FEATURES

* Six sizes of interchangeable orifice section
* Measurement of very low flow rates, liquid or gas
* Simple and precise installation using 2 oval flanges
* Direct mounting onto DP transmitter
* Body machined from single-piece stainless steel
* Coulton slip-ring locates orifice section without bolting
* Accuracy better than ±2% with flow calibration
* Ex-stock delivery

SCOPE

Coulton Instrumentation will supply the integral orifice assembly for fitting to the Customers own transmitter or a complete system fully calibrated and ready for direct installation into the pipeline.

Devices that may be fitted directly to the integral orifice assembly include dp switches, dp indicators and dp transmitters. 3-valve manifolds may be used with these devices to set zero and enable removal while the line is under pressure.

The dp transmitter can be supplied with square root extraction, analogue or digital indicator, HART communication, Exi, ExN or Exd hazardous area certification and/or NACE specification. Please refer to the manufacturers data sheet.

For mass flow, pressure and temperature transmitters can be built into a metered run and supplied complete with a mass flow computer.

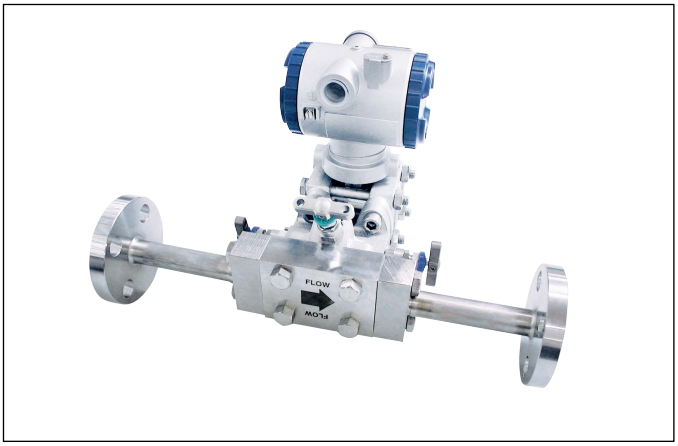
One instruction manual is supplied with each shipment. A full set of drawings and certificates can also be supplied. For a description of what is available please refer to the back page.

SPECIFICATION

The standard unit is supplied to the following specification. For different materials, threads and options please refer to the “Details Required” section on the back page, or the detailed engineering drawing.

Fluid:	Clean liquids and gases compatible with the materials of manufacture.
Process Pressure:	Vacuum to 160 BarG
Process Temperature:	-40 to + 120 degC
Ambient Temperature:	Depends upon transmitter
Body & Wetted Parts:	316 SS (see options)
Oval Flange:	316 SS
Bolts:	Cr Mo alloy (630 SS optional)
Seals:	Viton & PTFE
Process Connection:	1/2” NPT via oval flanges
Transmitter Connection:	Direct mounting on 54mm centres
Transmitter Bolt Threads:	M10 (7/16 UNF optional)
Oval Flange Bolt Threads:	M10

Integral Orifice



Transmitter mounted on integral orifice in pipeline

RED 66
INTEGRAL ORIFICE ASSEMBLY

Designed for safe and easy installation, the Coulton Red 66 will measure very low liquid or gas flow rates in small bore pipes. It may be bolted directly to almost any manufacturers DP transmitter that uses standard 54mm centres.

The body is machined from a single-piece of 316 SS (or other material) to give high pressure integrity. Its unique design incorporates the “Coulton Slip-Ring” to hold the orifice section in place without the use of additional bolts or screws.

Six different sizes of orifice section can be fitted without using any special tools. It is impossible for the orifice section to move out of place without removal from the pipeline. This significantly increases safety over other designs.

The complete assembly is fixed into the pipeline using standard oval flanges for easy maintenance. If a very high accuracy is required then the unit can be fitted into a metered run and flow calibrated as a complete assembly.

CE Mark Approval

EXPLANATION OF SYMBOLS

Symbol	Denoting	Units
Q_E	Water equiv. flow rate @ 20°C	l/hr
Q	Volumetric flow rate	l/hr
ΔP	Differential pressure	mmH_20
P	Absolute pressure	BarA
T	Absolute temperature	K
ρ	Density	kg/m^3
μ	Viscosity	cStokes

Subscript	Denoting
F	At flowing conditions
S	At standard conditions (0 °C and 1.013 BarA)

CHOOSING ORIFICE SIZE

Six sizes of orifice are available to cover a wide range of flow rates. The relationship $Q \propto \sqrt{\Delta P}$ will affect the overall cost. In order to choose the most suitable orifice size and hence range of flow transmitter, follow the simple steps described below.

Step1 *Convert volumetric flow rate into an equivalent flow rate of water using one of the following formulae.*

Fluid	Process Conditions	Equivalent Volumetric Flow of Water (20°C)
Homogeneous Liquid	Any	$Q_E = Q_{F\,max}\sqrt{\frac{\rho_F}{998.1}}$
Gases & Steam	Flowing	$Q_E = Q_{F\,max}\sqrt{\frac{\rho_F}{998.1}}$
Gases	Standard (0°C, 1.013 Bar A)	$Q_E = Q_{S\,max}\sqrt{\frac{\rho_F}{998.1}\frac{P_S}{P_F}\frac{T_F}{T_S}}$

Step 2 *Use the equivalent volumetric flow rate of water (Q_E) in the graph on the opposite page to establish the most appropriate differential pressure and orifice size.*

Step 3a *If a fixed DP range is required, for example 2500 mmH_2O. Use the table opposite to obtain the water equivalent full scale flow rate and then back-calculate the maximum flow rate of the fluid using the formula given in step 1.*

Step 3b *If a fixed full scale flow rate is required, for example 50 Sl/min. Use the water equivalent flow rate in one of the following formulae to calculate the transmitter full scale DP.*

Orifice Size Number	Differential Pressure (mm H2O)
1	$10^{2.0\,(\log_{10}\,Q_E)+1.689}$
2	$10^{2.01\,(\log_{10}\,Q_E)+0.876}$
3	$10^{2.013\,(\log_{10}\,Q_E)+32\,x\,40^3}$
4	$10^{2.007\,(\log_{10}\,Q_E)-1.174}$
5	$10^{2.007\,(\log_{10}\,Q_E)-2.026}$
6	$10^{2.012\,(\log_{10}\,Q_E)-3.00}$

Step 4 *Check that the velocity of sound is not being exceeded.*
If $\frac{\Delta P}{P_F} > 1800$ *then choose a larger size of orifice.*

Orifice Size	Orifice Diameter (mm)	DP Range (mmH_20)	Water Equiv Flow Rate (l/min)	Air Equiv Flow Rate (Sl/min)
1	0.635	5000 2500 1250 500 250	0.166 0.119 0.084 0.053 0.038	14.9 10.6 8.6 5.0 3.8
2	0.99	5000 2500 1250 500 250	0.423 0.300 0.212 0.135 0.095	38.9 27.7 18.8 12.8 9.6
3	1.587	5000 2500 1250 500 250	1.105 0.783 0.555 0.352 0.205	86.8 62.4 43.6 28.7 21.3
4	3.175	5000 2500 1250 500 250	4.465 3.161 2.238 1.418 1.004	351.1 254.2 167.2 120.5 89.2
5	5.150	5000 2500 1250 500 250	11.867 8.402 5.950 3.768 2.667	854.8 618.8 427.6 282.2 200.1
6	8.700	5000 2500 1250 500 250	35.592 25.220 17.870 11.333 8.030	2387.0 1752.0 1215.0 798.3 564.0

Equivalent Flow Rates For Fixed DP

ACCURACY

Standard Unit without Calibration

30 -100% Full Range Better than ±2% of flow rate
10 - 30% Full Range Better than ±0.6% of full range

In Metered Section with Flow Calibration

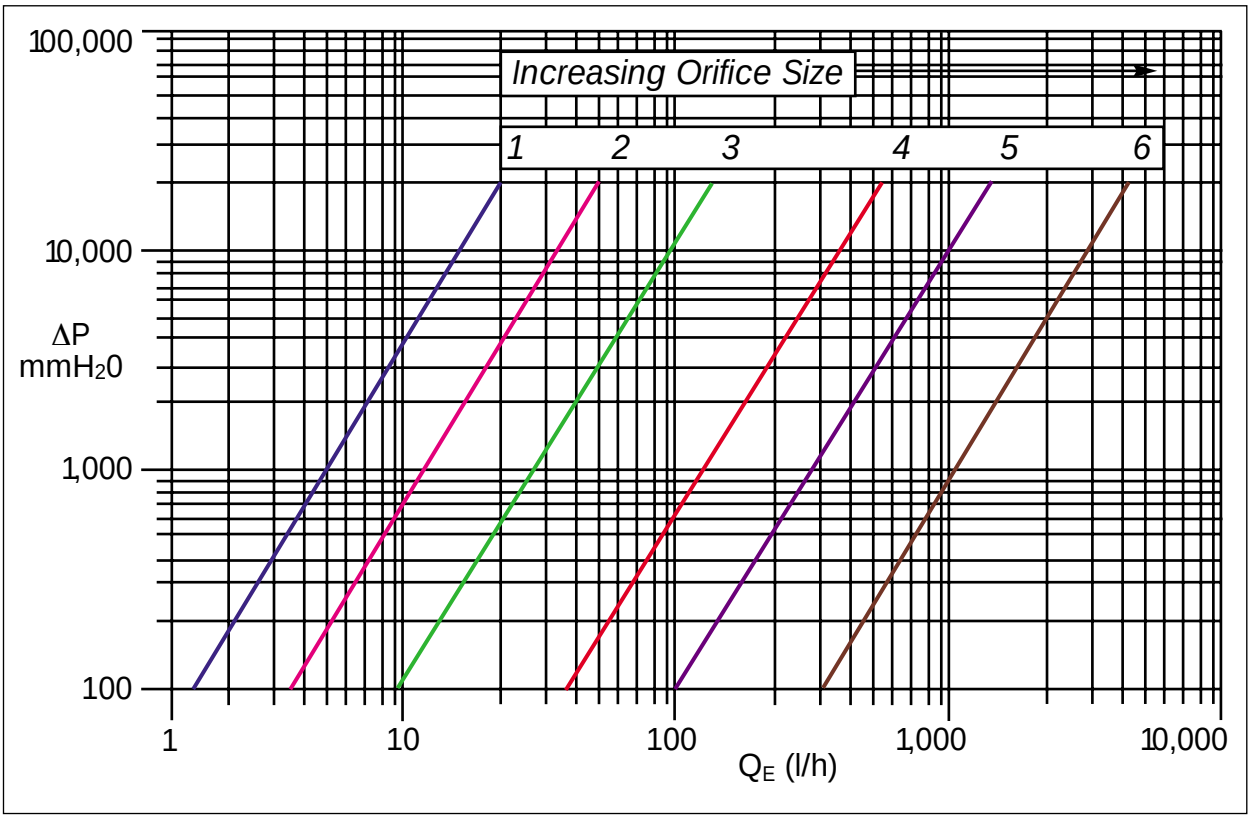
30 -100% Full Range Better than ±1% of flow rate
10 - 30% Full Range Better than ±0.3% of full range

To achieve these accuracies the integral orifice assembly must be installed in a straight section of pipe clear of upstream and downstream disturbances. As a rough guide, the upstream section should be 500mm long and the downstream 250mm long. The fluid must also be clean and the following ratio satisfied:

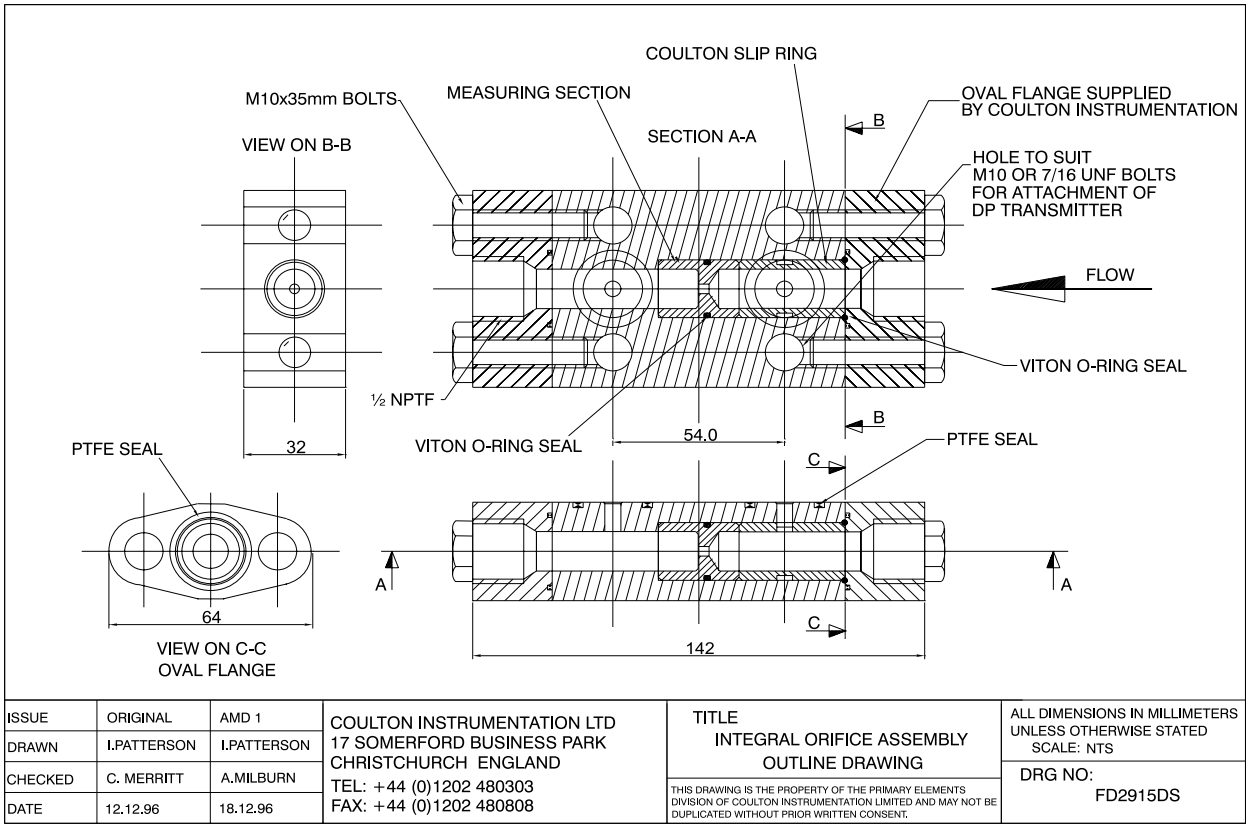
$$\frac{\mu_S \times Q_S \times \rho_F}{\mu_F \times Q_S \times \rho_S} \geq 1$$

If this ratio is less than 1, then the calibrated accuracy for rates above 30 percent of full flow rate will be reduced as shown in the table below:

Orifice Size:	1	2	3	4	5	6
Accuracy	Viscosity (cStokes)					
±1%	0 to 1	0 to 1	0 to 2	0 to 2	0 to 2	0 to 2
±2%	1 to 2	1 to 2	2 to 3	2 to 4	2 to 4	2 to 4
±5%	2 to 3	2 to 4	3 to 4	4 to 5	4 to 5	4 to 5



Orifice sizing graph



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CHECKED	C. MERRITT	A.MILBURN			DRG NO: FD2915DS
DATE	12.12.96	18.12.96		THIS DRAWING IS THE PROPERTY OF THE PRIMARY ELEMENTS DIVISION OF COULTON INSTRUMENTATION LIMITED AND MAY NOT BE DUPLICATED WITHOUT PRIOR WRITTEN CONSENT.	

General arrangement drawing

RED66
INTEGRAL ORIFICE ASSEMBLY

DETAILS REQUIRED

The following information is required to size the integral orifice and manufacture the complete assembly. Please note that in many cases only part of this information may be necessary. If help is required please contact your local representative.

Tag No	Name of Measurement

ORIFICE ASSEMBLY (Delete as appropriate)	
Orifice size (if known)	1 2 3 4 5 6
Material of body & wetted parts	316 SS Monel
Hastelloy C	Alloy 400
Seal material	Viton & PTFE
	Viton only PTFE only
Material of bolts	CrMo Alloy 630 SS
Transmitter bolt thread	M10 7/16 UNF
Depth of transmitter thread	13 mm
Transmitter pressure ports	54 mm centres
Process connection	1/2" NPT
Special Requirements	Oxygen cleaned
Material Cert	NACE
Flow Calibration	Yes / No
FLOW TRANSMITTER	
❑ 2-wire 4-20mA output	Sq Rt Extraction Yes/No
❑ Smart communication	Manuf Std HART
❑ Indicator	Analogue Digital
❑ Hazardous area cert	Exia ExN Exd
OTHER ITEMS	
❑ 3-Valve manifold	
❑ Metered run	
❑ Direct mounted flow indicator	
❑ Direct mounted DP switch	

FLOW DETAILS	
Normal flow	
Maximum flow	
Meter scale required	
Max press loss permissible	
Required DP (if known)	
FLUID DETAILS	
Fluid to be measured	
Normal upstream pressure	
Maximum design pressure	
Normal upstream temp	
Maximum design temp	
Working density	
Working viscosity	
DOCUMENTATION	
❑ Certificate of conformity	
❑ General arrangement drawing	
❑ Traceable flow calibration cert.	
❑ Hydrostatic pressure test cert.	
❑ BS EN 10204 3.1B Mat cert.	
❑ NACE MR-01-75 Conf. cert.	

Signature	
Company	
Date	

Notes

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