculation of maximum surface temperature		
A.4.1	General	See clause A.2.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

A.4.2	Rotor temperature	See clause A.2.1.	N/A
A.4.3	Stator temperature	See clause A.2.1.	N/A
A.5	Determination of tE time	See clause A.2.1.	N/A
A.6	Arduous starting conditions	See clause A.2.1.	N/A
A.7	Motors operated with a converter	See clause A.2.1.	N/A

Annex B (Normative)	Type tests for specific forms of resistance heating devices or resistance heating units (other than trace heater)		
B.1	Resistance heating devices subjected to mechanical stresses	The ENC_V01 is not a resistance heating device or unit.	N/A
B.2	Resistance heating devices or units intended for immersion	See clause B.1.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict

B.3	Resistance heating devices or units having hygroscopic insulating material	See clause B.1.	N/A
B.4	Verification of limiting temperature of resistance heating devices (other than trace heaters)		
B.4.1	General	See clause B.1.	N/A
B.4.2	Safety devices		
B.4.2.1	General	See clause B.1.	N/A
B.4.2.2	Safety device sensing the temperature	See clause B.1.	N/A
B.4.2.3	Safety device sensing the temperature and at least one other parameter	See clause B.1.	N/A
B.4.2.4	Safety device sensing a parameter other than the temperature	See clause B.1.	N/A



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Clause	Requirement – Test	Result – Remark	Verdict

B.4.3	Resistance heating unit of stabilized design	See clause B.1.	N/A
B.4.4	Heating device with temperature self-limiting characteristic	See clause B.1.	N/A

Annex C (Informat ive)	Cage motors – Thermal protection in service		
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Annex D (Informat ive)	Resistance heating devices and units – Additional electrical protection		
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Annex E (Informat ive)	Combinations of terminals and conductors for general purpose connection and junction boxes		
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EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

Annex F (Normative)	Dimensions of copper conductors	Noted.	N/A
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Annex G (Normative)	Test procedure for T5 (only 8 W), T8, T10 and T12 lamps		
G.1	Asymmetric pulse test		
G.1.1	General	The ENC_V01 is not a lamp.	N/A
G.1.2	Test procedure	See clause G.1.	N/A
G.2	Asymmetric power test		
G.2.1	General	See clause G.1.	N/A
G.2.2	Test procedure	See clause G.1.	N/A

Annex H (Normative)	Alternative separation distances for Level of Protection “ec” equipment under controlled environments		
H.1	General	The ENC_V01 is not level of protection “ec”.	N/A

EN IEC 60079-7:2015+A1:2018			
Clause	Requirement – Test	Result – Remark	Verdict

H.2	Specific Conditions of Use	See clause H.1.	N/A
H.3	Control of pollution access	See clause H.1.	N/A
H.4	Voltage limitation	See clause H.1.	N/A
H.5	Control of overvoltages and transient protection	See clause H.1.	N/A
H.6	Alternative separation distances	See clause H.1.	N/A

Annex I (Informat ive)	Application, installation, and testing considerations for Level of Protection “ec” asynchronous machines		
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Annex J (informat ive)	Luminaires incorporating LEDs		
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<b>Measurement Section, including Additional Narrative Remarks (as deemed applicable)</b>			
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N/A
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### 3.4.3 EN 60079-31:2014 CHECKLIST

EN 60079-31:2014			
Clause	Requirement – Test	Result – Remark	Verdict

1	Scope		
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2	Normative references		
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3	Terms and definitions		
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4	General		
4.1	Levels of protection	The ENC_V01's level of protection is "tb".	Pass
4.2	Equipment groups and ingress protection	The ENC_V01's level of protection is "tb", and is intended for use in Group IIIC applications. The enclosure therefore requires an ingress protection of IP6X.	Pass
4.3	Requirements for electrical equipment with level of protection "ta"		
4.3.1	Fault current	The ENC_V01's level of protection is not "ta".	N/A

EN 60079-31:2014			
Clause	Requirement – Test	Result – Remark	Verdict
4.3.2	Maximum surface temperature	See clause 4.3.1.	N/A
4.3.3	Overpressure	See clause 4.3.1.	N/A
4.3.4	Dust exclusion	See clause 4.3.1.	N/A
4.3.5	Protective devices		
4.3.5.1	General	See clause 4.3.1.	N/A
4.3.5.2	Thermal protective devices	See clause 4.3.1.	N/A
4.3.6	Protection for arcing and sparking parts	See clause 4.3.1.	N/A
4.4	Requirements for electrical equipment with Level of Protection “tb” and “tc”		
4.4.1	Maximum surface temperature	The ENC_V01 is an empty Ex Component enclosure, and is therefore not subject to maximum surface temperature tests.	N/A
4.4.2	Over pressure	A positive internal pressure of 2 kPa shall be applied to the ENC_V01 prior to the dust exclusion test.  To be confirmed by test.	TBT

EN 60079-31:2014			
Clause	Requirement – Test	Result – Remark	Verdict
4.4.3	Dust exclusion	Dust exclusion tests shall be carried out in accordance with clause 6.1.1  To be confirmed by test.	TBT

5	CONSTRUCTION		
5.1	Joints		
5.1.1	General	All joints of the ENC_V01 fit closely together within the tolerances specified in the documentation. They are effectively sealed against the ingress of dust, comply with the applicable requirements of this clause and have been subjected to the applicable tests of clause 6.1.1.	Pass
5.1.2	Threaded joints	The ENC_V01 does not incorporate threaded joints.	N/A

EN 60079-31:2014			
Clause	Requirement – Test	Result – Remark	Verdict
5.1.3	Gaskets and seals	<p>The cover and gland plate gaskets are of one piece construction.</p> <p>An adhesive is used to secure the gaskets in place. The cover gasket is adhered to the cover, and the gland plate gasket is adhered to the gland plate. A supplementary sealant is not used.</p>	Pass
5.1.4	Cemented joints	The ENC_V01 does not incorporate cemented joints.	N/A
5.1.5	Operating rods, spindles and shafts	The ENC_V01 does not incorporate operating rods, spindles or shafts.	N/A
5.1.6	Windows		
5.1.6.1	Windows employing a cemented joint	The ENC_V01 does not incorporate windows.	N/A
5.1.6.2	Windows employing a gasket joint	See clause 5.1.6.1.	N/A
5.2	Cable glands	Only suitably certified IP66 rated cable glands may be used. A condition of use has been applied to this effect.	Pass
5.3	Entries		

EN 60079-31:2014			
Clause	Requirement – Test	Result – Remark	Verdict
5.3.1	Plain entries	Plain entries into the enclosure are provided via a gland plate on the bottom side. The diameter of the clearance holes is not more than 0.7mm greater than the nominal diameter of the entry thread gland or fitting, as detailed in drawing ENC_V01_GP-001.	Pass
5.3.2	Threaded entries	Threaded entries are not provided.	N/A

6	Verification and tests		
6.1	Type tests		
6.1.1	Type tests for dust exclusion by enclosures		
6.1.1.1	General	One of the four samples previously subjected to the tests of enclosures of EN IEC 60079-0 shall be subjected to the pressure test of clause 6.1.1.3 followed by the IP test of clause 6.1.1.4.	Pass
6.1.1.2	Impact test for supplementary enclosures	The product under evaluation does not incorporate a supplementary enclosure.	N/A



EN 60079-31:2014			
Clause	Requirement – Test	Result – Remark	Verdict
6.1.1.3	Pressure test	A positive internal pressure of $2 \pm 0,2$ kPa shall be applied for $60_0^{+10}$ seconds.  To be confirmed by test.	TBT
6.1.1.4	IP test	The ENC_V01's level of protection is "tb", therefore IP6X must be achieved. The test shall be performed in accordance with EN 60529:1992+A2:2013 by the selected Notified Body.  To be confirmed by test.	TBT
6.1.2	Thermal tests	The ENC_V01 is an empty Ex Component enclosure and as such is not subjected to temperature rise tests.	N/A
6.2	Routine tests		

7	Marking	The ENC_V01 is internally marked according to the requirements of IEC 60079-0 and with the symbol "tb".	Pass
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**Measurement Section, including Additional Narrative Remarks (as deemed applicable)**

N/A
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### 3.4.4 DIRECTIVE 2014/EU/34 EHSRs

DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)			
Clause	Requirement – Test	Result – Remark	Verdict

1	GENERAL REQUIREMENTS		
1.0.1	Principles of integrated explosion protection	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.0.2	Analysis of possible operating faults	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.0.3	Special checking and maintenance conditions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.0.4	Surrounding area conditions	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.0.5	Marking	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.0.6	Instructions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

Clause	Requirement – Test	Result – Remark	Verdict
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1.1	MATERIALS		
1.1.1	Materials not to trigger off explosion	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.1.2	Effect of explosive atmosphere on materials	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.1.3	Changes in characteristics of materials and combinations thereof	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass

1.2	DESIGN AND CONSTRUCTION		
1.2.1	Design with regard to technological knowledge	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.2.2	Components for incorporation or replacement	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.2.3	Enclosed structures and prevention of leaks	Covered by EN IEC 60079-7:2015+A1:2018.	Pass

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
1.2.4	Dust deposits	Covered by EN IEC 60079-0:2018 and EN 60079-31:2014.	Pass
1.2.5	Additional means of protection	Covered by EN IEC 60079-7:2015+A1:2018.	Pass
1.2.6	Safe opening	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.2.7	Protection against other hazards	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.2.8	Overloading of equipment	Covered by EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.2.9	Flameproof enclosure systems	Not a flameproof enclosure system.	N/A

1.3	<b>POTENTIAL IGNITION SOURCES</b>		
1.3.1	Hazard arising from different ignition sources	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.3.2	Hazards arising from static electricity	Covered by EN IEC 60079-0:2018.	Pass

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

Clause	Requirement – Test	Result – Remark	Verdict
1.3.3	Hazards arising from stray electric and leakage currents	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.3.4	Hazards arising from overheating	Covered by EN IEC 60079-7:2015+A1:2018.	Pass
1.3.5	Hazards arising from pressure compensation operations	No pressure compensation operations.	N/A

1.4	HAZARDS ARISING FROM EXTERNAL EFFECTS		
1.4.1	Safe function in changing external conditions	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
1.4.2	Withstanding attack by aggressive substances	Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass

1.5	REQUIREMENTS IN RESPECT OF SAFETY RELATED DEVICES		
1.5.1	General requirements for safety related devices	The equipment is not a safety related device.	N/A

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
1.5.2	Safety device failure	The equipment is not a safety related device.	N/A
1.5.3	Restart lockouts	The equipment is not a safety related device.	N/A
1.5.4	Control and display units	The equipment is not a safety related device.	N/A
1.5.5	Devices with a measuring function	The equipment is not a safety related device.	N/A
1.5.6	Checking accuracy and serviceability	The equipment is not a safety related device.	N/A
1.5.7	Safety Factor	The equipment is not a safety related device.	N/A
1.5.8	Risk arising from software	The equipment is not a safety related device.	N/A

1.6	INTEGRATION OF SAFETY REQUIREMENTS RELATING TO THE SYSTEM		
1.6.1	Manual override	The equipment does not have a manual override.	N/A
1.6.2	Emergency shutdown	The equipment does not have an emergency shutdown.	N/A

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
1.6.3	Hazards arising from power failure	There are no hazards associated with the equipment in the event of power failure.	Pass
1.6.4	Hazards arising from connections	Covered by EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 and EN 60079-31:2014.	Pass
1.6.5	Placing of warning devices as parts of equipment	The component is not fitted with detection or alarm devices for monitoring the occurrence of explosive atmospheres.	N/A

2	SUPPLEMENTARY REQUIREMENTS IN RESPECT OF EQUIPMENT		
2.0.1	Category M1	The component is not Category M1.	N/A
2.0.2	Category M2	The component is not Category M2.	N/A
2.1.1	Category 1G	The component is not Category 1G.	N/A
2.1.1.1	Equipment design and construction	The component is not Category 1G.	N/A
2.1.1.2	Surface Temperature	The component is not Category 1G.	N/A

**DIRECTIVE 2014/34/EU - ESSENTIAL HEALTH AND SAFETY REQUIREMENTS (ANNEX II)**

<b>Clause</b>	<b>Requirement – Test</b>	<b>Result – Remark</b>	<b>Verdict</b>
2.1.1.3	Opening	The component is not Category 1G.	N/A
2.1.2	Category 1D	The component is not Category 1D.	N/A
2.2.1	Category 2G	The component is Category 2G. Covered by EN IEC 60079-0:2018 and EN IEC 60079-7:2015+A1:2018.	Pass
2.2.2	Category 2D	The component is Category 2D. Covered by EN IEC 60079-0:2018 and EN 60079-31:2014.	Pass
2.3.1	Category 3G	The component is not Category 3G	N/A
2.3.2	Category 3D	The equipment is not Category 3D.	N/A

<b>3</b>	<b>SPECIFIC REQUIREMENTS FOR PROTECTIVE SYSTEMS</b>		
3.0	General Requirements	The equipment is not a protective system.	N/A
3.1	Planning and Design	The equipment is not a protective system.	N/A



## 3.5 MATERIAL DATASHEETS

### 3.5.1 STAINLESS STEEL



thyssenkrupp Materials (UK) Ltd

Stainless Steel 1.4404

Material Data Sheet

This data sheet applies to hot and cold-rolled sheets/plates and strip, semi-finished products, rods, rolled wire and profiles as well as seamless and welded tubes for pressure purposes.

#### Application

Construction encasement, doors, windows and armatures, offshore modules, cisterns and pipes for chemical tankers, production, warehousing and overland transportation of chemicals, food and beverages, pharmacy, synthetic fibre, paper and textile plants and pressure vessels. Due to the low C-content, the resistance to intergranular corrosion is also guaranteed in the welded condition.

#### Chemical Composition (heat analysis in %)<sup>\*)</sup>

C	Si	Mn	P	S	N	Cr	Mo	Ni
≤ 0.030	1.00	2.00	0.045	0.015 <sup>*)</sup>	0.10	18.50 - 18.50	2.00 - 2.50	10.00 - 13.00

<sup>\*)</sup> Maximum value unless otherwise stated.

<sup>\*)</sup> For machinability a controlled sulphur content of 0.015 - 0.030% is recommended and permitted.

#### Mechanical Properties (at room temperature in solution annealed condition)

Product Form	Thickness mm max.	Yield Strength		Tensile Strength	Elongation		Impact energy (ISO-V) Room Temperature ≥ 10mm Thick	
		0.2%	1%	R <sup>m</sup> N/mm <sup>2</sup>	A <sup>1)</sup> % min (longitudinal)	A <sup>1)</sup> % min (transverse)	J min. (longitudinal)	J min. (transverse)
		R <sub>0.2</sub> N/mm <sup>2</sup> min.	R <sub>0.1</sub> N/mm <sup>2</sup> min.		-	-	-	-
C	8	240 <sup>3)</sup>	270 <sup>3)</sup>	530 - 680 <sup>3)</sup>	-	40	-	-
H	13.5	220 <sup>3)</sup>	280 <sup>3)</sup>	530 - 680 <sup>3)</sup>	-	40	100	80
P	75	220 <sup>3)</sup>	280 <sup>3)</sup>	520 - 670 <sup>3)</sup>	-	45	100	80
L	180	200 <sup>4)</sup>	235 <sup>4)</sup>	500 - 700 <sup>4)</sup>	40	-	100	-
L	250 <sup>5)</sup>	200 <sup>4)</sup>	235 <sup>4)</sup>	500 - 700 <sup>3)</sup>	-	30	-	80
T <sub>min</sub>	80	190 <sup>6)</sup>	240 <sup>6)</sup>	490 - 690 <sup>4)</sup>	40	30	100	60 <sup>7)</sup>

<sup>1)</sup> Gauge length and thickness according to DIN EN

<sup>2)</sup> > 160mm

<sup>3)</sup> Transverse test piece, with product widths < 300mm longitudinal test piece

<sup>4)</sup> Longitudinal test piece

<sup>5)</sup> Transverse test piece

<sup>6)</sup> Longitudinal test piece, external diameter > 508mm transverse test piece

<sup>7)</sup> Min. 60 J at - 196°C

## Reference data on some physical properties

Density at 20°C kg/dm <sup>3</sup>	Modulus of Elasticity kN/mm <sup>2</sup> at				Thermal Conductivity at 20°C W/m K	Specific Thermal Ca- pacity at 20°C J/kg K	Specific Electrical Resistivity at 20°C Ω mm <sup>2</sup> /m
	20°C	200°C	400°C	500°C			
8.0	200	186	172	185	15	500	0.75

Linear coefficient of thermal expansion 10 <sup>-6</sup> K <sup>-1</sup> between 20°C and				
100°C	200°C	300°C	400°C	500°C
18.0	18.5	17.0	17.5	18.0

 Guidelines on the temperature for hot forming and heat treatment<sup>1)</sup>

Hot Forming		Heat Treatment AT (Solution Annealed), Microstructure		
Temperature °C	Type of Cooling	Temperature °C <sup>2) 3)</sup>	Type of Cooling	Microstructure
1150 to 850	Air	1050 to 1110	Water, air	Austenite with a low content of ferrite

<sup>1)</sup> For simulative heat treatment test pieces the temperatures for solution annealing have to be agreed.

<sup>2)</sup> Solution annealing is in applicable, if the conditions for the hot forming and the concluding cooling are in such a way that the requirements for the mechanical properties of the product can be maintained.

<sup>3)</sup> If heat treatment is carried out in a continuous annealing furnace, usually the upper area of the mentioned temperature range is preferred or even exceeded.

<sup>4)</sup> For heat treatment within subsequent processing, the lower area of the stated temperature range for solution annealing has to be aspired, as otherwise the mechanical properties could be affected. If the lower limit for the solution annealing temperature was not undercut during hot forming, while repeating annealing a temperature of 1000°C as the lower limit is sufficient.

## Processing / Welding

Standard welding process for these steel grades are:

- TIG-Welding
- MAG-Welding Solid Wire
- Arc Welding (E)
- Submerged Arc Welding (SAW)
- Laser Beam Welding

Process	Filler Metal			
	Similar		Higher Alloyed	
TIG	Thermanit GE-318 L	1.4430	Thermanit A	1.4578
MAG Solid Wire	Thermanit GE-318 L Si	1.4430	Thermanit A Si	1.4578
Arc Welding (E)	Thermanit GE Special	1.4430	Thermanit A Special	1.4578
	Thermanit GEW 318 L-17	1.4430	Thermanit AW	1.4578
SAW	Wire	Powder	Wire	Powder
	Thermanit GE-318L	Marathon 451 Marathon 213	Thermanit A Thermanit 18/17 E	Marathon 451 - 213 Marathon 104
Laser Beam Welding	See Page 5			



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Stainless Steel 1.4404

Material Data Sheet

When choosing the filler metal, the corrosion stress has to be regarded, as well. The use of a higher alloyed filler metal can be necessary due to the cast structure of the weld metal.

A preheating is not necessary for this steel. A heat treatment after welding is normally not usual.

Austenitic steels only have 30% of the thermal conductivity of non-alloyed steels. Their fusion point is lower than that of non-alloyed steel therefore austenitic steels have to be welded with lower heat input than non-alloyed steels. To avoid overheating or burn-through of thinner sheets, higher welding speed has to be applied. Copper back-up plates for faster heat rejection conductivity a greater distortion has to be expected.

When welding 1.4404 all procedures, which work against this distortion (eg. back-step sequence welding, welding alternately on opposite sides with double-V butt weld, assignment of two welders when the components are accordingly large) have to be respected notably. For product thicknesses over 12mm the double-V butt weld has to be preferred instead of a single-V butt weld. The included angle should be 60° - 70°, when using MIG-welding about 50° are enough. An accumulation of weld seams should be avoided. Tack welds have to be affixed with relatively shorter distances from each other (significantly shorter than those of non-alloyed steels), in order to prevent strong deformation, shrinking, or flaking tack welds. The tacks should be subsequently grinded or at least be free from crater cracks.

1.4404 in connection with austenitic weld metal and too high heat input the addition to form heat cracks exists. The addition to heat cracks can be confined, if the weld metal features a low content of ferrite (delta ferrite). Contents of ferrite up to 10% have a favourable effect and do not affect the corrosion resistance generally. The thinnest layer as possible have to be welded (stringer bead technique) because a higher cooling speed decreases the addition to hot cracks. A preferably fast cooling has to be aspired while welding as well, to avoid the vulnerability to intergranular corrosion and embrittlement.

1.4404 is very suitable for laser beam welding (weldability A in accordance with DVS bulletin 3205, part 5) With a welding groove width smaller 0.3mm respectively 0.1mm product thickness the use of filler metals is not necessary. With larger welding grooves a similar filler metal can be used. With avoiding oxidation within the seam surface during laser beam welding by applicable backhand welding, eg. helium as inert gas, the welding seam is as corrosion resistant as the base metal. A hot crack hazard for the welding seam does not exist, when choosing an applicable process.

1.4404 is also suitable for laser beam fusion cutting with nitrogen or flame cutting with oxygen. The cut edges only have small heat affected zones and are generally free of micro cracks and thus are well formable. While choosing an applicable process the fusion cut edges can be converted directly. Especially, they can be welded without any further preparation.

While processing only stainless tools like steel brushes, pneumatic picks and so on are allowed, in order to not endanger the passivation.

It should be neglected to mark within the welding seam zone with oleigerous bolts or temperature indicating crayons. The high corrosion resistance of this stainless steel is based on the formation of a homogeneous, compact passive layer on the surface. Annealing colours, scales, slag residues, tramp iron, spatter and such like have to be removed in order to not destroy the passive later.

For cleaning the surface the processes brushing, grinding, pickling or blasting (iron-free silica sand or glas spheres) can be applied. For brushing only stainless steel brushes can be used. Pickling of the previously brushed seam area is carried out by dipping and spraying, however, often pickling pastes or solutions are used. After pickling, carefully flushin with water must be done.

#### Remark

In quenched condition the material can be slightly magnetizable. With increasing cold forming the magnetizability increases.

#### Editor

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Cradley Heath  
West Midlands  
B64 5QU


#### Important Note

Information given in this data sheet about the condition or usability of materials respectively products are no warranty for their properties, but act as a description.

The information, we give on for advice, comply to the experiences of the manufacturer as well as our own. We cannot give warranty for the results of processing and application of the products.

### 3.5.2 GASKET

Product Data Sheet



**bisco**  
TRUSTED TO THE EXTREME

## BISCO® HT-800 Medium Silicone Foam

BISCO® HT-800 medium cellular silicone foam embodies the transition from soft and conformable to firm and durable, as it offers the lightness of a foam while also exhibiting enhanced sponge rubber sealing capabilities. Patented chemistry and cell structure provide a long-term performance advantage.


**Features & Benefits:**

- Highly versatile medium firm foam
- Excellent memory and low stress relaxation reduces maintenance costs associated with gasket failures
- Resistance to UV, ozone, and extreme temperatures for consistent performance across many environments
- Rated to most stringent UL flame standards

† FDA compliant in accordance with regulation 21 CFR 177.2600

PROPERTY	TEST METHOD	TYPICAL VALUE*	SPECIFICATION**
<b>PHYSICAL</b>			
Color	Visual	<b>Black, Gray, Red</b>	---
Thickness, mm (inches)	Internal	<b>0.79 - 12.70 (0.031 - 0.500)</b>	See "Width Tolerance" table
Density, kg/m <sup>3</sup> (lb./ft <sup>3</sup> )	Internal	352 (22)	<b>300 - 473 (18.7 - 29.5)</b>
Compression Force Deflection, kPa (psi)	ASTM D1056	67 (9.7)	<b>41 - 97 (6 - 14)</b>
Compression Set, %	ASTM D1056 100°C (212°F) / 22 hrs / 50%	2.4	< 5
Water Absorption, %	Internal 2" below water surface / 24 hrs / change in weight	0.5	< 5
<b>FLAMMABILITY</b>			
Flame Resistance	UL 94 (File E83967)	Meets	V-0
Flame Spread Index (Is)	ASTM E162	Meets	Flaming Mode < 35
Smoke Density (Ds)	ASTM E662	Meets	Flaming Mode, 1.5 min, < 100 Flaming Mode, 4.0 min, < 200
Burn Length	FMVSS 302	Meets	< 100 mm/min
<b>THERMAL</b>			
Temperature Range, °C (°F)	Internal	-55 to +200 (-67 to +392)	---
Thermal Conductivity, W/m °K	ASTM C518	0.076	---
Low Temperature Flex	ASTM D1056 -55°C (-67°F) / 5 hrs	Pass	---
Low Temperature Brittleness	ASTM D746 -55°C (-67°F) / 3 min	Pass	---

Specification values in bold are tested on a batch basis.



The information contained in this Data Sheet is intended to assist you in designing with Rogers' Elastomeric Material Solutions. It is not intended to and does not create any warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose or that the results shown in this Data Sheet will be achieved by a user for a particular purpose. The user should determine the suitability of Rogers BISCO products for each application. The Rogers logo, BISCO, and the BISCO logo are trademarks of Rogers Corporation or one of its subsidiaries. © 2003, 2006, 2007, 2009, 2013, 2014, 2017, 2019-2022, 2023 Rogers Corporation. All rights reserved. 1123-PDF - Publication #180-070 [www.rogerscorp.com](http://www.rogerscorp.com)

PROPERTY	TEST METHOD	TYPICAL VALUE*	SPECIFICATION**
<b>OUTGASSING</b>			
Total Mass Loss (%)	ASTM E595 (4x10 <sup>-6</sup> Torr)	0.98	—
Collected Volatile Condensable Materials (CVCM) (%)	ASTM E595 (4x10 <sup>-6</sup> Torr)	0.25	—
Water Vapor Regain (%)	ASTM E595 (4x10 <sup>-6</sup> Torr)	0.03	—
<b>ELECTRIC</b>			
Dielectric Strength, Volts/mil	ASTM D149	75	—
Dielectric Constant, 1 kHz	ASTM D150	1.7	—
Dissipation Factor, 1 kHz	ASTM D495	0.005	—
Dry Arc Resistance, Seconds	ASTM D495	125	—
Volume Resistivity, Ohm-cm	ASTM D257	10 <sup>14</sup>	—

**Standard Thickness Tolerances**

NOMINAL THICKNESS	TOLERANCE
mm (inches)	mm (inches)
0.79 (0.031)	+ 0.381/0.102 (+ 0.015/-0.004)
1.60 (0.063)	± 0.508 (± 0.020)
2.39 (0.094)	± 0.508 (± 0.020)
3.18 (0.125)	± 0.635 (± 0.025)
4.78 (0.188)	± 0.635 (± 0.025)
6.35 (0.250)	± 0.762 (± 0.030)
9.53 (0.375)	± 1.143 (± 0.045)
12.70 (0.500)	± 1.270 (± 0.050)

**Slit Material and Tape (PSA) Width Tolerances**

NOMINAL WIDTH	TOLERANCE
mm (inches)	mm (inches)
> 0 - 76 (> 0 - 3)	± 1.60 (± 0.063)
> 76 - 203 (> 3 - 8)	± 2.39 (± 0.094)
> 203 - 305 (> 8 - 12)	± 3.18 (± 0.125)
> 305 - 457 (> 12 - 18)	± 4.78 (± 0.188)
> 457 - 660 (> 18 - 26)	± 5.56 (± 0.219)
> 660 - 914 (> 26 - 36)	+ 25.4/- 0 (+ 1/- 0)

**VALUE ADDED OFFERINGS**

- Adhesive (PSA) lamination
- Slit material/tapes

**SPECIFICATION**

- AMS3195

† Statement of FDA compliance is based solely on the following: HT-800 (Gray) silicone foams (I) are compounded and cured under conditions of good manufacturing practice; and (II) have been subjected to annual extraction testing in accordance with FDA Regulation 21 CFR 177.2600 paragraphs (e) and (f) and found to meet all extractives limitations, both of which are criteria set forth in 21 CFR 177.2600 as necessary for rubber articles intended for repeated use in those areas specified in the regulation.

**Notes:**

- \*Typical Value- Value is based on historical data. Please note the frequency of testing varies.
- \*\*Specification- Applies to physical properties only, which are based on Rogers' internal benchmark and standard BISCO specification values. Additional industry specifications are available as well. All other properties are based on industry standard guidelines.



The information contained in this Data Sheet is intended to assist you in designing with Rogers' Elastomeric Material Solutions. It is not intended to and does not create any warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose or that the results shown in this Data Sheet will be achieved by a user for a particular purpose. The user should determine the suitability of Rogers BISCO products for each application. The Rogers logo, BISCO, and the BISCO logo are trademarks of Rogers Corporation or one of its subsidiaries. © 2003, 2006, 2007, 2009, 2013, 2014, 2017, 2019-2022, 2023 Rogers Corporation. All rights reserved. 1123-PDF - Publication #180-070 www.rogerscorp.com



**RH Nuttall Limited**Great Brook Street  
Nechells Green  
Birmingham B7 4ENe: sales@rhnuttall.co.uk  
t: 0121 359 2484  
f: 0121 359 4439**Material Specification  
Sheet****RHN 27G**

www.rhnuttall.co.uk

**HT800 Silicone Sponge****General Description**

HT-800 is a highly versatile, medium firmness silicone that offers the lightness of a foam, with the enhanced sealing capabilities of a traditional sponge rubber. It is used to seal and protect various outdoor communication, electronics, and lighting enclosures, while providing protection against wind driven rain and fire. The material is also used to reduce shock or isolate vibration. HT00 is widely used in the rail/mass transit industry; it is BS6853 Cat 1A approved for use in rail vehicles and is LUL (London Underground) approved for use on the London Underground network.

**Feature and Benefits**

Excellent memory and low stress relaxation reduce maintenance costs associated with gasket failures due to compression set and softening. Resistance to ultraviolet light, ozone, extreme temperatures, and flame enables consistent performance in all environments. Compact cell structure and unique formulation provides enhanced sealing performance to resist penetration of fine particles and wind driven rain.

Property	Test Method	Typical Value
Density Lb/ft <sup>3</sup>	ASTM D1056	22
Compression set %	ASTM D1056 Test D @ 70 °C	<1
Compression set %	ASTM D1056 Test D @ 100 °C	<5
Tensile strength (psi)	ASTM D412	45
Elongation %	ASTM D412	80
Toxic gas emissions	SMP-800	Pass
Compression deflection (psi)	ASTM D1056 25% Deflection	9
Recommended intermittent High Temperature °C	Internal	250
Recommended use temperature °C	SAE J236	-55 to 200
Low temp flex at -55 °C	ASTM D1056	Pass
Flame resistance	UL94	Listed V-0 and HF-1
Flame Spread	ASTM E162	<25
Smoke Density (Ds)	ASTM E662 tested @ 4 mins	<50
Smoke Density (Ds)	ASTM E662 tested @ 1.5 mins	<20
Toxic gas emissions rating	SMP-800	Pass
Water absorption	Internal 24 Hours @ room temp	1.4%
UV resistance	SAE J-1960	No Degradation
Ozone effect rating	ASTM D1171	0 (no cracks)
Corrosion resistance	AMS-3568	No Degradation
Dialectic constant	ASTM D150	1.42
Dialectic strength	ASTM D149 Volts/Mil	91
Dry arc resistance	ATSM D495, seconds	92
Thermal conductivity BTU in/hr/ft <sup>2</sup> (w/m ° K)	ASTM C518	0.63 (0.09)


\*\*The information given above is based upon average values and is no way intended as a warranty. The purchaser is deemed responsible for determining the suitability of the product for any application. All data relating to suitable uses and description information concerning our products are compiled from research and are believed to be reliable but are provided for guidance purposes only. The Company holds no legal or contractual responsibility for information supplied\*\*




### 3.5.3 ADHESIVE

# Sil-Poxy™

## Silicone Rubber Adhesive



Cured Material  
Certified Skin Safe!



www.smooth-on.com

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#### TECHNICAL OVERVIEW

Mixed Viscosity: Thick-paste
Specific Gravity: g/cc: 1.12
Working Time: 5 minutes (73°F/23°C)
Handling Time: 1 hour (73°F/23°C)
Color: Translucent
Shore A Hardness: 40
Tensile Strength, psi: 750
Elongation @ Break: 750%
Tear Strength: 100 psi
Peel Strength: 100 psi
Temperature Range: -50°F (-41°C) to 500°F (260°C)
Note: Tests done bonding silicone to silicone * All values measured after 7 days at 73°F/23°C

#### PROCESSING RECOMMENDATIONS

##### PREPARATION...

**Safety** - Use in a properly ventilated area ("room size" ventilation). Wear safety glasses, long sleeves and rubber gloves to minimize contamination risk.

**Store and use material at room temperature (73°F/23°C).** This product has a limited shelf life and should be used as soon as possible.

A clean, dry surface is essential for successful adhesive bonding. If possible, abrade surface and follow with solvent wipe before applying.

Because no two applications are quite the same, a small test application to determine suitability for your project is recommended if performance of this material is in question.

##### DISPENSING & APPLYING...

**Dispensing** - Squeeze tube, taking care not to allow air to enter tube before replacing cap. Unused product in tube exposed to air will cure quickly. Replace cap immediately after dispensing.

**Applying** - Apply adhesive to surface and mate parts. Material will begin to cure in about 5 minutes. Pieces can be handled after 1 hour depending on temperature and humidity. Full cure is attained after 24 hours.

**Clean Up** - Uncured Sil-Poxy™ can be removed from surfaces using isopropyl alcohol. Do not allow isopropyl alcohol to pool on silicone rubber surfaces.

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Safety First!

The Material Safety Data Sheet (MSDS) for this or any Smooth-On product should be read prior to use and is available upon request from Smooth-On. All Smooth-On products are safe to use if directions are read and followed carefully.

**Keep Out of Reach of Children**

**BE CAREFUL** - Use only with adequate ventilation. This product is irritating to the eyes and skin. If contaminated, flush eyes with water for 15 minutes and seek medical attention. Remove from skin with waterless hand cleaner then soap and water. Refer to MSDS. Vapors may irritate the respiratory tract. If contaminated, flush eyes with water for 15 minutes and seek medical attention. Remove from skin with soap and water.

**IMPORTANT** - The information contained in this bulletin is considered accurate. However, no warranty is expressed or implied regarding the accuracy of the data, the results to be obtained from the use thereof, or that any such use will not infringe upon a patent. User shall determine the suitability of the product for the intended application and assume all risk and liability whatsoever in connection therewith.



Call Us Anytime With Questions About Your Application.

Toll-free: (800) 381-1733 Fax: (610) 252-6200

[www.smooth-on.com](http://www.smooth-on.com) is loaded with information about mold making, casting and more. 121123DH

### 3.6 TESTS

Although performing the tests will be the responsibility of the Notified Body conducting the certification, it is important to consider what tests will be performed and the samples that will be required.

The assessment performed in the checklists indicates that the following tests will be required:

- Thermal endurance to heat and cold.
- Impact tests at heat and cold.
- Pressure test.
- IP66.

Although from a standards point of view only IP6X is required, commercially it is preferable to get IP66 rating as this seems to be the norm in other empty enclosures that are available on the market. Not having the enclosure IP66 rated could be a commercial disadvantage with respect to other competitors.

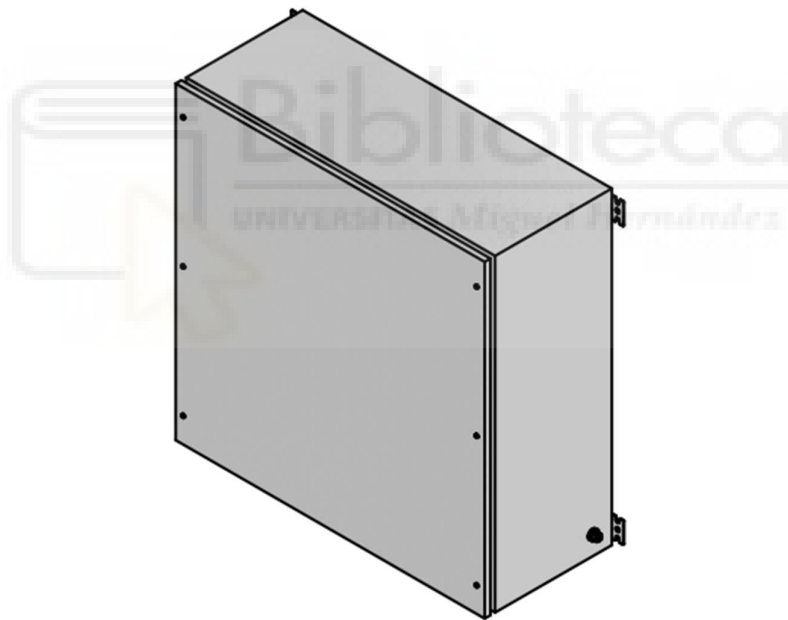




### 3.7 MANUAL

#### 3.7.1 EQUIPMENT DESCRIPTION

The ENC\_V01 is an empty Ex Component enclosure. It consists of an enclosure body and hinged cover and is constructed entirely of stainless steel 316L, and utilises silicone foam gaskets to maintain ingress protection rating of IP66. Its overall dimensions are 800mm x 800mm x 330mm (H x L x D). Entry into the enclosure is via a stainless steel gland plate provided on the bottom side of the enclosure body. Up to 20 plain holes can be provided, sizes are Ø20.5mm, Ø25.5mm, or a combination of both. External and internal earth facilities are provided by means of M10 studs located on the walls of the enclosure. The ENC\_V01 has four attachment lugs for fixing to a wall, metal frame or similar structure.



#### 3.7.2 EQUIPMENT SPECIFICATIONS

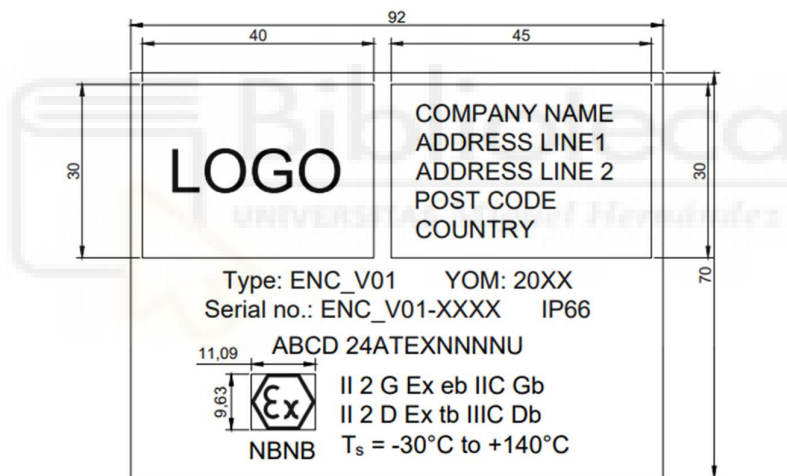
The NICP's specifications are shown below:

Equipment	Empty Enclosure
Model	ENC_V01

Approximate weight	12Kg
Approximate dimensions	800mm x 800mm x 330mm (H x Lx D)
Ex marking	II 2 G Ex eb IIC Gb II 2 D Ex tb IIIC Db
Service temperature range	T <sub>s</sub> = -30°C to +140°C
Electrical ratings	N/A

### 3.7.3 MARKING LABEL

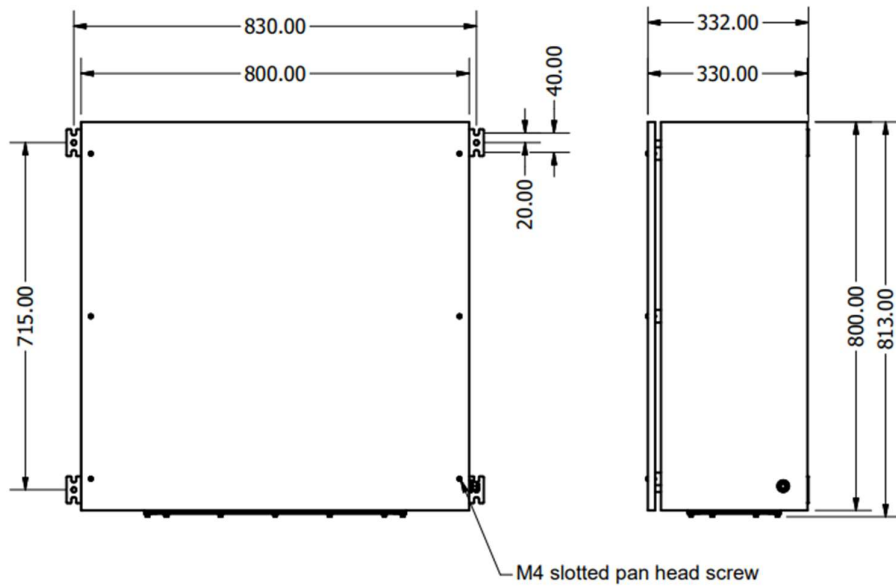
Example marking label shown below:



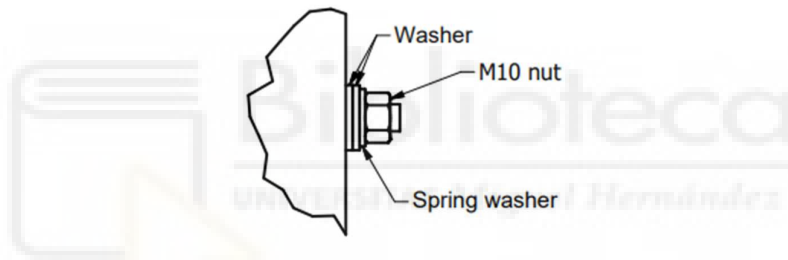
### 3.7.4 INSTALLATION GUIDELINES

The control panel shown in the illustrations below has dimensions of 800mm x 800mm x 330mm (H x Lx D) with a single door. The enclosure is unpainted and constructed of 2mm 316L stainless steel to prevent corrosion. Document number ENC\_V01-GA-001 – General Arrangement details the dimensions, layout and physical characteristics of the empty enclosure.

The cabinet has four attachment lugs for fixing to a wall, a unistrut frame or similar arrangement:



External and internal earth facilities are provided:



The connections must be performed in accordance with clause 15 of EN IEC 60079-0.

The cross-sections of the conductors must be selected as follows:

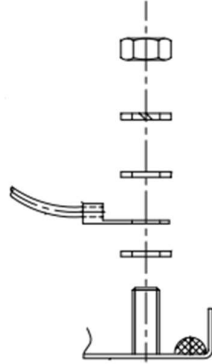
Cross-section of the phase wire of the installation S	Minimum cross-section of the associated Protective conductor Sp
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	0.5 S

The PE / equipotential bonding conductor terminal fittings are designed for a minimum cross-section of 4 mm<sup>2</sup>.

Select materials for the protective conductor terminal that are not likely to be susceptible to electro-chemical corrosion. Appropriate measures must be taken to protect protective earth conductors against mechanical, electro-dynamic and

thermodynamic stress. Mechanical protective earth connections must be accessible for inspection and testing.

Protective earth conductor arrangement is shown below:



The control panel is provided with up to 20 plain entries via a gland plate located on the bottom side of the enclosure. Dimensions can be Ø20.5 mm, Ø25.5 mm or a combination of both. Only suitably certified IP66 rated cable glands or blanking elements shall be used.

### **3.7.5 REPAIR AND MAINTENANCE INSTRUCTIONS**

Repair and maintenance work on the ENC\_V01 may be performed only by authorised personnel with the appropriate training.

Maintenance and servicing shall be performed based on EN 60079-17. As part of the maintenance, in particular, parts that depend on the ignition safety must be inspected. This includes, in particular, the seals, the fastening system, cable and wire entries.

The maintenance intervals must be chosen depending on the operating conditions and the operating time.

### **3.7.6 SCHEDULE OF LIMITATIONS**

- Installation of electrical components requires a further assessment by a Notified Body.
- Only suitably certified IP66 rated cable glands and blanking elements shall be used.

### 3.8 ATTESTATION OF CONFORMITY

#### ATTESTATION OF CONFORMITY (AOC-001)

1. Equipment:

Empty Enclosure ENC\_V01

2. Name and address of manufacturer:

COMPANY NAME

ADDRESS LINE 1

ADDRESS LINE 2

POST CODE

COUNTRY

3. This attestation of conformity is issued under the sole responsibility of the manufacturer listed above.

4. Object of the attestation:

The ENC\_V01 is an empty Ex Component enclosure. It consists of an enclosure body and hinged cover and is constructed entirely of stainless steel 316L, and utilises silicone foam gaskets to maintain ingress protection rating of IP66. Its overall dimensions are 800mm x 800mm x 330mm (H x L x D). Entry into the enclosure is via a stainless steel gland plate provided on the bottom side of the enclosure body. Up to 20 plain holes can be provided. External and internal earth facilities are provided by means of M10 studs located on the walls of the enclosure. The ENC\_V01 has four attachment lugs for fixing.

Installation of electrical components requires a further assessment by a Notified Body.

5. The object of the attestation described above is in conformity with the relevant Union harmonisation legislation:

2014/34/EU (ATEX)	Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and
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	protective systems intended for use in potentially explosive atmospheres.
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6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

ATEX harmonised standards applied	
EN IEC 60079-0:2018	Explosive atmospheres - Part 0: Equipment - General requirements
EN IEC 60079-7:2015+A1:2018	Explosive atmospheres - Part 7: Equipment protection by increased safety 'e'
EN 60079-31:2014	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
Additional harmonised standards applied	
EN 60529:1991/A2:2013	Degrees of protection provided by enclosures (IP code)

7. EU-Type Examination Certificate and Quality Assurance Notification:

- Certificate: NoBo 24ATEXNNNU
- QAN: NoBo 24ATEXQNNN
- Notified Body number: nnnn

8. Signatories

CITY, 04/06/2024

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Managing Director at COMPANY NAME

