

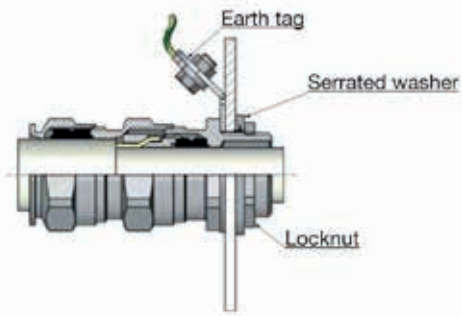
# Technical information



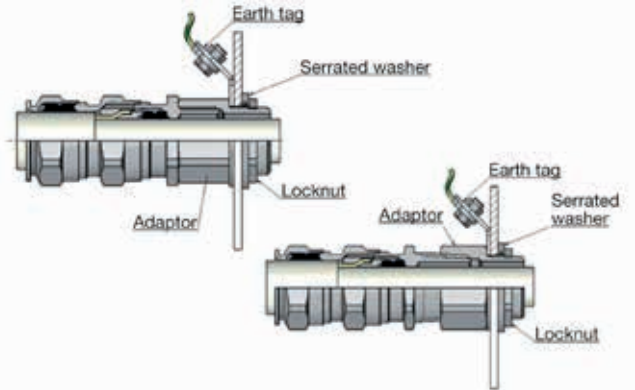
# Cable glands - installation guide

## Fixing - blank hole

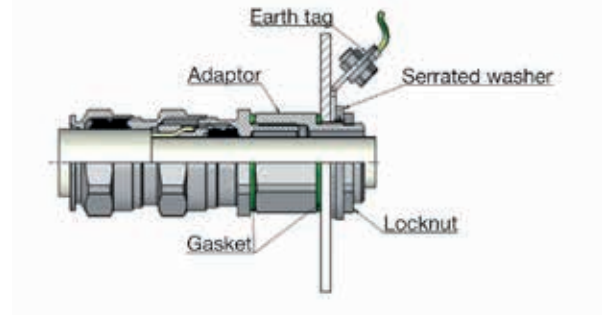
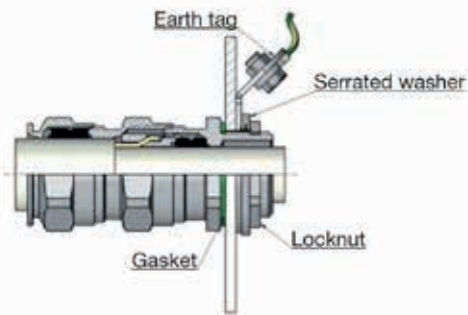
Cable gland



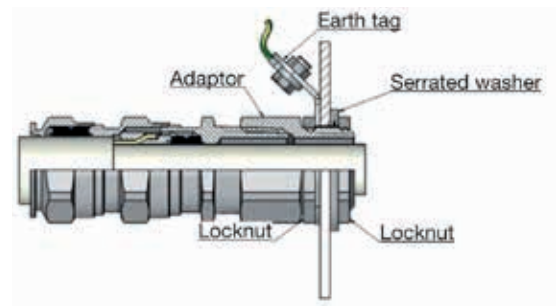
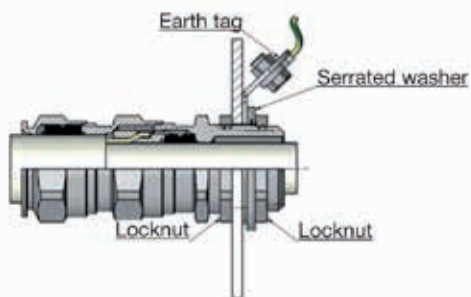
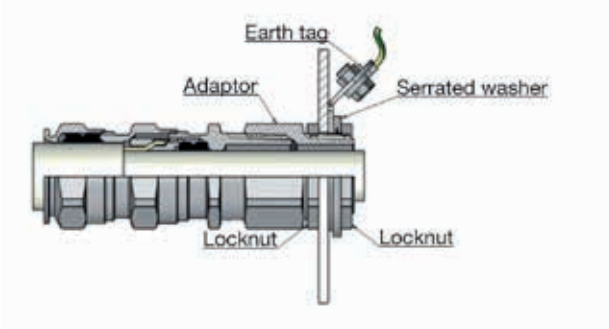
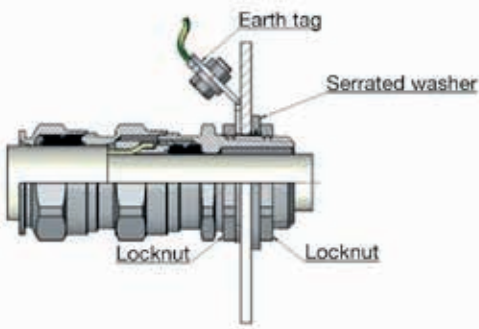
Cable gland with an accessory



ISO



NPT

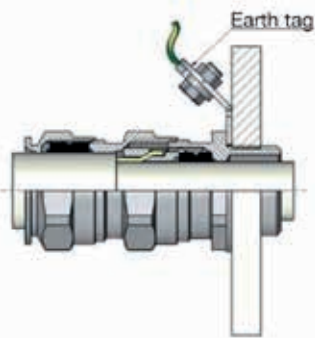


# Cable glands - installation guide

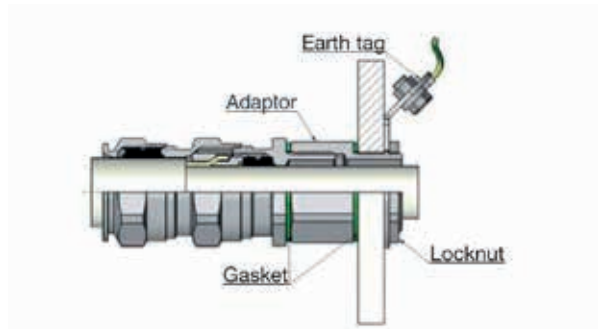
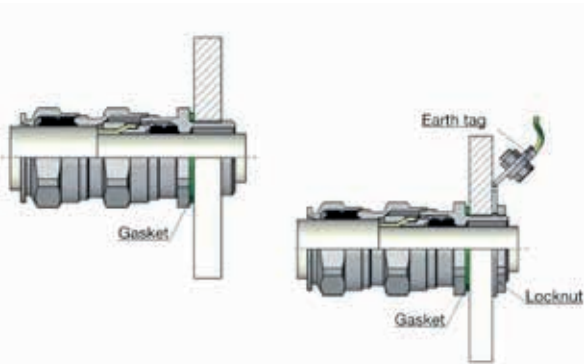
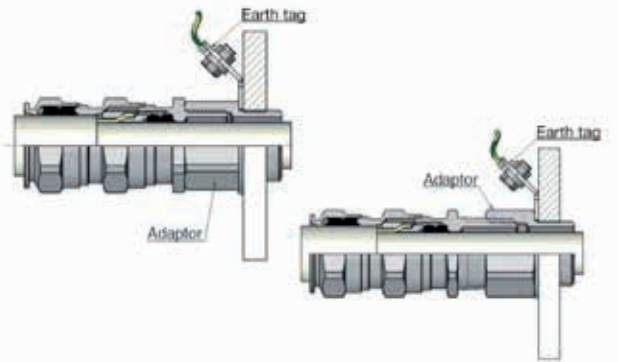
## Fixing - threaded hole

ISO

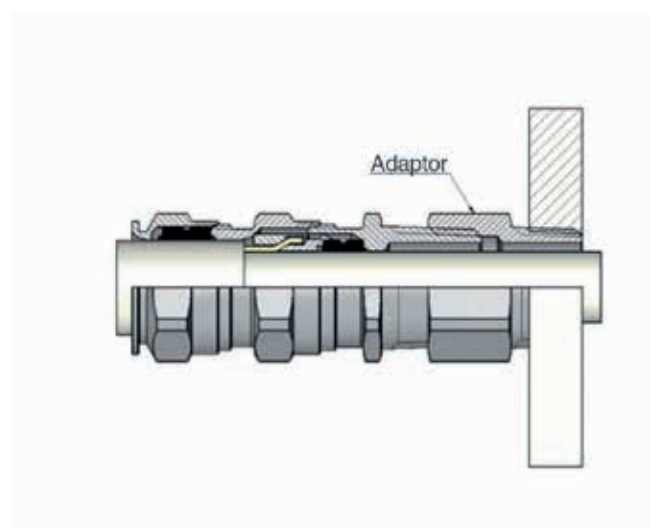
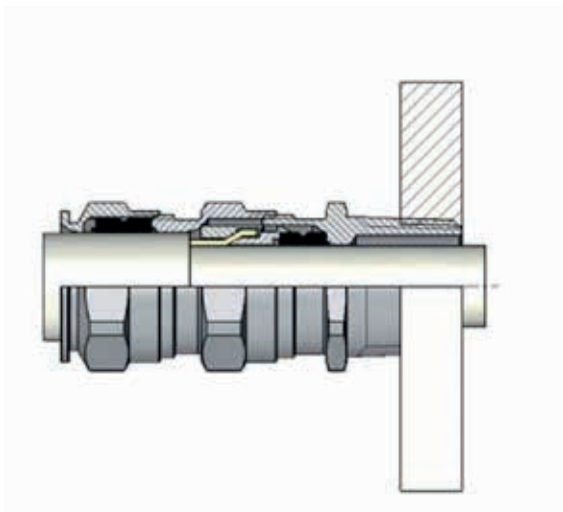
Cable gland



Cable gland with an accessory



NPT



# Capri cable gland certifications

ADE Ex Certification	LOCATIONS	HAZARDOUS LOCATIONS				
	Labs:	ATEX / INERIS	IECEx / INERIS	CCoE	INMETRO/CEPEL	KOSHA
<p><b>ADE-1F2,1F2 A,1F2 DS</b> Cable outer Ø 2.75 to 104 mm Metric fixing thread M10 to M110 NPT fixing thread 1/8" to 4"</p> <p><b>ADE-4F and 5F;</b> n°4 to 17 Cable outer Ø 4.5 to 104 mm Metric fixing thread M10 to M110 NPT fixing thread 1/8" to 4"</p> <p><b>ADE-6F;</b> n°5 to 11 Cable outer Ø 6 to 48 mm Metric fixing thread M16 to M63 NPT fixing thread 3/8" to 2"</p> <p><b>ADE-1FC;</b> n°4 to 16 Cable outer Ø 4 to 93 mm Metric fixing thread M16 to M110 NPT fixing thread 3/8" to 4"</p> <p><b>ADE-6FC;</b> n°5 to 17 Cable outer Ø 6 to 104 mm Metric fixing thread M16 to M110 NPT fixing thread 3/8" to 4"</p>	Certificate no:	INERIS 12ATEX0032X	IECEx INE12.0025X	P360379/1	05.0558X 1F2, 1F2 A, 1F2 DS, 1FC  05.0559X 4F, 5F, 6F, 6FC	2015-BO-0245 to 0248 4F  2015-BO-0249 to 0256 1F2, 1F2 A, 1F2 DS  2015-BO-0479 to 0482 1FC  2015-BO-0483 to 0490 5F, 6F  2015-BO-0491 to 0494 6FC
	Standards:	EN 60079-0:2012; 60079-1:2007; 60079-7:2007; 60079-31:2009  IEC 60079-0:2011; 60079-1:2007; 60079-7:2006; 60079-31:2008	IEC 60079-0:2011; 60079-1:2007; 60079-7:2006; 60079-15:2010; 60079-31:2008	IEC 60079-0:2011; 60079-1:2007; 60079-7:2006; 60079-15:2010	ABNT NBR IEC 60079-0:2008; 60079-1:2009; 60079-7:2008; 60529:2009  IEC 60079-15:2010; 60079-31:2008	2013-54  IEC 60079-0:2004; IEC 60079-1:2003; IEC 60079-7:2001; IEC 60079-15:2005; IEC 61241-1:2004
	Protections:	II2GD Ex db IIC Ex eb IIC Ex tb IIIC  II3G Ex nRc IIC IM2 Ex db I/Ex eb I	Ex db IIC Ex eb IIC Ex tb IIIC Ex db I Ex eb I	Ex db IIC Ex eb IIC Ex nRc IIC	Ex db IIC Ex eb IIC Ex tb IIIC Ex db I Ex eb I	Ex d IIC Ex e II Ex nR II Ex tD A21
	GR I special note:	Minimum thread M16 and 3/8" NPT; <b>1F2 A</b> brass, bronze no:8-17; stainless steel no:4-17; <b>1F2 DS</b> brass, bronze and stainless steel no:8-17; <b>4F</b> and <b>5F</b> brass, bronze no:7-17; stainless steel no:4-17				
	Operating temperatures:	<b>ADE-1F2, 1F2 A, 1F2 DS, 4F and 5F:</b> Black ring: -30°C to +80°C; red or grey ring: -60°C to +140°C <b>ADE-6F:</b> Red or grey ring: -60°C to +80°C <b>ADE-1FC and 6FC:</b> TSC compound: -60°C to +80°C				
	Cable types:	Non-armoured cable with ADE-1F2, 1F2 A, 1F2 DS and 1FC. Armoured or braided cable with ADE-4F, 5F, 6F and 6FC.				
	IP:	IP66, IP67, IP68 (30m/7days).				

ADE UL Certification	cULus and UL	cULus Marine	UL Marine
File No:	E310130	E314047	E324850
Standards:	UL 2225 UL 514B CSA C22.2 no: 60079-0:07 CSA E60079-7:03 CSA C22.2 no: 60079-1:07	UL 2225 UL 60079-0 UL 60079-7	UL 2225 UL 514B
IP:	IP68 (with washers)	IP68 (with washers)	IP68 (with washers)
Scope of certification:	<p><b>Class I, Zone 1, AEx e II</b> <b>ADE-1F2, 1F2 A, 1F2 DS and 1FC</b> no 3 to no 8, thread sizes 1/2" to 1 1/4" NPT or M20 to M40, with TC-ER-HL non-armoured cable up to diameter 1 inch.</p> <p><b>Class I, Zone 2, AEx e II, Ex e II</b> <b>ADE-1F2, -1F2 A and -1F2 DS</b> no 3 to 17, 1/2" to 4" NPT or M20 to M110 with non-armoured cable ITC, MV, PLTC, TC-ER-HL, TC-ER and TC. <b>ADE-4F and -5F</b> no 4 to 17, 1/2" to 4" NPT or M20 to M110 with armoured cable ITC, MV, PLTC, TC-ER-HL, TC-ER and TC. <b>ADE-6F</b> no 5 to 11, 1/2" to 2" NPT or M20 to M63 with armoured cable ITC, MV, PLTC, TC-ER-HL, TC-ER and TC.</p> <p><b>Class I, Zone 2, AEx de II, Ex de II</b> <b>ADE-1FC</b> no 4 to 16, 1/2" to 4" NPT or M20 to M110 with non-armoured cable ITC, MV, PLTC, TC-ER-HL, TC-ER, TC and TSC compound. <b>ADE-6FC</b> no 5 to 17, 1/2" to 4" NPT or M20 to M110 with armoured cable ITC, MV, PLTC, TC-ER-HL, TC-ER, TC and TSC compound.</p> <p><b>Class I, Division 1, Groups A, B, C and D</b> <b>ADE-1FC</b> no 4 to 9, 1/2" to 1 1/4" NPT or M20 to M40 with TC-ER-HL cable and TSC compound. <b>ADE-6FC</b> no 5 to 9, 1/2" to 1 1/4" NPT or M20 to M40 with TC-ER-HL cable and TSC compound. <b>ADE-1FC</b> no 4 to 16, 1/2" to 4" NPT or M20 to M110 with ITC-HL cable and TSC compound. <b>ADE-6FC</b> no 5 to 17, 1/2" to 4" NPT or M20 to M110 with ITC-HL cable and TSC compound.</p> <p><b>Class I, Division 2, Groups A, B, C and D</b> <b>ADE-1FC</b> no 4 to 16, 1/2" to 4" NPT or M20 to M110 with non-armoured cable PLTC, PLTC-ER, ITC, ITC-ER, ITC-HL, TC, TC-ER, TC-ER-HL, MV and TSC compound. <b>ADE-6FC</b> no 5 to 17, 1/2" to 4" NPT or M20 to M110 with armoured cable PLTC, PLTC-ER, ITC, ITC-ER, ITC-HL, TC, TC-ER, TC-ER-HL, MV and TSC compound.</p>	<p><b>Class I, Zone 2, AEx e II, Ex e II</b> <b>ADE-1F2, -1F2 A and -1F2 DS</b> no 3 to 17, 1/2" to 4" NPT or M20 to M110 with non-armoured marine shipboard cable.</p> <p><b>Class I, Zone 1, AEx e II, Ex e II Hazardous Locations for:</b> <b>ADE-4F and -5F</b> no 4 to 17, 1/2" to 4" NPT or M20 to M110 with armoured marine shipboard cable. <b>ADE-6F</b> no 5 to 11, 1/2" to 2" NPT or M20 to M63 with armoured marine shipboard cable.</p>	<p><b>Class I, Division 2, Groups A, B, C and D</b> <b>ADE-1FC</b> no 4 to 16, 1/2" to 4" NPT or M20 to M110 with non-armoured marine shipboard cable and TSC compound.</p> <p><b>Class I, Division 1, Groups A, B, C and D</b> <b>ADE-6FC</b> no 5 to 17, 1/2" to 4" NPT or M20 to M110 with armoured marine shipboard cable and TSC compound.</p>
Operating temperature:	<b>ADE-1F2, 1F2 A, 1F2 DS, 4F and 5F</b> Black ring: -30°C to +80°C; red/grey ring: -60°C to +140°C <b>ADE-6F, 1FC, 6FC</b> -60°C to +80°C		<b>ADE-1FC, 6FC</b> -20°C to +40°C

The Zone 1 and 2 marking allow installation in all gas atmospheres allowed by Article 505 of the NEC and section 18 of CEC. Per the NEC, 501.5, Zone 1 or 2 cable glands are permitted in a Division 2 location for non-sparking and arcing applications.

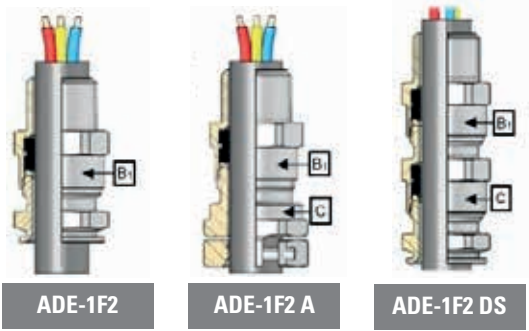


HAZARDOUS LOCATIONS			HAZARDOUS LOCATIONS FOR SHIPPING APPLICATIONS				DELUGE
NANIO EAC	NEPSI	SABS	BV	DNV	ABS	LLOYDS	Dcns
TC RU C-FR.F605.B.00858	GYJ13.1082X	MS/15-0314X	40910/A0 BV	TAE000010X	14-HS1274083-2-PDA	11/00072	DTSO 120121029
TR CU 012/2011  FOCT P M3K 60079-0:2011; 60079-1:2011; 60079-7:2012; 60079-15:2010; 60079-31:2010	GB 3836.1-2010; 3836.2-2010; 3836.3-2010; 12476.1-2000	SANS 60079-0:2012; 60079-1:2009; 60079-7:2009; 60079-15:2010; 60079-31:2009	IEC 60079-0:2011; 60079-1:2007; 60079-7:2006; 60079-15:2010; 60079-31:2008	EN 62444/1998 60079-0:2012; 60079-1:2007; 60079-7:2007; 60079-31:2009  IEC 62444:2014; 60079-0:2011; 60079-1:2007; 60079-7:2006; 60079-31:2008	ABS: 2014 Steel Vessels Rules 1-1-4/7.7, 1-1-A3, 1-1-A4 (4-8-3/1, 7 & 13, 4-8-4/27.4) ABS: 2014 Offshore Units & Structures 1-1-4/9.7, 1-1-A2, 1-1-A3 (4-3-3/9.1.2)  UL 2225  IEC 60079-0:2011; 60079-1:2007 60079-7:2006; 60079-15:2010 60079-31:2008	IEC 60079-0:2011; 60079-1:2007 60079-7:2006; 60079-15:2010; 60079-31:2008  UL 2225 514B  C22.2 No1	DTSO1:1991
1Ex d IIC Gb X 1Ex e IIC Gb X Ex nR IIC Gc X Ex tb IIIC Db PB Ex db I X PB Ex eb I X	Ex d IIC Gb Ex e IIC Gb Ex d I Mb Ex e I Mb DIP A21	Ex db IIC Ex eb IIC Ex tb IIIC Ex nRc IIC Ex db I Ex eb I	Ex db IIC Ex eb IIC Ex tb IIIC Ex nRc IIC Ex db I Ex eb I	Ex db IIC Ex eb IIC Ex tb IIIC Ex nRc IIC Ex db I Ex eb I			

	ATEX	IECEx	SHIPPING APPLICATION
Certificate No:	INERIS13ATEX0008X	IECEx INE13.0003X	BV 40909_A0
Standards:	EN 60079-0:2009 EN 60079-7:2007 EN 60079-31:2009 IEC 60079-0:2011 IEC 60079-7:2006 IEC 60079-31:2008	IEC 60079-0:2011 IEC 60079-7:2006 IEC 60079-15:2010 IEC 60079-31:2008	IEC 60079-0:2011 IEC 60079-7:2006 IEC 60079-15:2010 IEC 60079-31: 2008
Protections:	II2GD Ex eb IIC, Ex tb IIIC II3G Ex nRc IIC	Ex eb IIC Ex nRc IIC Ex tb IIIC	Ex eb IIC Ex nRc IIC Ex tb IIIC
IP:	IP66, IP67, IP68		
Operating Temperature:	-20°C to +80°C		

	ATEX	IECEx
Certificate no:	PTB14ATEX1015X	IECEx-PTB14.0027X
Standards:	EN 60079-0:2012 EN 60079-7:2007 EN 60079-31:2009	IEC 60079-0:2011 IEC 60079-7:2006-2007 IEC 60079-31:2008
Protections:	II2G Ex e IIC Gb II2D Ex tb IIIC Db	Ex e IIC Gb Ex tb IIIC Db
IP:	IP66	
Operating temperature:	-55°C to +70°C	

# Capri ADE Ex Markings



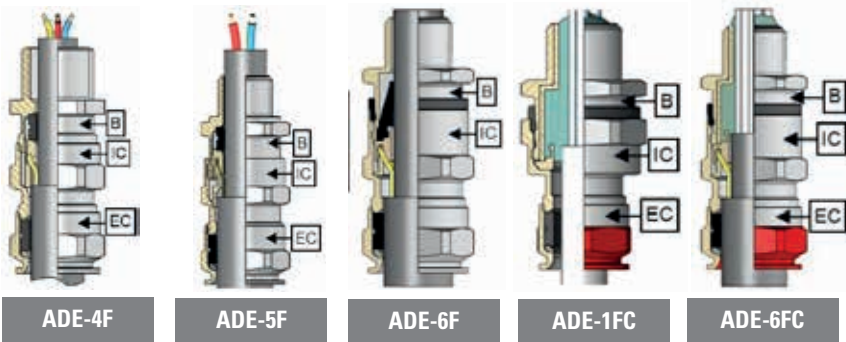
## ADE-1F2, 1F2 A, 1F2 DS series

- B<sub>1</sub>** Body: main Ex markings - dependent on gland size
- C** Capnut: Group I (mining) markings (not aluminum)

### **B<sub>1</sub>** Main Ex markings example

Manufacturer name/trademark	Gland type	Fixing thread	Cable range diameter*	IP rating	ATEX/IECEx certificate numbers
Line 1 EATON-Crouse-Hinds, Series-1, ADE-1F2, n*10, NPT1*1/2, cable Ø29-41, IP66 / IP68, INERIS, 12ATEX0032X, IECEx, INE, 12.0025X					
Lines 2-4 					
UL/cULus marking	ATEX marking	Alternate Ex marking gas and dust protection levels*	Ex certificate numbers	Additional Ex certificate numbers*	

\*Presence of marking dependent on available space



## ADE-1FC, 4F, 5F, 6F, 6FC series

- B** Body: fixing thread markings
- IC** Internal capnut: main Ex markings - dependent on gland size
- EC** External capnut: Group I (mining) markings (not aluminum)

### **B** Fixing thread markings example

M32x1.5

### **IC** Main Ex markings example

Manufacturer name/trademark	Gland type	Cable range diameter*	IP rating	ATEX/IECEx certificate numbers
Line 1 EATON-Crouse-Hinds, Series-1, ADE-5F, n*10, cable Ø29-41, IP66/68, INERIS, 12ATEX0032X, IECEx, INE, 12.0025X				
Lines 2-4 				
UL/cULus marking	ATEX marking	Alternate Ex marking gas and dust protection levels*	Ex certificate numbers	Additional Ex certificate numbers*

\*Presence of marking dependent on available space

### **C** / **EC** ATEX Group I (mining) markings example - on ADE-1F2 series, ADE-4F, ADE-5F, ADE-6F

ADE IM2 Ex db I Ex eb I

# Crouse-Hinds cable gland certification

US Cable Gland certification (January 2014):					
UL Certification	File No.	cULus E122485	UL E36379	UL E22133	LR13046
	Standards:	UL2225 3rd Ed. and UL 514B	UL 514B	UL 514B	CSA C22.2 NO 174
<b>TMCX II</b> Cable outer Ø 0.49 to 1.39 inches Fixing Thread NPT : 1/2" to 1 1/4"	<b>Classification:</b>	TMCX II : cULus Listed Class I Div 1 ABCD, Class II EFG, Class III			
	<b>Sealing type, Service temperature and Environmental</b>	TMCX II : TSC compound, Chico LiquidSeal : -40°C to +60°C : NEMA 6P			
	<b>Cable type:</b>	TMCX II : MC-HL (Metal Clad for Hazardous Locations), MC (Metal Clad), TECK, TC (Tray Cable)			
<b>TMCX</b> Cable outer Ø 0.49 to 4.28 inches Fixing Thread NPT : 1/2" to 4"	<b>Classification:</b>	TMCX : UL Listed Class I Div 1 ABCD, Class II EFG, Class III			TMCX : CSA Listed Class I Div 1 ABCD, Class II EFG, Class III
	<b>Sealing type, Service temperature and Environmental</b>	TMCX : TSC compound: -25°C to +40°C : NEMA 4X			TMCX : TSC compound: -25°C to +40°C
	<b>Cable type:</b>	TMCX : MC-HL (Metal Clad for Hazardous Locations), MC (Metal Clad), TECK			TMCX : MC-HL (Metal Clad for Hazardous Locations), MC (Metal Clad), TECK
<b>TMC</b> Cable outer Ø 0.49 to 4.28 inches Fixing Thread NPT : 1/2" to 4"	<b>Classification:</b>		UL Listed Ordinary Locations		
	<b>Sealing type, Service temperature and Environmental</b>		Neoprene seal : -25°C to +60°C : NEMA 4		
	<b>Cable type:</b>		MC (Metal Clad)		
<b>TECK</b> Cable outer Ø 0.52 to 4.34 inches Fixing Thread NPT : 1/2" to 4"	<b>Classification:</b>				CSA Certified Class II EFG, Class III
	<b>Sealing type, Service temperature and Environmental</b>				Neoprene seal : -25°C to +60°C : Type 4 and IP56
	<b>Cable type:</b>				TECK
<b>CGB</b> Cable outer Ø 0.12 to 2.50 inches Fixing Thread NPT : 3/8" to 3"	<b>Classification:</b>			cULus Listed Ordinary Locations	
	<b>Sealing type, Service temperature and Environmental</b>			Neoprene seal : -25°C to +40°C	
	<b>Cable type:</b>			Non-armoured	

# Cable types and wiring methods

		CABLE TYPES														
		MC	MC-HL	TC/ TC-ER	TC-ER-HL†	MI	TECK	TECK-HL	PLTC/ PLTC-ER	MV	ITC/ ITC-ER	ITC-HL	SWA#	STA#	SWB	Braided marine shipboard
IEC	Zone 1			■			■					■	■	■	■	■
	Zone 2			■			■					■	■	■	■	■
NORTH AMERICA	Div 1		■		■	■*	■*				■				■**	
	Div 2	■	■	■	■	■	■	■	■	■	■	■			■	■
	Zone 1		■		■	■*	■*				■				■**	
	Zone 2	■	■	■	■	■	■	■	■	■	■	■			■	■

All wiring for Div 1 is suitable for Div 2

All wiring for Zone 1 is suitable for Zone 2

† TC-ER-HL with above approvals up to 1" outer diameter cable only

# Includes lead sheath cable

\* Canada ONLY

\*\* Armoured and sheathed marine shipboard cable can be used in Class 1, Division 1 locations offshore as mentioned in API RPI14F

For Canada: Not Class 1. For areas under jurisdiction of Transport Canada's Electrical requirements per TP127E. For further details on Canada specific requirements please contact your local Eaton representative.







## IEC Wiring methods

Although there are no IEC construction standards for the cables intended for use in flammable atmospheres, according to IEC 60079-14:2002, 10.4.2(b), if a cable gland with an elastomeric flameproof sealing ring is to be used, when connecting cables to Ex d equipment enclosures, the cable should be:- substantially compact and circular, have an extruded bedding (without gaps), have fillers, if any are used, which are non-hygroscopic.



## NEC/CEC Wiring methods

As shown in the table above, the only cables that are permitted for use in Class1 Div1 are those that are mechanically protected by armour. The three protection techniques approved for Class1 Div1 locations are "intrinsically safe", "Purge and Pressurized" and "Explosionproof." When using the explosionproof protection technique, the cable must be sealed at the point of entry with an approved sealing device.

## Armoured cable

	STEEL WIRED ARMoured	<b>ADE-4F*</b>
	STEEL BRAID ARMoured	<b>ADE-5F*</b>
	STEEL TAPE ARMoured	<b>ADE-6F</b>
	TYPE P CABLE	<b>ADE-6FC</b>
		* Lead sheathed on ADE-4F and ADE-5F ONLY
	METAL CLAD	<b>TMCX TMCX II TMC</b>
	TECK	<b>TMCX TMCX II TECK</b>

## Non-armoured cable

	NON-ARMoured	<b>ADE-1F2 ADE-1F2 DS ADE-1F2 A ADE-1F2 O-RING ADE-1FC</b>
	TRAY / TYPE P	<b>ADE-1F2 ADE-1F2 DS ADE-1F2 A ADE-1F2 O-RING ADE-1FC ADE-6FC TMCX TMCX II CGB CGD CGE</b>



# Selection of cable glands - technical references

## References to IEC Standards:

60079-14/Ed.5: Explosive atmospheres – Part 14: Electrical installations design, selection and erection

60079-0/Ed.6: Explosive atmospheres - Part 0: Equipment - General requirements

## Extract from IEC 60079-14/Ed.5:

### 10.2 Selection of Cable Glands

Cable glands shall be in accordance with IEC 60079-0 and shall be selected to maintain the requirements of the protection technique according to the table below.

PROTECTION TECHNIQUE FOR THE EQUIPMENT	GLANDS, ADAPTORS AND BLANKING ELEMENT PROTECTION TECHNIQUE			
	Ex 'd' - see 10.6	EX 'e' - see 10.4	Ex 'n' - see 10.4	Ex 't' - see 10.7
Ex 'd'	X			
Ex 'e'	X	X		
Ex 'i' and Ex 'nL' - Group IIa	X	X	X see 16.5	
Ex 'i' - Group IIIa				X see 16.5
Ex 'm'	Ex 'm' would not normally be applied to wiring connections. The protection technique for connections shall suit the wiring system used.			
Ex 'n' except Ex 'nL' For Ex "nR" see also 10.8	X	X	X	
Ex 'o'	Ex 'o' would not normally be applied to wiring connections. The protection technique for connections shall suit the wiring system used			
Ex 'p', all types	X	X	X <sub>b</sub>	
Ex 'pD'				X
Ex 'q'	Ex 'q' would not normally be applied to wiring connections. The protection technique for connections shall suit the wiring system used.			
Ex 's'	Only as allowed by the conditions of the certificate.			
Ex 't'				X

X denotes permitted use.

- a) If only one intrinsically safe circuit is applied then there are no specified requirements for cable glands.
- b) Only permitted for Gc installations.

To meet the ingress protection requirement it may also be necessary to seal between the cable glands, adaptors and blanking elements and the enclosure (for example by means of a sealing washer or thread sealant).

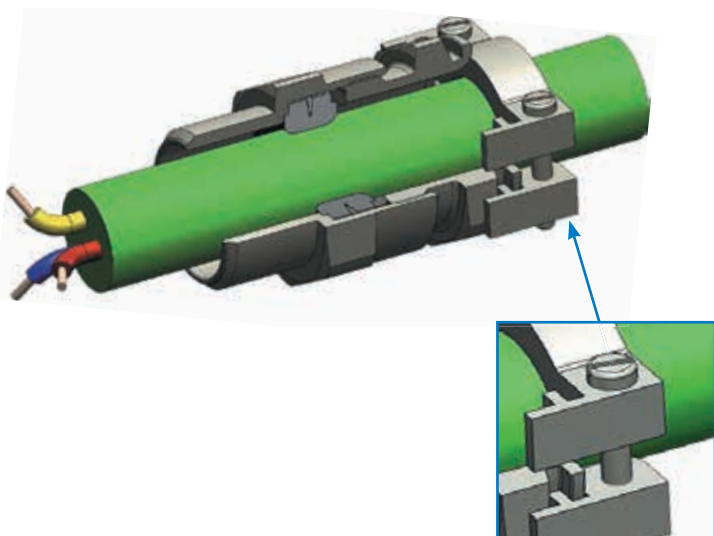
Note 2: In order to meet the minimum requirement of IP54, threaded cable entry devices into threaded cable entry plates or enclosures of 6 mm or greater thickness need no additional sealing between the cable entry device and the entry plate or enclosure providing the axis of the cable entry device is perpendicular to the external surface of the cable entry plate or enclosure.

# Selection of cable glands - technical references

## 10.3 Connections of cables to equipment

Cable glands shall be installed in a manner that after installation they are only capable of being released or dismantled by means of a tool. If additional clamping is required to prevent pulling and twisting of the cable transmitting the forces to the conductor terminations inside the enclosure, a clamp shall be provided, as close as practicable to the gland along the cable.

### Capri ADE gland with clamping module



**NOTE 1** Cable clamps within 300 mm of the end of the cable gland are preferred.

Cables shall be routed straight from the cable gland to avoid lateral tension that may compromise the seal around the cable. Where cable glands, blanking elements and adaptors with tapered threads are used in enclosures having gland plates with unthreaded entries, care shall be taken to use appropriate fittings to maintain the enclosure integrity.

**NOTE 2** Tapered threads include NPT threads.

When braided or armoured cables have been terminated within the cable gland, the body components that are intended to retain and secure the cable braid or armour should not be able to be released manually or opened by hand without the use of a tool.

The connection of cables to the electrical equipment shall be effected by means of cable glands appropriate to the type of cable used and shall maintain the explosion protection integrity of the relevant type of protection.

Where the threaded entry or hole size is different to that of the cable gland, a threaded adaptor complying with Table 10 shall be fitted.

## 10.6 Additional requirements for type of protection 'd' – flameproof enclosures

### 10.6.1 General

Where cables enter into flameproof equipment via flameproof bushings through the wall of the enclosure which are part of the equipment (indirect entry), the parts of the bushings outside the flameproof enclosure shall be protected in accordance with one of the types of protection listed in IEC 60079-0. For example, the exposed parts of the bushings are within a terminal compartment which may either be another flameproof enclosure or will be protected by type of protection "e".

If an Ex 'd' gland clamping by the sealing ring (compression) is used with braided or armoured cable, it shall be of the type where the braid or armour is terminated in the gland and compression takes place on the inner cable sheath. For fine braided cable, where the braid is less than 0.15 mm diameter and has coverage of at least 70 % compression only on the outer sheath is accepted.

**NOTE 1** Flame propagation of flame may occur through the interstices between the strands of standard stranded conductors, or between individual cores of a cable. Special cable construction can be employed as means of reducing and preventing flame propagation. Examples include compacted strands, sealing of the individual strands, and extruded bedding. Further information is given in Annex E.

# Selection of cable glands - technical references

Flameproof cable glands, adaptors or blanking elements, having parallel threads may be fitted with a sealing washer between the entry device and the flameproof enclosure provided that, after the washer has been fitted, the applicable thread engagement is still achieved. Thread engagement shall be at least five full threads. Suitable grease may be used provided it is non-setting, non-metallic and non-combustible and any earthing between the two is maintained.

Where taper threads are used, the connection shall be made wrench tight.

The addition of holes or alteration to thread form is only permitted when in compliance with the certification documents and completed by the manufacturer or certified workshops. Where the threaded entry or hole size is different to that of the cable gland, a flameproof threaded adaptor complying with IEC 60079-1 shall be fitted which complies with thread engagement requirements detailed above. Unused cable entries shall be sealed with a flameproof blanking element complying with IEC 60079-1, which shall be fitted directly to the hole (no threaded adaptor shall be used), and shall comply with thread engagement requirements detailed above and shall be secured against loosening.

**NOTE 2** Non-threaded cable glands can be used if certified with the complete equipment or if certified as equipment.

## 10.6.2 Selection of cable glands

The cable entry system shall comply with one of the following:

- a) Cable glands sealed with setting compound (barrier cable glands) in compliance with IEC 60079-1 and certified as equipment;
- b) Cables and glands meeting all of the following:
  - cable glands comply with IEC 60079-1 and are certified as equipment
  - cables used comply with 9.3.2(a)
  - the connected cable is at least 3 m in length;
- c) Indirect cable entry using combination of flameproof enclosure with a bushing and increased safety terminal box;
- d) Mineral-insulated metal-sheathed cable with or without plastic outer covering with appropriate flameproof cable gland complying with IEC 60079-1;
- e) Flameproof sealing device (for example a sealing chamber) specified in the equipment documentation or complying with IEC 60079-1 and employing a cable gland appropriate to the cables used. The sealing device shall incorporate compound or other appropriate seals which permit stopping around individual cores. The sealing device shall be fitted at the point of entry of cables to the equipment.

**NOTE 1** The minimum length of cable is to minimize the potential for flame transmission through the cable (see also Annex E);

**NOTE 2** If the cable gland and actual cable are certified as a part of the equipment (enclosures) then compliance to 10.6.2 is not necessary.

### Extract from IEC 60079-0/Ed.6:

#### Annex A - Supplementary requirements for cable glands

##### A.2.3 Clamping

###### A.2.3.1 General

Cable glands shall provide clamping of the cable in order to prevent pulling or twisting applied to it from being transmitted to the connections. Such clamping can be provided by a clamping device, sealing ring or filling compound. Whichever clamping arrangement is used, it shall be capable of meeting the relevant type tests in Clause A.3.

###### A.2.3.2 Group II or III cable glands

Cable glands for Group II or III equipment, without a clamping device, shall also be accepted as complying with this annex if they are capable of passing the clamping tests with values reduced to 25 % of those required in Clause A.3. The descriptive documents shall then state that such cable glands may not provide sufficient clamping and that the user shall provide additional clamping of the cable to ensure that pulling and twisting is not transmitted to the terminations. Such cable glands shall be marked with the symbol "X" to indicate this specific condition of use according to item e) of 29.3.

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# Bi-metallic corrosion

## Material information

### Bi-metallic corrosion

Bi-metallic corrosion occurs when two metals, with different potentials, are in electrical contact while immersed / in contact in an electrically conducting corrosive liquid / atmosphere. Because the metals have different natural potentials, a current will flow from the anode (more electronegative) metal to the cathode (more electropositive), which will increase the corrosion on the anode.

This additional corrosion is bi-metallic corrosion. It is also referred to as a galvanic corrosion, dissimilar metal corrosion or contact corrosion. The electrode potential is determined by many factors but the only fluid / atmospheres for which these factors are really well documented is sea water.

The value of the potential for any alloy, even in sea water, can be changed by a variety of factors such as temperature, velocity, biocide treatment, etc. Selection table below are thereby indicatives.

### Key corrosion prevention points

- Don't mix metals. If only one material is used in a construction, the problem is avoided.
- Consider area effect to avoid bi-metallic corrosion. The area effect should also be considered in avoiding corrosion damage.
- Remember stainless steels, such as 316L, have a thin, protective oxidized film and while this is intact, corrosion rates are very low and the alloy is said to be in its passive state.
- The bi-metallic corrosion rate of many copper-based and of stainless steel in sea-water, depends upon the flow rate of the water as well as on the area ratio. Natural brass alloys tend to become less noble with increasing flow rate and to corrode more - thereby plating brass will improve the performance, while stainless steels become more noble and corrode less. In well-aerated flowing solutions, stainless steels are also likely to become passive and corrode less.



### Indoor use

CABLE GLAND SERIES	ENCLOSURE				
	316 STAINLESS STEEL	STEEL	BRASS	ALUMINUM	NON-METALLIC
Nickel-plated brass	S	S	S	S	S
316L stainless steel	S	S	S	S	S
Aluminum	S	L	L	S	S
Polyamide	S	S	S	S	S

### Outdoor use in sea water environment

Nickel-plated brass	L	NC	S	L	S
316L stainless steel	S	L	L	NC	S
Aluminum	NC	NC	NC	S	S
Polyamide	S	S	S	S	S

**S** Suitable

**L** Limited corrosion

**NC** Not compliant. Severe corrosion - do not use

# Thread dimension guide

## Thread lengths

ADE - CABLE GLAND RANGE			
THREAD SIZE ISO	STANDARD LENGTH	THREAD SIZE NPT	STANDARD LENGTH
12	15.0	3/8" NPT	16.6
16	15.0	1/2" NPT	22.2
20	15.0	3/4" NPT	22.5
25	15.0	1" NPT	27.3
32	15.0	1 1/4" NPT	28.0
40	15.0	1 1/2" NPT	28.5
50	16.0	2" NPT	29.2
63	17.0	2 1/2" NPT	42.5
75	18.0	3" NPT	44.0
90	22.0	3 1/2" NPT	45.2
110	22.0	4" NPT	46.5

All dimensions in mm.

NEWCAP - CABLE GLAND RANGE				
THREAD SIZE ISO	STANDARD LENGTH	LONG LENGTH	THREAD SIZE Pg	STANDARD LENGTH
12	6.5	15.0	PG7	6.5
16	6.5	15.0	PG9	6.5
20	6.5	15.0	PG11	6.5
25	7.0	15.0	PG13.5	6.5
32	8.0	15.0	PG16	7.0
40	8.0	15.0	PG21	8.0
50	9.0	15.0	PG29	8.0
63	10.0	15.0	PG36	9.0
			PG48	10.0

All dimensions in mm.

## Thread pitch

ISOMETRIC - (ISO) to BS 3643:1981			
SIZE	MAJOR DIAMETER (MM)	THREADS PER INCH	PITCH
16mm (M16)	16	16.93	1.50
20mm (M20)	20	16.93	1.50
25mm (M25)	25	16.93	1.50
32mm (M32)	32	16.93	1.50
40mm (M40)	40	16.93	1.50
50mm (M50)	50	16.93	1.50
63mm (M63)	63	16.93	1.50
75mm (M75)	75	16.93	1.50

All dimensions in mm.

NATIONAL PIPE THREAD - (NPT) to ANSI / ASME: 1983			
SIZE	MAJOR DIAMETER (MM)	THREADS PER INCH	PITCH
1/8" NPT	10.30	27	0.94
1/4" NPT	13.72	18	1.41
3/8" NPT	17.15	18	1.41
1/2" NPT	21.34	14	1.81
3/4" NPT	26.67	14	1.81
1" NPT	33.40	11 1/2	2.20
1 1/4" NPT	42.16	11 1/2	2.20
1 1/2" NPT	48.26	11 1/2	2.20
2" NPT	60.33	11 1/2	2.20
2 1/2" NPT	73.03	8	3.175
3" NPT	88.90	8	3.175
4" NPT	114.30	8	3.175

All dimensions in mm.

PANZERGEWINDE - (Pg) to EN 40430			
SIZE	MAJOR DIAMETER (MM)	THREADS PER INCH	PITCH
PG7	12.5	20	1.27
PG9	15.5	18	1.4112
PG11	18.6	18	1.4112
PG13.5	20.4	18	1.4112
PG16	22.5	18	1.4112
PG21	28.3	16	1.5875
PG29	37.0	16	1.5875
PG36	47.0	16	1.5875
PG42	54.0	16	1.5875
PG48	59.3	16	1.5875

All dimensions in mm.