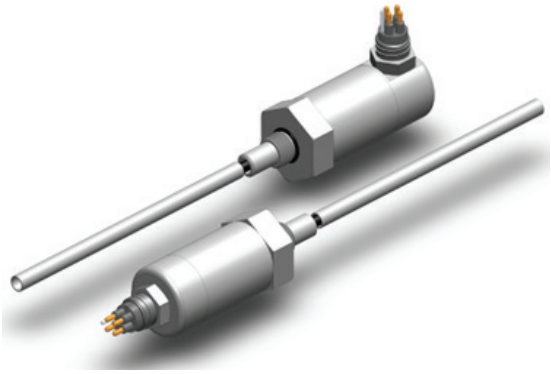
mm X120

APPLICATION

- Intrinsically safe for Gas to: Ex II 1G
- Non-contacting inductive technology to eliminate wear
- Travel set to customer's requirement
- High durability and reliability
- High accuracy and stability
- Sealing to IP68 50 Bar



As a leading designer and manufacturer of linear, rotary, tilt and intrinsically safe position sensors, Althen has the expertise to supply a sensor to suit a wide variety of applications. Our intrinsically safe X120 incorporates electronics system EX07 which is ATEX / IECEx / UKEX approved for use in potentially explosive **gas/vapour** atmospheres. The X120 is designed for arduous underwater hydraulic or pneumatic cylinder position feedback applications where service life, environmental resistance and is ideal for OEMs seeking good sensor performance where hazardous surface conditions may exist. Overall performance, repeatability and stability are outstanding over a wide temperature range. The unit is highly compact and space-efficient, being responsive along almost its entire length.

Like all Althen sensors, the X120 provides a linear output proportional to travel. Each unit is supplied with the output calibrated to the travel required by the customer, any stroke from 0-5mm to 0-800mm and with full EMC protection built in. The sensor is very rugged, being made of stainless steel with an inert fluoropolymer-sheathed probe with a stainless steel target tube. The sensor is easy to install in cylinders and has a range of mechanical options. Environmental sealing is to IP68 350 Bar. The maximum system pressure is limited to 350 Bar (Water pressure plus hydraulic pressure).

SPECIFICATIONS

Dimensions[1]	
Body diameter	40 mm
Body Length (to seal face)	80.3 mm (axial), 88.8 mm (radial)
Probe Length (from seal face)	calibrated travel + 58 mm
Target Tube Length	calibrated travel + 30 mm, Ø9.45 mm
Independent Linearity	≤ ± 0.25% FSO @ 20°C - up to 450 mm ≤ ± 0.5% FSO @ 20°C - over 450 mm
Temperature Coefficients	< ± 0.01%/°C Gain & < ± 0.01%FS/°C Offset
Frequency Response	> 10 kHz (-3dB)
Resolution	Infinite
Noise	< 0.02% FSO
Intrinsic Safety[2]	Ex II 1G Ex ia IIC T4 Ga (Ta= -40°C to 80°C)
Sensor Input Parameters **(without cable)** **(with cable)**	Ui: 11.4V, Ii: 0.20A, Pi: 0.51W. Ci: 1.16µF, Li: 50µH Ci: 1.36µF, Li: 860µH with 1km max. cable
Environmental Temperature Limits	
Operating	-4°C to +50°C
Storage	-4°C to +50°C
Sealing	IP68 350 Bar
Hydraulic Pressure	350Bar Absolute Limit of 350 Bar for water pressure + hydraulic pressure
EMC Performance	EN 61000-6-2, EN 61000-6-3

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SPECIFICATIONS (CONTINUED)

Vibration	IEC 68-2-6: 10 g
Shock	IEC 68-2-29: 40 g
MTBF	350,000 hrs 40°C Gf
Drawing List[3] **X120-11** **P100-12** **P100-15** **TG24-11**	 Sensor Outline Typical Target Installation details Mounting Thread details Optional Target Tube Flange details

[1] *For full mechanical details see drawings X120-11*
[2] *Approval only applies to the specified ambient temperature range and atmospheric conditions in the range 0.80 to 1.10 Bar, oxygen ≤ 21%*
[3] *3D models, step or .igs format, available on request*

INTRINSICALLY SAFE EQUIPMENT

Intrinsically safe equipment is defined as “equipment which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmosphere mixture in its most easily ignited concentration.” ATEX / IECEx / UKEX approved to;

Ex II 1G

Ex ia IIC T4 Ga (Ta= -40°C to 80°C)

Designates the sensor as belonging to; Group II: suitable for all areas **except mining**, Category 1 G: can be used in areas with continuous, long or frequent periods of exposure to hazardous gas / vapour (Zones 2 to 0).

Gas / Vapour:

Protection class ia, denotes intrinsically safe for all zones

Apparatus group IIC: suitable for IIA, IIB and IIC explosive gas / vapour.

Temperature class T4: maximum surface temperature under fault conditions 135°C.

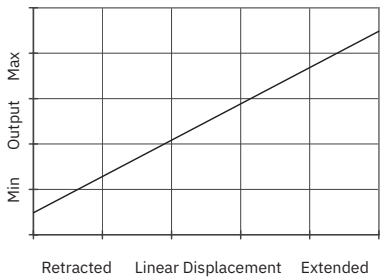
Ambient temperature range extended to -40°C to +80°C.

It is imperative Althen intrinsically safe sensors be used in conjunction with a galvanic barrier to meet the requirements of the product certification. The Althen X005 Galvanic Isolation Amplifier is purpose made for Althen IS sensors making it the perfect choice. Refer to the X005 datasheet for product specification and output configuration options.

For cable lengths exceeding 10 metres a five wire connection is recommended to eliminate errors introduced by cable resistance and associated temperature coefficients.

ATEX / IECEx / UKEX approved sensors suitable for dust (E series) and mining (M series) applications, are also available from Althen.

Output Characteristic - Standard



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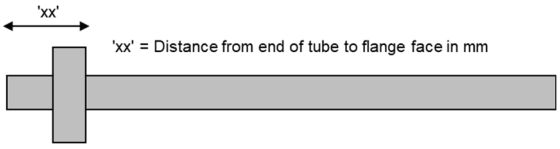
X120	.	a	b	c	d	e	f
		Displacement	A	Connections	Option	Option	Z000

a Displacement		**Value**
Factory set to any length from 0-5 mm to 0-800 mm (e.g. 0-254 mm)		**254**
b Output		
Supply V_{dc} (tolerance)	**Output**	**Code**
+5V (4.5 - 5.5V)	0.5 - 4.5V (ratiometric with supply)	**A**
Supply Current 10mA typical, 12mA max.		
c Connections		**Code**
Connector axial IP68 350 Bar Wet mate 4 pin MC BH-4-M		**J50**
Connector radial IP68 350 Bar Wet mate 4 pin MC BH-4-M		**K50**
Supplied with an over-moulded MC IL-4-F connector with 0.5 m, 4-core 20 AWG (0.5mm²) EPDM cable assembly, and locking collar as standard.		
d Mounting Thread		**Code**
3/4 16 UNF	Hex. 30 mm A/F, Ø 30 mm seal face. Supplied with O-ring seal.	**P**
M18 x 1.5		**T**
See P100-15 Drawing for Mating Thread Details.		

e Target Tube Mounting Flange		**Code**
None		**U**
Penny & Giles HLP100		**Vxx**
Temposonics (M4 fixing)	Please specify flange position in mm. eg. W17.5 specifies a Tempo style flange fitted 17.5 mm from the front face	**Wxx**
Parker Hannifin		**Xxx**
See TG24-11 Drawing for Target Details.		
f Z-code (optional)		**Code**
Calibration to suit X005 required		**Z000**
Tighter Independent Linearity; ≤± xx% FSO @20°C ≤± 0.1% 0 - 10 mm min. to 0 - 450 mm ≤± 0.25% 0 - 451 mm to 0 - 600 mm ≤± 0.5% 0 - 601 mm to 0 - 800 mm max.		**Z650**



THREE OR FIVE-WIRE MODE CONNECTION

The aim of this document is to help readers who do not understand what is meant by three or five wire modes of connection between the galvanic isolation amplifier and sensor, and the factors behind them. It is by no means an in-depth technical analysis of the subject.

Whether opting for a pre-wired Althen Intrinsically Safe sensor or one with a connector, choosing the right mode of connection and cable to suit the application requires careful consideration.

Interconnecting cables are not perfect conductors and offer resistance to current flow, the magnitude of resistance† depends on conductors resistivity, which changes with temperature, cross sectional area‡ and length. If the voltage were to be measured at both ends of a length of wire it would be found they are different, this is known as volts drop. Volts drop changes with current flow and can be calculated using Ohm's law, it should be noted that volts drop occurs in both positive and negative conductors. The effects of volts drop can be reduced by increasing the conductors cross sectional area, this does not however eliminate the effects due to temperature variation. There are instances where large cross-section cables are not practical; for example most standard industrial connectors of the type used for sensors have a maximum conductor capacity of 0.75mm², copper prices and ease of installation are other considerations.

This is important because the effects of volts drop can significantly alter the perceived accuracy of the sensor which is ratiometric i.e. the output signal is directly affected by the voltage across the sensor. Changes in temperature will also be seen as gain variation in the sensor output.

Three wire mode connections are common and are suitable in most cases with short or moderate cable runs. Applications that do not require a high degree of accuracy but have cable runs, say in excess of 10m, volts drop can reduced by introducing a terminal box close to the sensor and using a larger cross-section cable for a majority of the cable run. Sensors supplied with three core cable are calibrated with the cable fitted which largely eliminates errors due to conductor resistance at room temperature however, as mentioned above, small gain errors due to temperature fluctuations should be expected.

Five wire mode connections have significant benefits as losses in the positive and negative conductors are compensated for by the galvanic isolation amplifier which can 'sense' the voltage across the sensor and dynamically adjust the output voltage so that the voltage across the sensor is correct. The effects of cable resistance and associated temperature coefficients are eliminated allowing for smaller conductors than a three wire connection for the same cable run. The amplifier can compensate for up to 15Ω per conductor with a current flow of 15mA, which is more than adequate for 150m of 0.25 mm² cable, longer lengths will require larger conductors.

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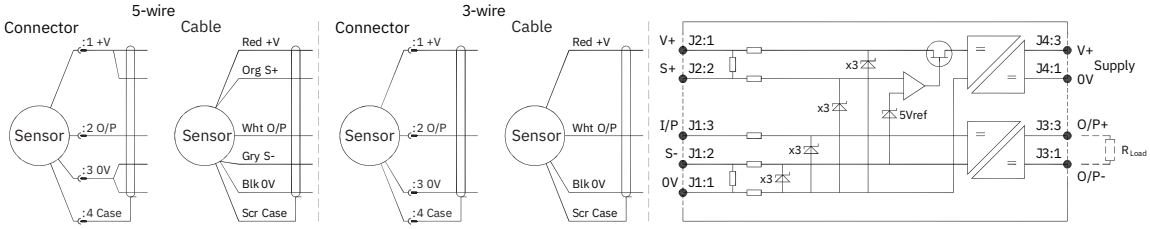
For this reason Althen recommends five wire connections for cable lengths exceeding 10 metres in 0.25 mm² cable to preserve the full accuracy of the sensor.

See illustrations below for examples of connecting a sensor to the galvanic isolation amplifier.



Cable Length (metres)	Up to 150	150 - 300	300 - 450	450 - 600	600 - 900	900 - 1000
Cross Section (mm²)	0.25	0.5	0.75	1.0	1.5	2.0

The table above shows recommended conductor sizes with respect to cable length for both three and five wire connections, based on copper conductors. Three wire connections will introduce a gain reduction of 5% and a ±1% temperature dependence of gain over the range -40°C to +80°C for the cable temperature. (i.e. about –150 ppm/°C for the maximum lengths shown and less pro rata for shorter lengths.)

It should be noted that the maximum cable length, as specified in the sensor certification, takes **precedence** and **must not** be exceeded.

Althen sensors are supplied with three core 0.25 mm² cable as standard, however five core 0.25 mm² cable can be supplied on request. The galvanic isolation amplifier is available as;

G005-*** for ‘G’ and ‘H’ prefix sensors

X005-*** for ‘E’, ‘M’ and ‘X’ prefix sensors

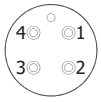
† R = ρL/A ρ is the resistivity of the conductor (Ωm) L is the length of conductor (m) A is the conductor cross-sectional area (m²).

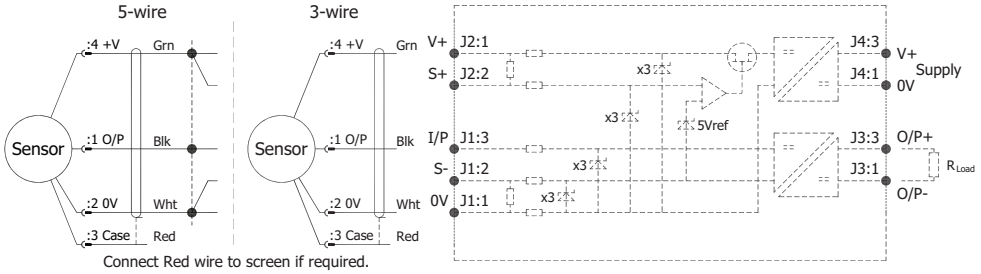
‡It is presumed that direct current flow is uniform across the cross-section of the wire, the galvanic isolation amplifier and sensor are a dc system.

INSTALLATION INFORMATION

ATEX / IECEx / UKEX Qualified to Intrinsic Safety Standard Certificate numbers SIRA 13ATEX2371X IECEx SIR 13.0154X CSAE 21UKEX2537X			Ex II 1G Ex ia IIC T4 Ga (Ta = -40°C to +80°C)
Electronics Version	**Output Description**	**Supply Voltage: V_s (tolerance)**	**Load resistance**
EX07	0.5 - 4.5V (ratiometric with supply) [Output code ‘A’]	+5V (4.5 - 5.5V)	5kΩ min

Connector Pin Layout:
MC BH 4 M (face view)





Connect Red wire to screen if required.

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PUTTING INTO SERVICE

The sensor must be used with a galvanic isolation barrier designed to supply the sensor with a nominal 5V and to transmit the sensor output to a safe area. The barrier parameters must not exceed:-

Ui = 11.4V	**Ii = 0.20A**	**Pi = 0.51W**
Ci = 1.36µF*	**Li = 860µH***	(with cable) *Figures for 1km cable
Ci = 1.16µF	**Li = 50µH**	(without cable)

*Figures for 1km cable where: Ci = 200pF/m & Li = 810nH/m

The sensor is certified to be used with up to **1000m** of cable, cable characteristics must not exceed:-

Capacitance: ≤ 200 pF/m or max. total of: 200 nF

Inductance: ≤ 810 nH/m or max. total of: 810 µH

Approval only applies to specified ambient temperature range and atmospheric conditions in the range: 0.80 to 1.10 Bar, oxygen ≤ 21%.

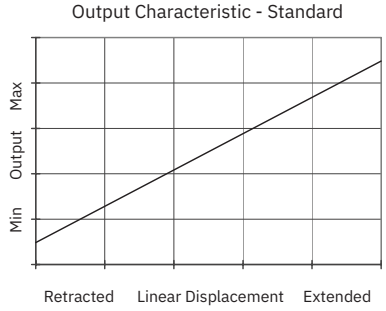
The performance of the sensor may be affected by voltage drops associated with long cable lengths; For cable lengths exceeding 10 metres a five wire connection is recommended to eliminate errors introduced by cable resistance and associated temperature coefficients.

N.b. Cable free end must be appropriately terminated, including preventing water ingress into the cable. See page 2 for connector handling instructions.

OUTPUT CHARACTERISTIC

Target position at start of normal travel is 36.0 mm from seal face.

The output increases as the target is moved away from the sensor body, the calibrated stroke is between 5 mm and 800 mm.



SPECIAL CONDITION FOR SAFE USE

The apparatus does not meet the 500 V r.m.s dielectric strength test between circuit and frame, in accordance with clause 6.3.13 of IEC 60079- 11:2011. This must be taken into consideration on installation.

Under certain extreme circumstances, the non-metallic and isolated metal parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. This is particularly important if the equipment is installed in a zone 0 location. In addition, the equipment shall only be cleaned with a damp cloth.

Use: The sensor is designed to measure linear displacement and provide an analogue output signal.

Assembly and Dismantling:

The unit is not to be serviced or dismantled and re-assembled by the user.

Maintenance: No maintenance is required.

MECHANICAL MOUNTING

Via mounting thread, maximum tightening torque: 100Nm. See drawing P100-15, Installation Details Mounting Threads & Seals. An O ring seal is provided, size BS908 for 3/4 UNF thread or 14.3 x 2.4 for M18 thread. Install the target tube using the flange provided or fix directly into the piston rod using adhesive for instance, the end of the target tube can be proud or flush with the piston end face as required - see drawing P100-12.

INCORRECT CONNECTION PROTECTION LEVELS

A	**Not protected** – the sensor is **not** protected against either reverse polarity or over-voltage. The risk of damage should be minimal where the supply current is limited to less than 50mA.

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CONNECTOR MATING INSTRUCTIONS

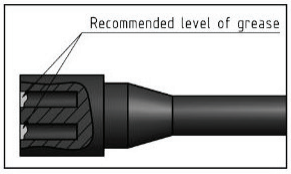
Handling

- Always apply grease mating
- Disconnect by pulling straight, not at an angle
- Do not pull on the cable and avoid sharp bends at cable entry
- When using bulkhead connector, ensure that there are no angular load
- Do not over-tighten the bulkhead nuts
- Connectors should not be exposed to extended periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use

Cleaning

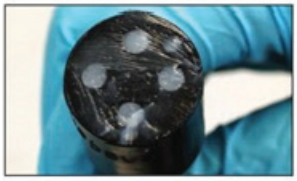
- General cleaning to remove any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol)
- New grease must be applied again prior to mating

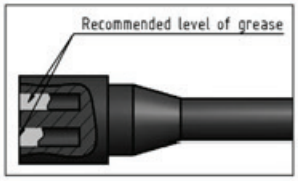
GREASING AND MATING ABOVE WATER (DRY MATE)



- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to approximately 1/10 of the socket depth should be applied to the female connector
- The inner edge of all the sockets should be completely covered, and a transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets
- To confirm that the grease has been sufficiently applied, de- mate and check for grease on every male min. Then re-mate the connector

GREASING AND MATING ABOVE WATER (WET MATE)

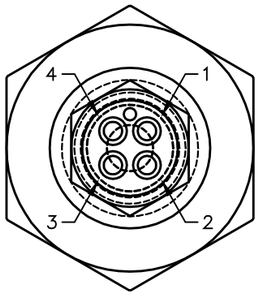


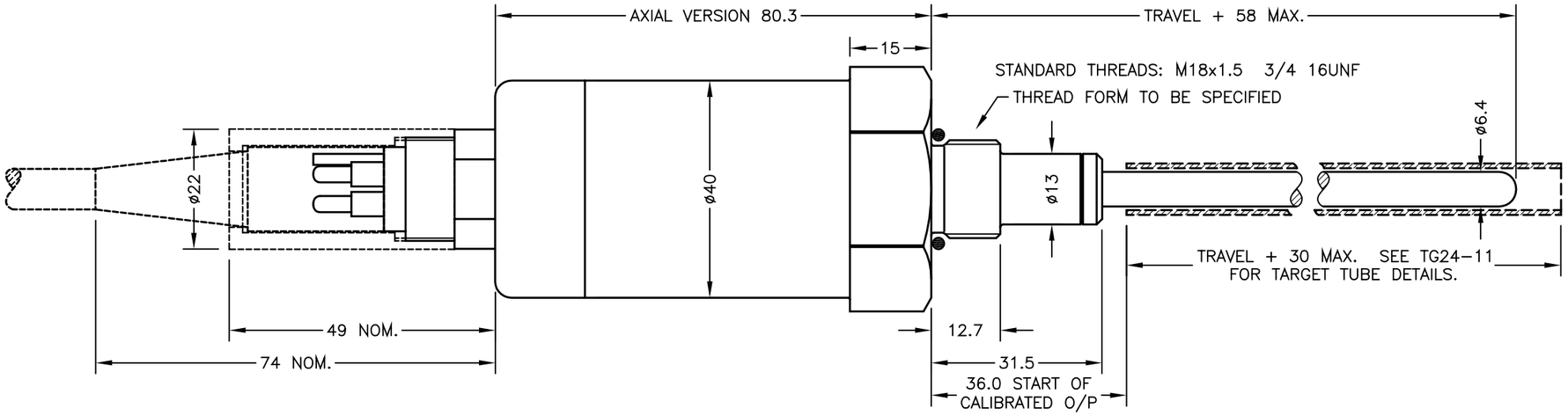


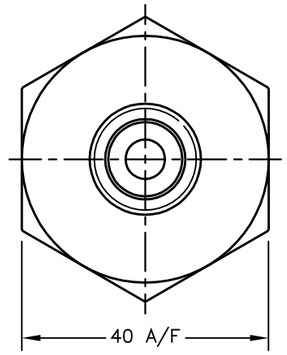
- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to approximately 1/3 of the socket depth should be applied to the female connector
- All sockets should be completely sealed, and a transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector and remove any excess grease from the connector joint

CONNECTORS; MICRO MINI WETMATE, 4–POLE.
BULKHEAD; MCBH–4–MP–SS, STAINLESS STEEL/MOLDED NEOPRENE, SEALING; 340 BAR OPEN FACE, 600 BAR MATED.
IN–LINE; MCIL–4–FS, MOLDED NEOPRENE WITH CABLE. LOCKING SLEEVE; MCDLS–F, DELRIN.

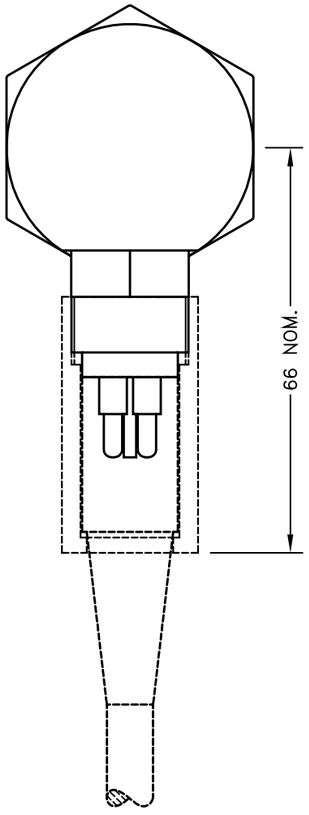
AXIAL CONNECTOR
(CODE 'J50')

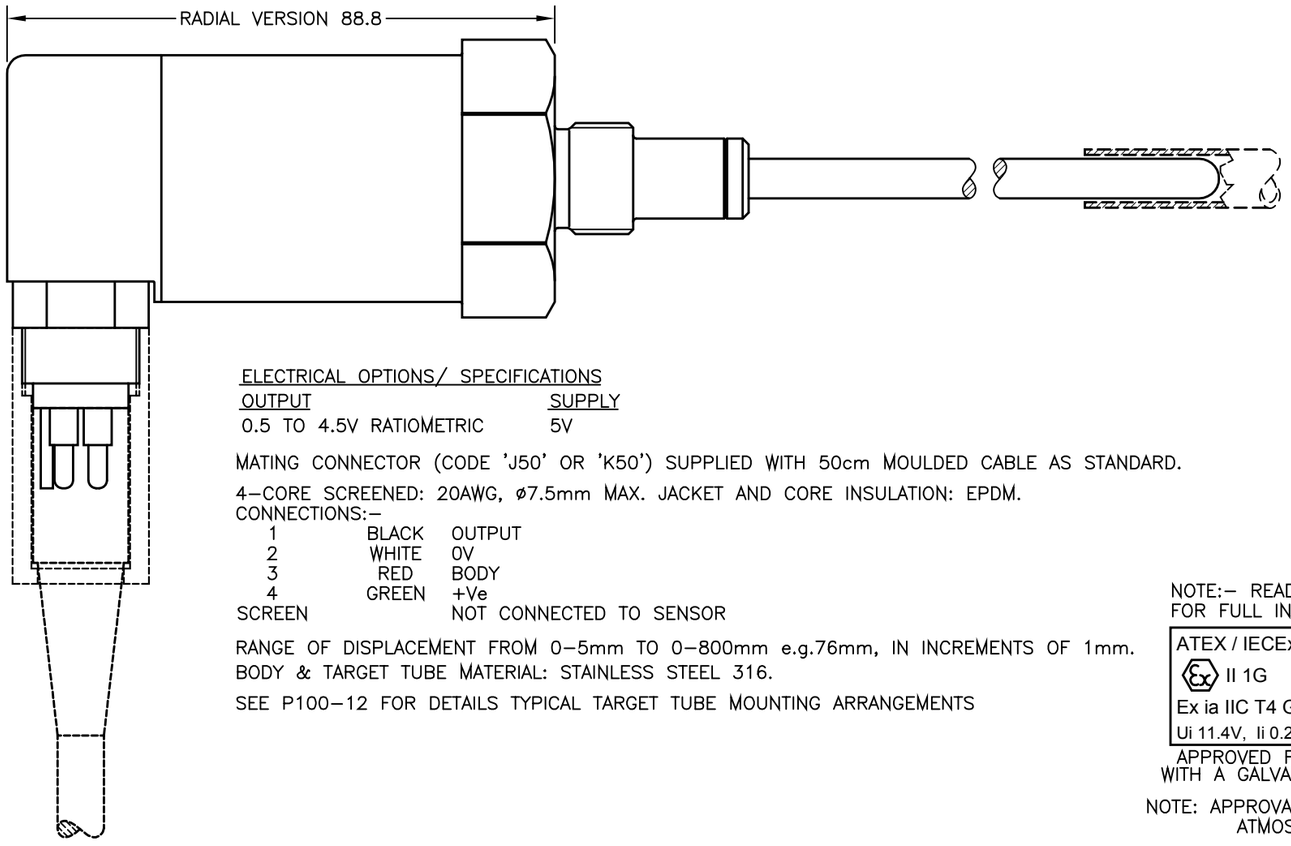


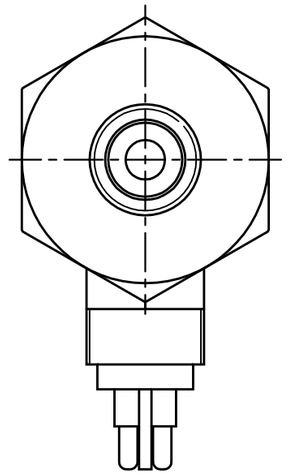




RADIAL CONNECTOR
(CODE 'K50')







ELECTRICAL OPTIONS/ SPECIFICATIONS

OUTPUT	SUPPLY
0.5 TO 4.5V RATIOMETRIC	5V

MATING CONNECTOR (CODE 'J50' OR 'K50') SUPPLIED WITH 50cm MOULDED CABLE AS STANDARD.

4–CORE SCREENED: 20AWG, ø7.5mm MAX. JACKET AND CORE INSULATION: EPDM.
CONNECTIONS:–

1	BLACK	OUTPUT
2	WHITE	0V
3	RED	BODY
4	GREEN	+Ve
SCREEN		NOT CONNECTED TO SENSOR

RANGE OF DISPLACEMENT FROM 0–5mm TO 0–800mm e.g.76mm, IN INCREMENTS OF 1mm.
BODY & TARGET TUBE MATERIAL: STAINLESS STEEL 316.

SEE P100–12 FOR DETAILS TYPICAL TARGET TUBE MOUNTING ARRANGEMENTS

NOTE:– READ INSTALLATION SHEET X120–19
FOR FULL INSTRUCTIONS FOR USE.

ATEX / IECEx APPROVED TO
Ex II 1G
Ex ia IIC T4 Ga (Ta= -40° to +80°C)
Ui 11.4V, Ii 0.2A, Pi 0.51W

APPROVED FOR USE IN CONJUNCTION
WITH A GALVANICALLY ISOLATED BARRIER.

NOTE: APPROVAL ONLY APPLIES AT NORMAL
ATMOSPHERIC PRESSURE!

MAXIMUM WORKING PRESSURE; HYDRAULIC / PNEUMATIC CYLINDER AND EXTERNAL WATER PRESSURE MUST NOT EXCEED 350 BAR.
WHERE THE FREE END OF THE CABLE IS TO BE TERMINATED IN A SUBMERGED POSITION, ADEQUATE SEALING MUST BE PROVIDED TO PROTECT CONNECTIONS.

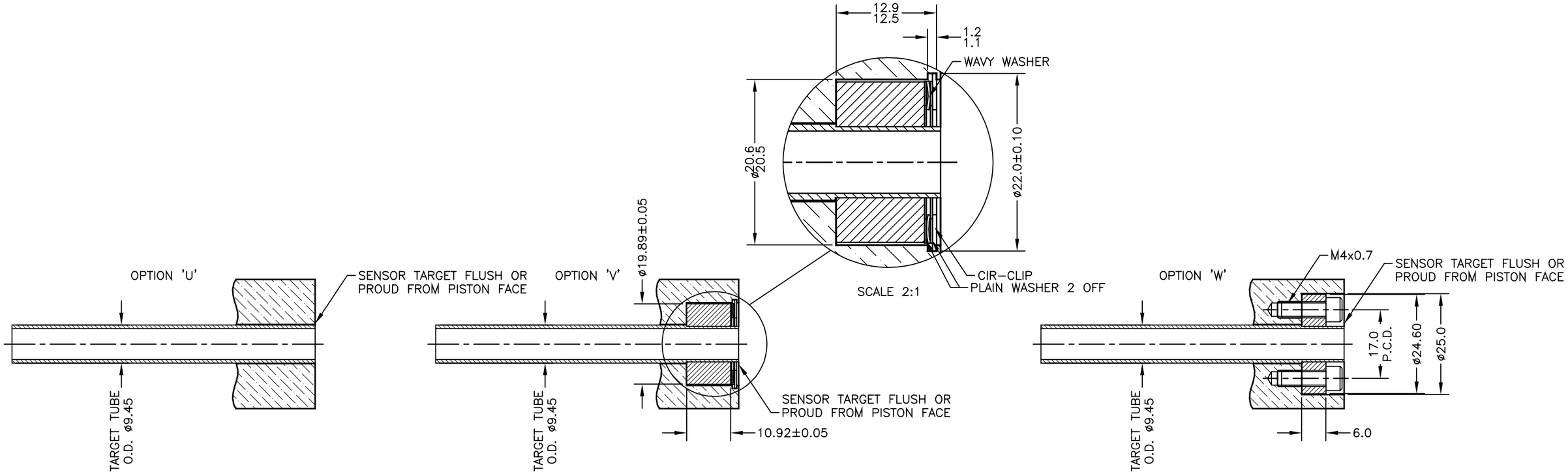
A	FIRST ISSUE ~ RAN1219	PDM

CE

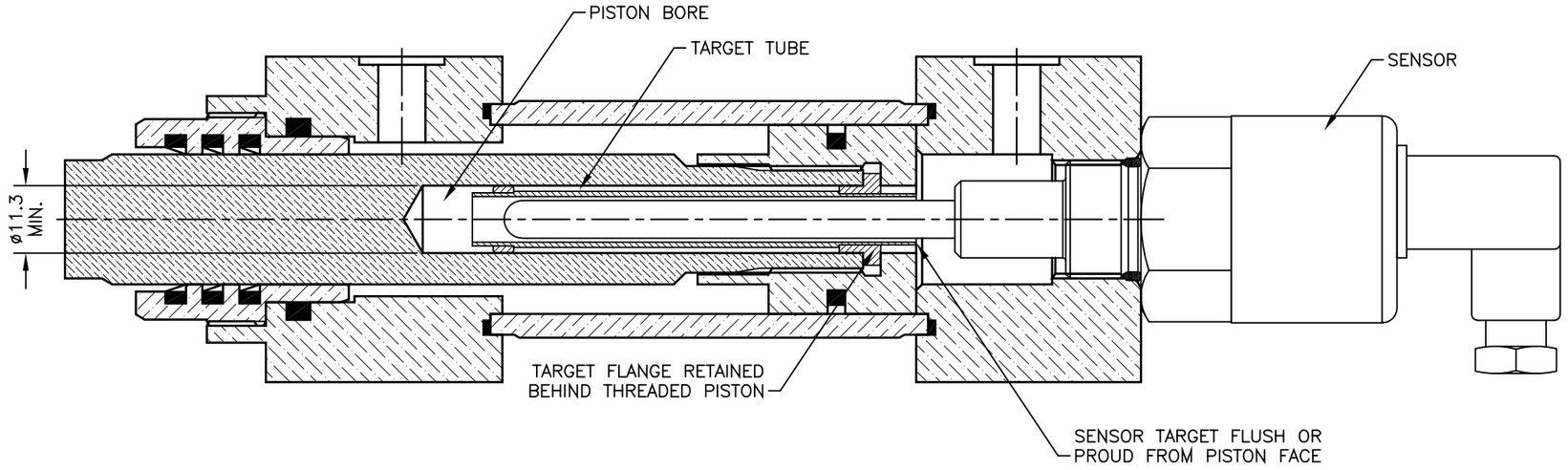
DRAWINGS NOT TO BE CHANGED WITHOUT REFERENCE TO THE CHANGE PROCEDURE.
CHANGES TO PARTS USED IN INTRINSICALLY SAFE PRODUCT MUST BE APPROVED
BY THE AUTHORISED PERSON
THIS IS AN UNCONTROLLED PRINT AND WILL NOT BE UPDATED.

A	23/11/17		CHECKED BY RDS	X ±0.4 X.X ±0.2 X.XX ±0.1 DIMS mm
		DESCRIPTION: INTRINSICALLY SAFE 350 BAR SUBMERSIBLE LIPS CYLINDER LINEAR POSITION SENSOR		
SCALE 10mm		DRAWING NUMBER X120-11	REV A	SHEET 1 OF 1

SEE DRAWING TG24–11 FOR TARGET TUBE FLANGE OPTIONS 'V', 'W' & 'X'.



OPTION 'X'



A	FIRST ISSUE.	RDS
B	REDRAWN.	PDM
C	WORDING AMMENDED	RDS
D	TARGET NOTES AMENDED - RAN1349	PDM

DRAWINGS NOT TO BE CHANGED WITHOUT REFERENCE TO THE CHANGE PROCEDURE.
CHANGES TO PARTS USED IN INTRINSICALLY SAFE PRODUCT MUST BE APPROVED BY THE AUTHORISED PERSON
THIS IS AN UNCONTROLLED PRINT AND WILL NOT BE UPDATED.

A	28/06/95		CHECKED BY RDM	X ±0.4 X.X ±0.2 X.XX ±0.1 DIMS mm
B	04/10/11			
C	26/10/17			
D	22/01/21	DESCRIPTION		
		TYPICAL TARGET TUBE FITTING OPTIONS		
SCALE 10mm		DRAWING NUMBER P100-12	REV D	SHEET 1 OF 1

CHECKED AT REV. A

RDS

DRAWING NOT TO BE CHANGED WITHOUT REFERENCE TO THE CHANGE PROCEEDURE.
CHANGES TO PARTS USED IN INTRINSICALLY SAFE PRODUCT MUST BE APPROVED
BY THE AUTHORISED PERSON
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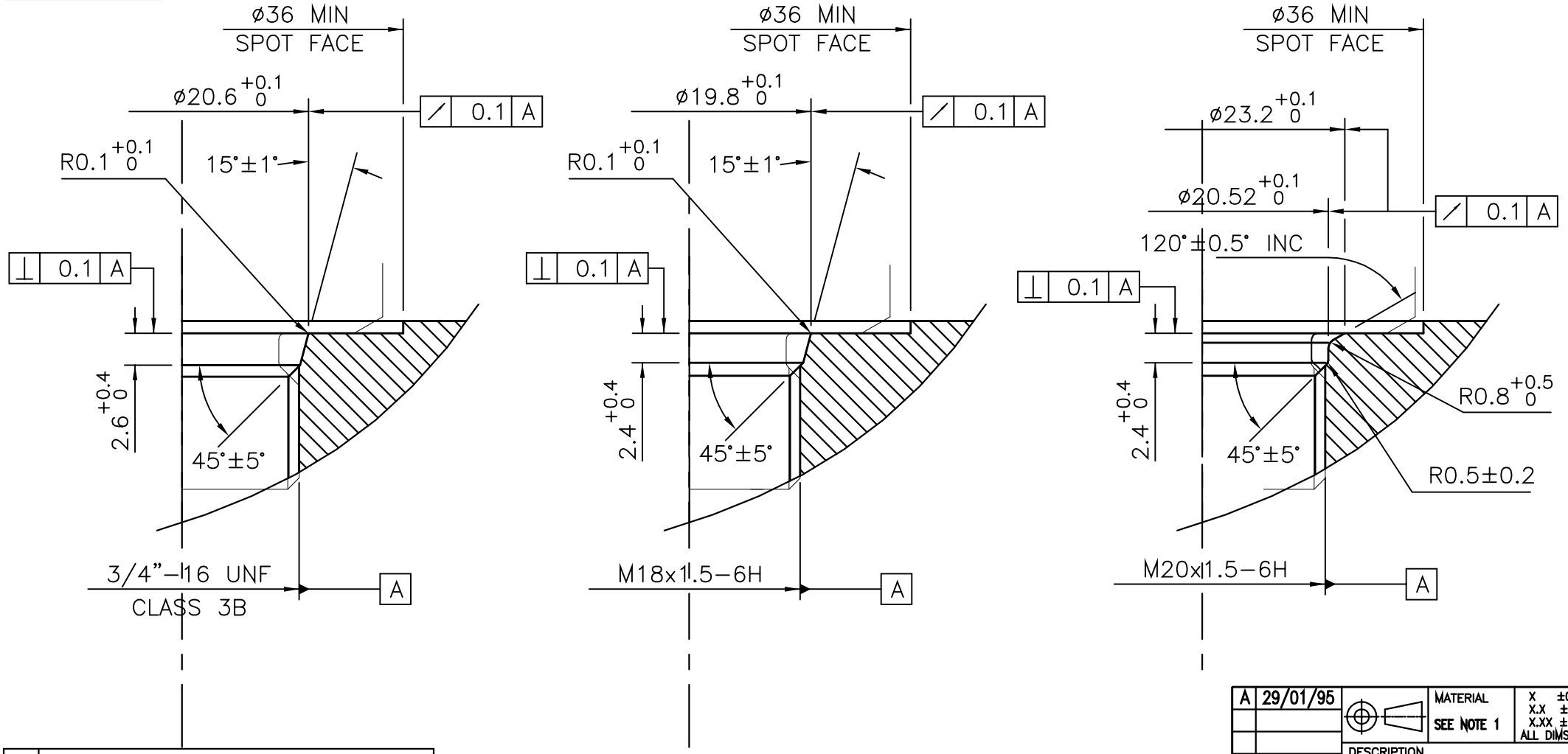
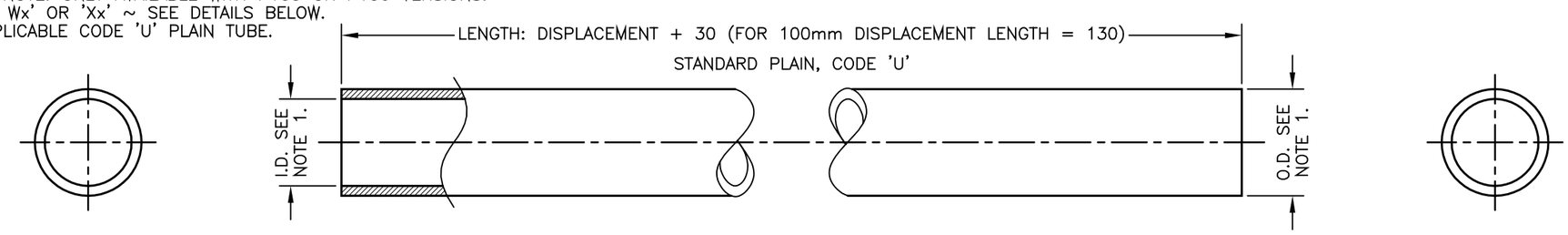
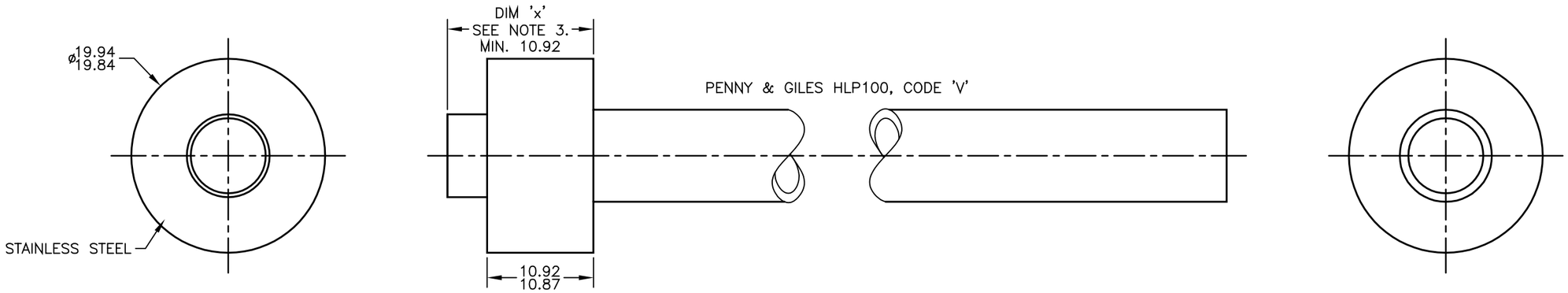


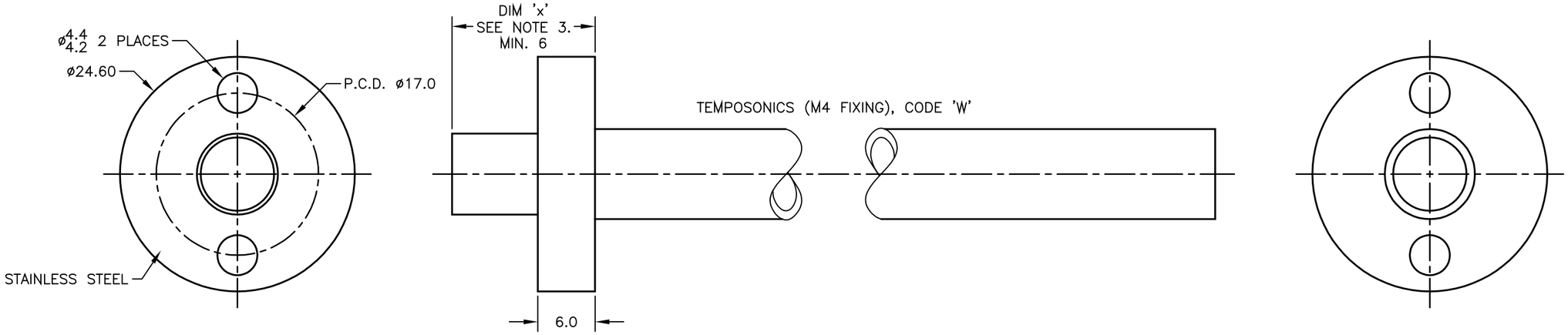
A	FIRST ISSUE	COH/DS

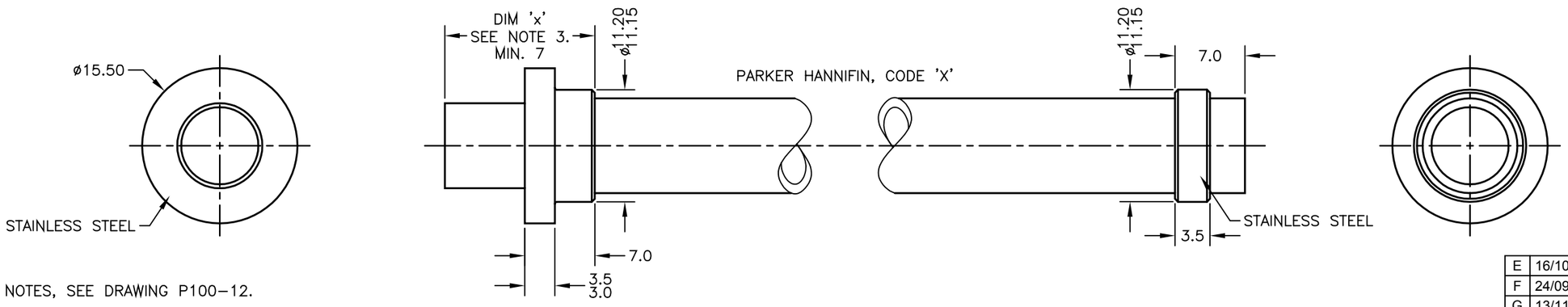
A	29/01/95	MATERIAL SEE NOTE 1	X ±0.4 X.X ±0.2 X.XX ±0.1 ALL DIMS mm
		DESCRIPTION: INSTALLATION DETAILS MOUNTING THREADS & SEALS	
		SCALE 5mm	DRAWING NUMBER P100–15 REV A SHEET 1 OF 1

TARGET TUBE OPTION NOTES:–
1. SPECIFY TUBE MATERIAL; CODE:–
   'R' STAINLESS STEEL 316 ø9.45.
   'S' ALUMINIUM 6063 ø3/8" (9.2–9.8). NOTE! ONLY AVAILABLE WITH P100 OR P106 VERSIONS.
2. SPECIFY FLANGE TYPE; CODE: 'U', 'Vx', Wx' OR 'Xx' ~ SEE DETAILS BELOW.
3. SPECIFY DIMENSION 'x' (mm), NOT APPLICABLE CODE 'U' PLAIN TUBE.









TARGET TUBE MOUNTING NOTES, SEE DRAWING P100–12.

E	MATERIAL OPTION REMOVED.	PDM
F	MAT'L OPTION REINSTATED RAN221.	PDM
G	X DIM FOR PH FLANGE SHOWN RAN225	RDS
H	9.45 WAS 9.5 RAN396	RDS
J	REDRAWN, PH FLANGE ROTATED RAN507.	PDM
K	NOTE 1 AMENDED ~ RAN1114.	PDM
L	'x' WAS 'n' ~ RAN1309	PDM

E	16/10/06		CHECKED BY	X ±0.4
F	24/09/08		RDM	X.X ±0.2
G	13/11/08			X.XX ±0.1
H	11/12/12			DIMS mm
J	23/07/14	DESCRIPTION		
K	30/11/16	TARGET TUBE AND FLANGE OPTIONS (LIPS 100/106)		
L	08/11/22			
SCALE 5mm		DRAWING NUMBER TG24-11		REV L
				SHEET 1 OF 1