

Gas Turbine Meter X-XIC Series



GENERAL

The INSTROMET X turbine meter is an integrating flow meter for the measurement of gases. The volume of gas passed through the meter, at the operating pressure and temperature, is indicated on a counter in units of volume (cuF or m³). The volume registered can be converted to a reference volume by application of a volume integrator such as the INSTROMET electronic flow computers and electronic volume correctors. The X turbine meter is based on the proven SM-RI concept and incorporates the patented X4X[®] flow conditioner. Its superior characteristics are maintained in practical, non-ideal installations. The X turbine gas meter is approved for custody transfer applications according to EEC Directives and by many other inter-national approval authorities.

APPLICATIONS

The standard X meter is suitable for all non-corrosive gases such as natural gas, propane, butane, air, nitrogen, ethylene, hydrogen, etc. Special construction can be supplied for use with corrosive gases.

The X turbine meters are widely used for custody transfer of natural gas. They are also used for industrial loads, in distribution stations, major supply stations and as master reference meters.

GENERAL TECHNICAL DATA

Pressure Ratings :	ND 10 to ND 100 and ANSI 125 to ANSI 600. Higher pressure ratings on request.
Nominal Diameters :	2" (50 mm) to 24" (600 mm). Larger sizes on request.
Flow rates :	3,500 to 900,000 ACFH - 2" to 24" (line conditions).
Installation :	Up to 8" (200 mm) horizontal or vertical on request, over 8" (200 mm) horizontal only.
Repeatability:	0.1 %
Measuring Accuracy :	Min to max ± 1.0 % 20 % min to max ± 0.5 %
Temperature range :	-20° F to 220° F. Other temperature ranges on request.

CONSTRUCTION

The main parts of the X turbine gas meter are :

1. Meter body (length = 3 x D).
2. Measuring mechanism and turbine wheel.
3. Inlet Flow conditioner X4X[®] (patented).
4. Mechanical drive and magnetic coupling to bring turbine wheel rotation outside the pressure body.
5. Mechanical counter for registering the volume measured.
6. Oil lubrication system for the turbine wheel shaft bearings.

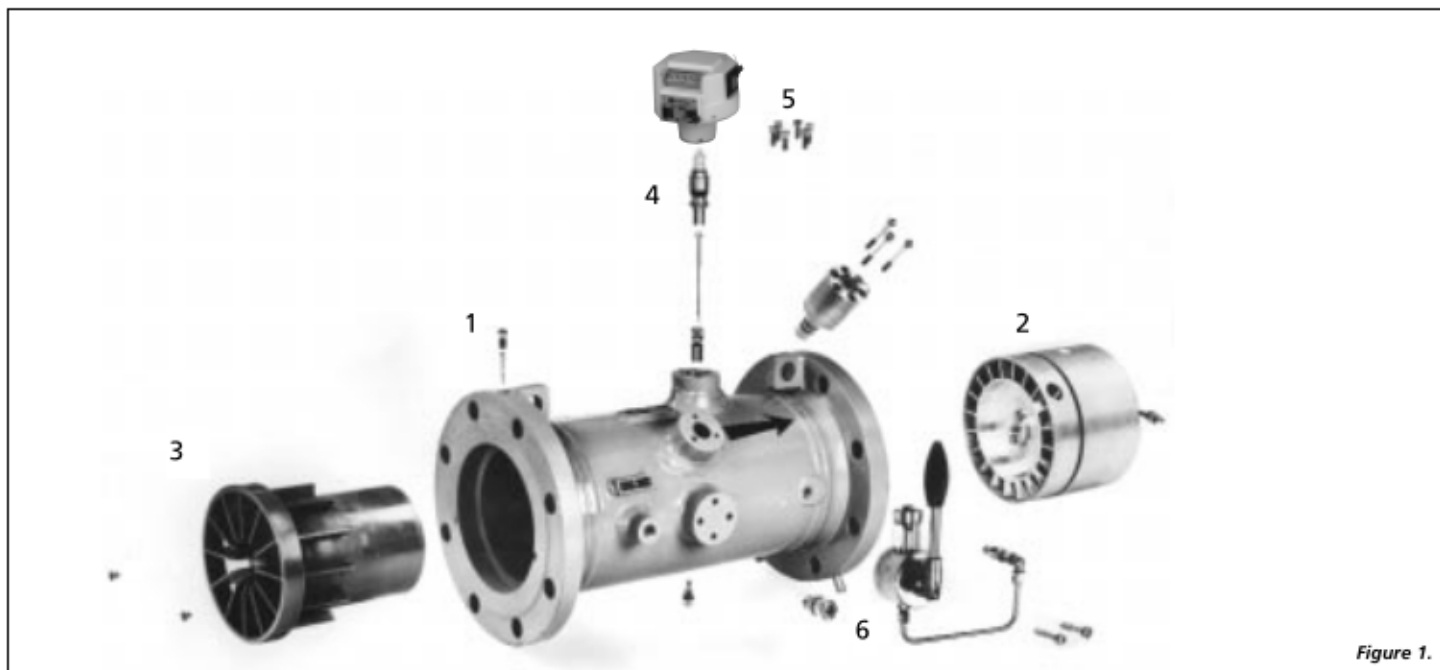


Figure 1.

OPERATING PRINCIPLE

The flowing gas enters the meter through a built-in flow conditioner (1) that conditions the flow profile and increases the gas velocity. The gas continues along the flow channel (2) and enters the turbine rotor. The turbine rotor blading (3) is designed with overlap to give complete guidance to the flowing gas and extract the maximum energy at low gas velocities. The turbine wheel's angular velocity is proportional to the average gas velocity flowing through the meter. The gas exits the turbine rotor through a flow ring and an expanding exit channel to minimize pressure losses. The rotation of the turbine rotor is transmitted via a gear train and transferred from the pressurized meter body to the counter (5) by a gas tight magnetic coupling (4). The follower magnet of the magnetic coupling drives the counter to register volumes metered at the operating conditions.

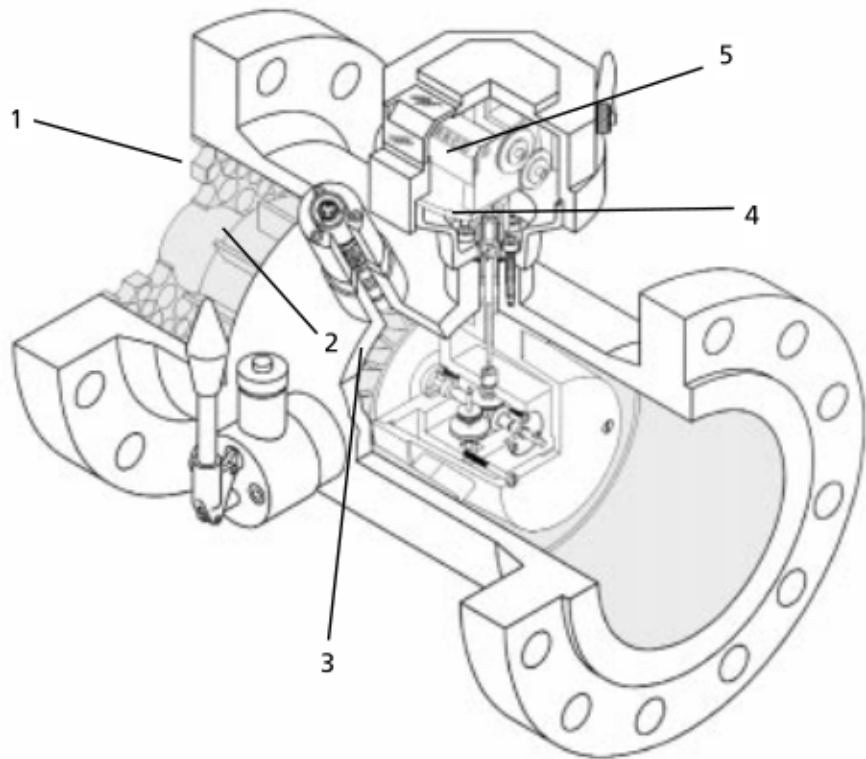


Figure 2.

MEASURING RANGE

The measuring range of the X meter determined for atmospheric conditions meets with, and generally exceeds, European and all major international standards. At higher operating pressures the measuring range of the turbine meters will increase since the required kinetic energy transfer to the turbine rotor occurs at lower velocities. The following equation may be used to estimate the minimum flow rate of the meter for various operating conditions.

$$Q = Q_m \sqrt{\frac{P(\text{atm})}{P}} \times \frac{1.29}{\rho}$$

- Q = minimum capacity under operating conditions.
- Q_m = minimum capacity for meter accuracy
- p = operating pressure of the meter in bar absolute.
- p(atm) = atmospheric pressure in bara (1.01325 bara)
- ρ = Density of the gas at atmospheric pressure

ACCURACY / TYPICAL CALIBRATION CURVE

Each X turbine gas meter is tested with atmospheric air to traceable calibrated references. The Instromet error limits are half those allowed by EU standards, OIML recommendation R32 and ISO 9951. For pressures of 110 PSI and above, meters calibrated within even narrower limits are available. Optionally, meters can be calibrated with natural gas at pressures up to 930 PSI, using test installations traceable to primary standards.

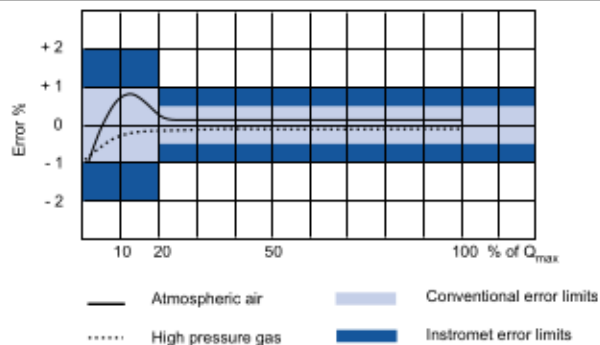


Figure 3 : Typical calibration curves of X meter.

METER INDEX, PULSERS



Figure 4 : Multi-Index.

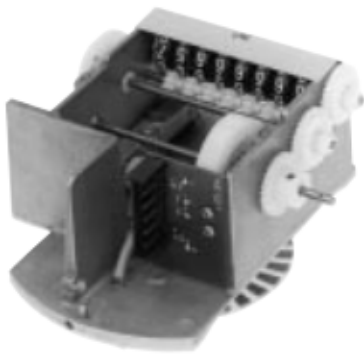


Figure 5 : LF Reed Contact.

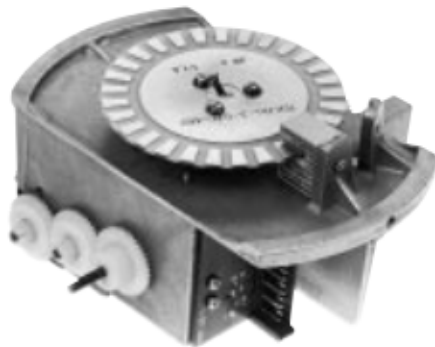


Figure 6 : HF Slot Sensor.

Standard Multi-Index

The standard index is a Multi-Index as shown, fitted with a reed contact to provide a low frequency pulse (Impulse values see page 15).

The impulse is accessed through an electrical connection. The counter is readable over a 90° field of vision and has 8 digits.

Possible Index Options :

- ▣ LF double pulser (Reed contact)
- ▣ HF pulser (Slot sensor)
- ▣ HF double pulser (Slot sensor)
- ▣ HF / LF pulse combinations
- ▣ Anti-fraud reed contact
- ▣ Mechanical drive - (Type 25 H7 according to DIN 33800)
- ▣ Reverse current barrier
- ▣ Remote read-out of counter via HART protocol (Digitur)
- ▣ "Cryo" index extension to prevent icing problems in meters operating with sub-zero temperature gas
- ▣ Drying agent option (aluminum silicate)
- ▣ Tropical operation
- ▣ Polyepoxy coated material - for corrosive environment

Connector Options

Standard :

Pins 1 and 4 = LF Reed contact

Pins 3 and 6 = HF slot sensor

Or according to customer's requirements

All connector combinations are indicated on the type plate.

HF PROXIMITY SENSOR - TURBINE WHEEL / REFERENCE WHEEL



Figure 7.

Each turbine gas meter with an aluminum turbine wheel can be fitted with a Reprox probe type pulse sensor. As each turbine blade passes the proximity sensor a pulse is produced, the number of which is proportional to the speed of the wheel and thus the quantity of gas can be determined (for pulse values see page 15).

A proximity sensor can also be fitted above a toothed reference wheel fitted on the main shaft. These impulse values are identical to the values produced by the turbine blades. The electrical separation between the hazardous and non-hazardous areas is accomplished by an intrinsically safe isolation amplifier, Type Mk 15-PRN-Ex0/K11.

DIFFERENT GAS TURBINE METER MODELS



Figure 8.

X-Series 'Cryo' to measure sub-zero temperature gas.

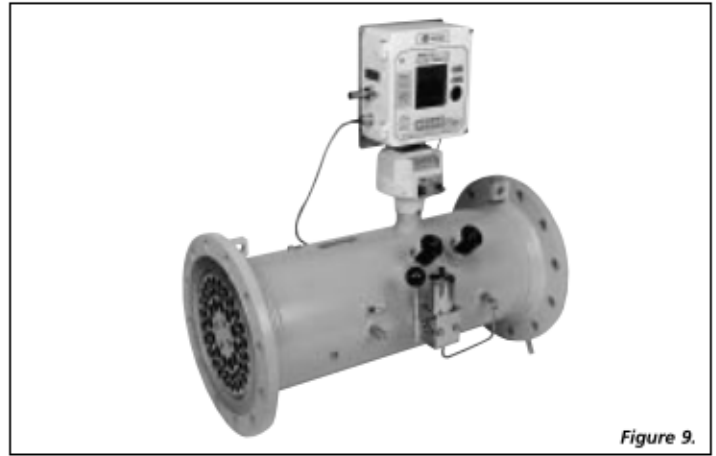


Figure 9.

X-Series with Model 999 electronic volume corrector.

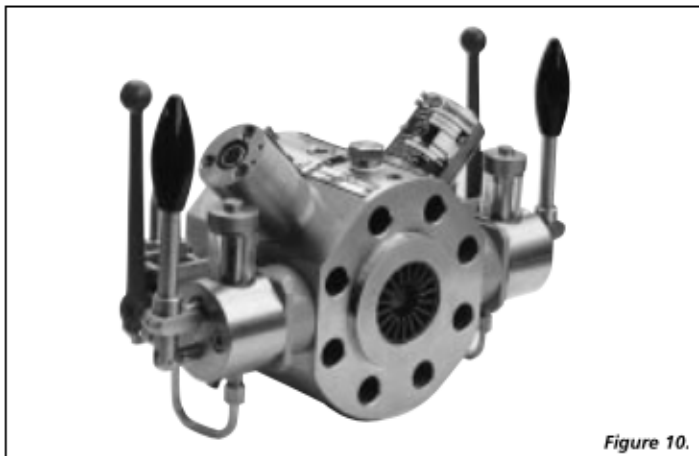


Figure 10.

SM-RI-P high pressure turbine gas meter for the measurement of ethylene with a very high density.

IN SITU INSPECTION AND SPIN TEST

Optionally a special port can be provided to allow visual inspection of the turbine wheel without removing the meter mechanism from the line. This port can also be used to test the conditions of the bearings by means of a spin test.

ELECTRONIC VOLUME CORRECTORS AND ASSOCIATED PRODUCTS

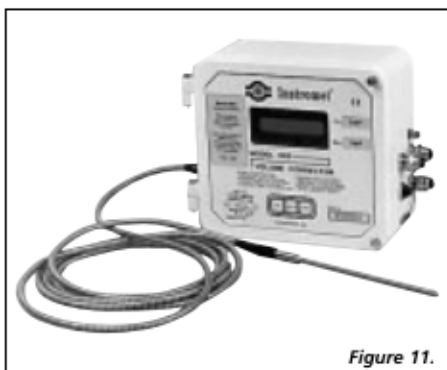


Figure 11.

Model 555 or 999 Corrector

User configurable, highly accurate electronic volume corrector with an extremely versatile logging capability correcting for temperature and pressure.

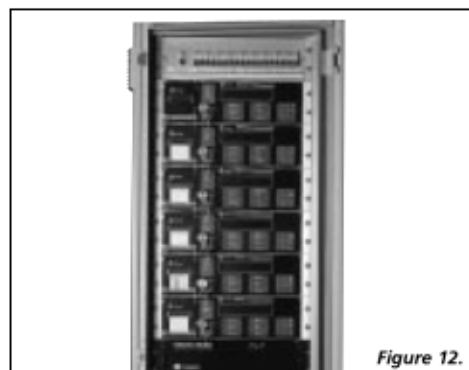


Figure 12.

Series 793 Flow Computer

For remote calculation of flow quantity in base volume and energy without any additional error. Temperature and pressure are digitally read using a HART bus.



Figure 13.

Tru-Therm Calorimeter

For real-time measurement. Provides total energy flow and gas quality at bare conditions.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 3,500 - METER SIZE: 2 INCH

2 INCH		45° Rotor Angle						30° Rotor Angle						
		Standard Model Q & X Turbine Flow Rates						Increased Capacity Model Q & X Turbine Flow Rates						
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate		Turn Down Ratio
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h			
0	1.01	3,500	99	500	14	7:1	2.4							
0.25	1.03	3,559	101	504	14	7:1	2.4							
1	1.08	3,738	106	517	15	7:1	2.6							
10	1.70	5,876	166	648	18	9:1	4.0							
25	2.74	9,440	267	821	23	11:1	6.5							
50	4.46	15,381	436	1,048	30	15:1	10.5							
75	6.18	21,321	604	1,234	35	17:1	14.6							
100	7.91	27,261	772	1,395	40	20:1	18.7							
125	9.63	33,201	940	1,540	44	22:1	22.8							
200	14.80	51,022	1,445	1,909	54	27:1	35.0							
300	21.70	74,783	2,118	2,311	65	32:1	51.3							
400	28.59	98,544	2,790	2,653	75	37:1	67.6							
500	35.49	122,305	3,463	2,956	84	41:1	83.9							
600	42.38	146,066	4,136	3,230	91	45:1	100.2							
700	49.28	169,827	4,809	3,483	99	49:1	116.5							
800	56.17	193,588	5,482	3,719	105	52:1	132.7							
900	63.07	217,349	6,155	3,940	112	55:1	149.0							
1000	69.96	241,110	6,827	4,150	118	58:1	165.3							
1100	76.86	264,871	7,500	4,350	123	61:1	181.6							
1200	83.75	288,632	8,173	4,541	129	64:1	197.9							
1300	90.65	312,393	8,846	4,724	134	66:1	214.2							
1400	97.54	336,154	9,519	4,900	139	69:1	230.5							

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 10,000 - METER SIZE: 3 INCH

3 INCH		45° Rotor Angle						30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates						Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate	
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h		
0	1.01	10,000	283	880	25	11:1	2.8	14,000	396	1,250	35	11:1	6.8
0.25	1.03	10,170	288	887	25	11:1	2.8	14,238	403	1,261	36	11:1	6.9
1	1.08	10,679	302	909	26	12:1	3.0	14,950	423	1,292	37	12:1	7.3
10	1.70	16,789	475	1,140	32	15:1	4.7	23,504	666	1,620	46	15:1	11.4
25	2.74	26,972	764	1,445	41	19:1	7.6	37,761	1,069	2,053	58	18:1	18.3
50	4.46	43,944	1,244	1,845	52	24:1	12.3	61,522	1,742	2,620	74	23:1	29.9
75	6.18	60,916	1,725	2,172	62	28:1	17.1	85,283	2,415	3,085	87	28:1	41.4
100	7.91	77,889	2,206	2,456	70	32:1	21.8	109,044	3,088	3,489	99	31:1	53.0
125	9.63	94,861	2,686	2,710	77	35:1	26.6	132,805	3,761	3,850	109	34:1	64.5
200	14.80	145,777	4,128	3,360	95	43:1	40.8	204,088	5,779	4,773	135	43:1	99.1
300	21.70	213,666	6,050	4,068	115	53:1	59.8	299,132	8,470	5,778	164	52:1	145.3
400	28.59	281,555	7,973	4,669	132	60:1	78.8	394,177	11,162	6,633	188	59:1	191.5
500	35.49	349,443	9,895	5,202	147	67:1	97.8	489,221	13,853	7,389	209	66:1	237.6
600	42.38	417,332	11,818	5,685	161	73:1	116.9	584,265	16,545	8,075	229	72:1	283.8
700	49.28	485,221	13,740	6,130	174	79:1	135.9	679,309	19,236	8,707	247	78:1	330.0
800	56.17	553,109	15,662	6,545	185	85:1	154.9	774,353	21,927	9,296	263	83:1	376.1
900	63.07	620,998	17,585	6,935	196	90:1	173.9	869,397	24,619	9,850	279	88:1	422.3
1000	69.96	688,887	19,507	7,304	207	94:1	192.9	964,441	27,310	10,375	294	93:1	468.4
1100	76.86	756,775	21,429	7,655	217	99:1	211.9	1,059,485	30,001	10,874	308	97:1	514.6
1200	83.75	824,664	23,352	7,991	226	103:1	230.9	1,154,530	32,693	11,351	321	102:1	560.8
1300	90.65	892,553	25,274	8,314	235	107:1	249.9	1,249,574	35,384	11,809	334	106:1	606.9
1400	97.54	960,441	27,197	8,624	244	111:1	268.9	1,344,618	38,075	12,250	347	110:1	653.1

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 18,000 - METER SIZE: 4 INCH

4 INCH		45° Rotor Angle						30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates						Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate	
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h		
0	1.01	18,000	510	1,250	35	14:1	3.1	27,000	765	1,750	50	15:1	5.2
0.25	1.03	18,305	518	1,261	36	15:1	3.2	27,458	778	1,765	50	16:1	5.3
1	1.08	19,222	544	1,292	37	15:1	3.3	28,833	816	1,808	51	16:1	5.6
10	1.70	30,220	856	1,620	46	19:1	5.2	45,330	1,284	2,268	64	20:1	8.7
25	2.74	48,550	1,375	2,053	58	24:1	8.4	72,825	2,206	2,874	81	25:1	14.0
50	4.46	79,100	2,240	2,620	74	30:1	13.6	118,650	3,360	3,669	104	32:1	22.9
75	6.18	109,650	3,105	3,085	87	36:1	18.9	164,475	4,657	4,319	122	38:1	31.7
100	7.91	140,200	3,970	3,489	99	40:1	24.1	210,299	5,955	4,884	138	43:1	40.5
125	9.63	170,749	4,835	3,850	109	44:1	29.4	256,124	7,253	5,390	153	48:1	49.3
200	14.80	262,399	7,430	4,773	135	55:1	45.2	393,599	11,145	6,682	189	59:1	75.8
300	21.70	384,599	10,891	5,778	164	67:1	66.2	576,898	16,336	8,089	229	71:1	111.1
400	28.59	506,798	14,351	6,633	188	76:1	87.3	760,198	21,526	9,286	263	82:1	146.4
500	35.49	628,998	17,811	7,389	209	85:1	108.3	943,497	26,717	10,345	293	91:1	181.7
600	42.38	751,198	21,272	8,075	229	93:1	129.4	1,126,796	31,907	11,305	320	100:1	217.0
700	49.28	873,397	24,732	8,707	247	100:1	150.4	1,310,096	37,098	12,190	345	107:1	252.3
800	56.17	995,597	28,192	9,296	263	107:1	171.5	1,493,395	42,288	13,015	369	115:1	287.6
900	63.07	1,117,796	31,652	9,850	279	113:1	192.5	1,676,695	47,479	13,791	391	122:1	322.9
1000	69.96	1,239,996	35,113	10,375	294	120:1	213.6	1,859,994	52,669	14,525	411	128:1	358.2
1100	76.86	1,362,196	38,573	10,874	308	125:1	234.6	2,043,293	57,860	15,224	431	134:1	393.5
1200	83.75	1,484,395	42,033	11,351	321	131:1	255.6	2,226,593	63,050	15,892	450	140:1	428.8
1300	90.65	1,606,595	45,494	11,809	334	136:1	276.7	2,409,892	68,241	16,533	468	146:1	464.1
1400	97.54	1,728,794	48,954	12,250	347	141:1	297.7	2,593,191	73,431	17,150	486	151:1	499.4

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 35,000 - METER SIZE: 6 INCH

6 INCH		45° Rotor Angle						30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates						Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate	
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h		
0	1.01	35,000	991	1,750	50	20:1	2.8	60,000	1,699	2,800	79	21:1	6.4
0.25	1.03	35,594	1,008	1,765	50	20:1	2.8	61,018	1,728	2,824	80	22:1	6.5
1	1.08	37,376	1,058	1,808	51	21:1	3.0	64,073	1,814	2,893	82	22:1	6.8
10	1.70	58,761	1,664	2,268	64	26:1	4.7	100,733	2,852	3,628	103	28:1	10.7
25	2.74	94,403	2,673	2,874	81	33:1	7.6	161,833	4,583	4,598	130	35:1	17.3
50	4.46	153,805	4,355	3,669	104	42:1	12.3	263,666	7,466	5,870	166	45:1	28.1
75	6.18	213,208	6,037	4,319	122	49:1	17.1	365,499	10,350	6,911	196	53:1	39.0
100	7.91	272,610	7,719	4,884	138	56:1	21.8	467,332	13,233	7,814	221	60:1	49.8
125	9.63	332,013	9,402	5,390	153	62:1	26.6	569,165	16,117	8,624	244	66:1	60.7
200	14.80	510,221	14,448	6,682	189	76:1	40.8	874,664	24,768	10,691	303	82:1	93.3
300	21.70	747,831	21,176	8,089	229	92:1	59.8	1,281,996	36,302	12,943	366	99:1	136.7
400	28.59	985,441	27,905	9,286	263	106:1	78.8	1,689,328	47,836	14,857	421	114:1	180.2
500	35.49	1,223,052	34,633	10,345	293	118:1	97.8	2,096,660	59,371	16,552	469	127:1	223.6
600	42.38	1,460,662	41,361	11,305	320	129:1	116.9	2,503,992	70,905	18,088	512	138:1	267.1
700	49.28	1,698,272	48,090	12,190	345	139:1	135.9	2,911,324	82,440	19,504	552	149:1	310.5
800	56.17	1,935,883	54,818	13,015	369	149:1	154.9	3,318,656	93,974	20,824	590	159:1	354.0
900	63.07	2,173,493	61,546	13,791	391	158:1	173.9	3,725,988	105,508	22,065	625	169:1	397.4
1000	69.96	2,411,103	68,275	14,525	411	166:1	192.9	4,133,320	117,043	23,240	658	178:1	440.9
1100	76.86	2,648,714	75,003	15,224	431	174:1	211.9	4,540,652	128,577	24,358	690	186:1	484.3
1200	83.75	2,886,324	81,732	15,892	450	182:1	230.9	4,947,984	140,111	25,427	720	195:1	527.8
1300	90.65	3,123,934	88,460	16,533	468	189:1	249.9	5,355,316	151,646	26,453	749	202:1	571.2
1400	97.54	3,361,544	95,188	17,150	486	196:1	268.9	5,762,648	163,180	27,441	777	210:1	614.7

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 60,000 - METER SIZE: 8 INCH

8 INCH		45° Rotor Angle							30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates							Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate		Turn Down Ratio
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h			
0	1.01	60,000	1,699	2,800	79	21:1	1.2	100,000	2,832	4,400	125	23:1	2.2	
0.25	1.03	60,018	1,728	2,824	80	22:1	1.2	101,697	2,880	4,437	126	23:1	2.2	
1	1.08	64,073	1,814	2,893	82	22:1	1.3	106,789	3,024	4,547	129	23:1	2.3	
10	1.70	100,733	2,852	3,628	103	28:1	2.0	167,889	4,754	5,701	161	29:1	3.7	
25	2.74	161,833	4,583	4,598	130	35:1	3.2	269,722	7,638	7,226	205	37:1	5.9	
50	4.46	263,666	7,466	5,870	166	45:1	5.3	439,442	12,444	9,224	261	48:1	9.7	
75	6.18	365,499	10,350	6,911	196	53:1	7.3	609,165	17,250	10,860	308	56:1	13.4	
100	7.91	467,332	13,233	7,814	221	60:1	9.3	778,887	22,056	12,280	348	63:1	17.1	
125	9.63	569,165	16,117	8,624	244	66:1	11.4	948,608	26,862	13,552	384	70:1	20.9	
200	14.80	874,664	24,768	10,691	303	82:1	17.5	1,457,773	41,280	16,800	476	87:1	32.1	
300	21.70	1,281,996	36,302	12,943	366	99:1	25.6	2,136,660	60,503	20,339	576	105:1	47.0	
400	28.59	1,689,328	47,836	14,857	421	114:1	33.8	2,815,547	79,727	23,347	661	121:1	61.9	
500	35.49	2,096,660	59,371	16,552	469	127:1	41.9	3,494,433	98,951	26,010	737	134:1	76.9	
600	42.38	2,503,992	70,905	18,088	512	138:1	50.1	4,173,320	118,175	28,425	805	147:1	91.8	
700	49.28	2,911,324	82,440	19,504	552	149:1	58.2	4,852,206	137,399	30,649	868	158:1	106.7	
800	56.17	3,318,656	93,974	20,824	590	159:1	66.4	5,531,093	156,623	32,723	927	169:1	121.7	
900	63.07	3,725,988	105,508	22,065	625	169:1	74.5	6,209,980	175,847	34,674	982	179:1	136.6	
1000	69.96	4,133,320	117,043	23,240	658	178:1	82.7	6,888,866	195,071	36,520	1,034	189:1	151.6	
1100	76.86	4,540,652	128,577	24,358	690	186:1	90.8	7,567,753	214,295	38,277	1,084	198:1	166.5	
1200	83.75	4,947,984	140,111	25,427	720	195:1	99.0	8,246,640	233,519	39,957	1,131	206:1	181.4	
1300	90.65	5,355,316	151,646	26,453	749	202:1	107.1	8,925,526	252,743	41,569	1,177	215:1	196.4	
1400	97.54	5,762,648	163,180	27,441	777	210:1	115.3	9,604,413	271,967	43,121	1,221	223:1	211.3	

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 100,000 - METER SIZE: 10 INCH

10 INCH		45° Rotor Angle							30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates							Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate		Turn Down Ratio
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h			
0	1.01	100,000	2,832	4,400	125	23:1	1.4	150,000	4,248	5,600	159	27:1	3.4	
0.25	1.03	101,697	2,880	4,437	126	23:1	1.4	152,546	4,320	5,647	160	27:1	3.5	
1	1.08	106,789	3,024	4,547	129	23:1	1.5	160,183	4,536	5,787	164	28:1	3.6	
10	1.70	167,889	4,754	5,701	161	29:1	2.4	251,833	7,131	7,256	205	35:1	5.7	
25	2.74	269,722	7,638	7,226	205	37:1	3.8	404,582	11,456	9,197	260	44:1	9.2	
50	4.46	439,443	12,444	9,224	261	48:1	6.2	659,165	18,665	11,739	332	56:1	14.9	
75	6.18	609,165	17,250	10,860	308	56:1	8.5	913,747	25,874	13,822	391	66:1	20.7	
100	7.91	778,887	22,056	12,280	348	63:1	10.9	1,168,330	33,083	15,629	443	75:1	26.5	
125	9.63	948,608	26,862	13,552	384	70:1	13.3	1,422,912	40,292	17,248	488	82:1	32.3	
200	14.80	1,457,773	41,280	16,800	476	87:1	20.4	2,186,660	61,919	21,381	605	102:1	49.6	
300	21.70	2,136,660	60,503	20,339	576	105:1	29.9	3,204,990	90,755	25,885	733	124:1	72.6	
400	28.59	2,815,547	79,727	23,347	661	121:1	39.4	4,223,320	119,591	29,715	841	142:1	95.7	
500	35.49	3,494,433	98,951	26,010	737	134:1	48.9	5,241,650	148,427	33,104	937	158:1	118.8	
600	42.38	4,173,320	118,175	28,425	805	147:1	58.4	6,259,980	177,263	36,177	1,024	173:1	141.9	
700	49.28	4,852,206	137,399	30,649	868	158:1	67.9	7,278,310	206,099	39,008	1,105	187:1	165.0	
800	56.17	5,531,093	156,623	32,723	927	169:1	77.4	8,296,640	234,935	41,648	1,179	199:1	188.1	
900	63.07	6,209,980	175,847	34,674	982	179:1	86.9	9,314,969	263,771	44,130	1,250	211:1	211.1	
1000	69.96	6,888,866	195,071	36,520	1,034	189:1	96.4	10,333,299	292,606	46,480	1,316	222:1	234.2	
1100	76.86	7,567,753	214,295	38,277	1,084	198:1	105.9	11,351,629	321,442	48,716	1,379	233:1	257.3	
1200	83.75	8,246,640	233,519	39,957	1,131	206:1	115.5	12,369,959	350,278	50,854	1,440	243:1	280.4	
1300	90.65	8,925,526	252,743	41,569	1,177	215:1	125.0	13,388,289	379,114	52,906	1,498	253:1	303.5	
1400	97.54	9,604,413	271,967	43,121	1,221	223:1	134.5	14,406,619	407,950	54,881	1,554	263:1	326.6	

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 150,000 - METER SIZE: 12 INCH

12 INCH		45° Rotor Angle							30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates							Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate		Turn Down Ratio
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h			
0	1.01	150,000	4,248	5,600	159	27:1	1.6	250,000	7,079	9,200	261	27:1	3.6	
0.25	1.03	152,546	4,320	5,647	160	27:1	1.6	254,243	7,199	9,278	263	27:1	3.7	
1	1.08	160,183	4,536	5,787	164	28:1	1.7	266,972	7,560	9,507	269	28:1	3.8	
10	1.70	251,833	7,131	7,256	205	35:1	2.7	419,722	11,885	11,921	338	35:1	6.0	
25	2.74	404,582	11,456	9,197	260	44:1	4.3	674,304	19,094	15,109	428	45:1	9.7	
50	4.46	659,165	18,665	11,739	332	56:1	7.0	1,098,608	31,109	19,286	546	57:1	15.8	
75	6.18	913,747	25,874	13,822	391	66:1	9.7	1,522,912	43,124	22,707	643	67:1	21.9	
100	7.91	1,168,330	33,083	15,629	443	75:1	12.5	1,947,217	55,139	25,676	727	76:1	28.0	
125	9.63	1,422,912	40,292	17,248	488	82:1	15.2	2,371,521	67,154	28,336	802	84:1	34.1	
200	14.80	2,186,660	61,919	21,381	605	102:1	23.3	3,644,433	103,199	35,126	995	104:1	52.5	
300	21.70	3,204,990	90,755	25,885	733	124:1	34.2	5,341,650	151,259	42,526	1,204	126:1	76.9	
400	28.59	4,223,320	119,591	29,715	841	142:1	45.0	7,038,866	199,318	48,817	1,382	144:1	101.4	
500	35.49	5,241,650	148,427	33,104	937	158:1	55.9	8,736,083	247,378	54,385	1,540	161:1	125.8	
600	42.38	6,259,980	177,263	36,177	1,024	173:1	66.8	10,433,299	295,438	59,433	1,683	176:1	150.2	
700	49.28	7,278,310	206,099	39,008	1,105	187:1	77.6	12,130,516	343,498	64,085	1,815	189:1	174.7	
800	56.17	8,296,640	234,935	41,648	1,179	199:1	88.5	13,827,733	391,558	68,422	1,937	202:1	199.1	
900	63.07	9,314,969	263,771	44,130	1,250	211:1	99.4	15,524,949	439,618	72,499	2,053	214:1	223.6	
1000	69.96	10,333,299	292,606	46,480	1,316	222:1	110.2	17,222,166	487,677	76,359	2,162	226:1	248.0	
1100	76.86	11,351,629	321,442	48,716	1,379	233:1	121.1	18,919,382	535,737	80,033	2,266	236:1	272.4	
1200	83.75	12,369,959	350,278	50,854	1,440	243:1	131.9	20,616,599	583,797	83,546	2,366	247:1	296.9	
1300	90.65	13,388,289	379,114	52,906	1,498	253:1	142.8	22,313,815	631,857	86,917	2,461	257:1	321.3	
1400	97.54	14,406,619	407,950	54,881	1,554	263:1	153.7	24,011,032	679,917	90,162	2,553	266:1	345.8	

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 250,000 - METER SIZE: 16 INCH

16 INCH		45° Rotor Angle							30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates							Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate		Turn Down Ratio
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h			
0	1.01	250,000	7,079	9,200	261	27:1	1.6	350,000	9,911	11,700	331	30:1	3.6	
0.25	1.03	254,243	7,199	9,278	263	27:1	1.6	355,940	10,079	11,799	334	30:1	3.7	
1	1.08	266,972	7,560	9,507	269	28:1	1.7	373,761	10,584	12,091	342	31:1	3.8	
10	1.70	419,722	11,885	11,921	338	35:1	2.7	587,610	16,639	15,160	429	39:1	6.0	
25	2.74	674,304	19,094	15,109	428	45:1	4.3	944,026	26,732	19,215	544	49:1	9.7	
50	4.46	1,098,608	31,109	19,286	546	57:1	7.0	1,538,052	43,553	24,527	695	63:1	15.8	
75	6.18	1,522,912	43,124	22,707	643	67:1	9.7	2,132,077	60,374	28,877	818	74:1	21.9	
100	7.91	1,947,217	55,139	25,676	727	76:1	12.5	2,726,103	77,195	32,653	925	83:1	28.0	
125	9.63	2,371,521	67,154	28,336	802	84:1	15.2	3,320,129	94,016	36,035	1,020	92:1	34.1	
200	14.80	3,644,433	103,199	35,126	995	104:1	23.3	5,102,206	144,478	44,672	1,265	114:1	52.5	
300	21.70	5,341,650	151,259	42,526	1,204	126:1	34.2	7,478,310	211,762	54,082	1,531	138:1	76.9	
400	28.59	7,038,866	199,318	48,817	1,382	144:1	45.0	9,854,413	279,046	62,082	1,758	159:1	101.4	
500	35.49	8,736,083	247,378	54,385	1,540	161:1	55.9	12,230,516	346,330	69,163	1,958	177:1	125.8	
600	42.38	10,433,299	295,438	59,433	1,683	176:1	66.8	14,606,619	413,613	75,583	2,140	193:1	150.2	
700	49.28	12,130,516	343,498	64,085	1,815	189:1	77.6	16,982,722	480,897	81,500	2,308	208:1	174.7	
800	56.17	13,827,733	391,558	68,422	1,937	202:1	88.5	19,358,826	548,181	87,014	2,464	222:1	199.1	
900	63.07	15,524,949	439,618	72,499	2,053	214:1	99.4	21,734,929	615,465	92,200	2,611	236:1	223.6	
1000	69.96	17,222,166	487,677	76,359	2,162	226:1	110.2	24,111,032	682,748	97,109	2,750	248:1	248.0	
1100	76.86	18,919,382	535,737	80,033	2,266	236:1	121.1	26,487,135	750,032	101,782	2,882	260:1	272.4	
1200	83.75	20,616,599	583,797	83,546	2,366	247:1	131.9	28,863,238	817,316	106,249	3,009	272:1	296.9	
1300	90.65	22,313,815	631,857	86,917	2,461	257:1	142.8	31,239,341	884,600	110,536	3,130	283:1	321.3	
1400	97.54	24,011,032	679,917	90,162	2,553	266:1	153.7	33,615,445	951,883	114,662	3,247	293:1	345.8	

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 350,000 - METER SIZE: 20 INCH

20 INCH		45° Rotor Angle						30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates						Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate	
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h		
0	1.01	350,000	9,911	11,700	331	30:1	1.6	600,000	16,990	18,700	530	32:1	3.6
0.25	1.03	355,940	10,079	11,799	334	30:1	1.6	610,183	17,278	18,858	534	32:1	3.7
1	1.08	373,761	110,584	12,091	342	31:1	1.7	640,733	18,144	19,324	547	33:1	3.8
10	1.70	587,610	16,639	15,160	429	39:1	2.7	1,007,332	28,524	24,230	686	42:1	6.0
25	2.74	944,026	26,732	19,215	544	49:1	4.3	1,618,330	45,826	30,711	870	53:1	9.7
50	4.46	1,538,052	43,553	24,527	695	63:1	7.0	2,636,660	74,662	39,201	1,110	67:1	15.8
75	6.18	2,132,077	60,374	28,877	818	74:1	9.7	3,654,990	103,498	46,154	1,307	79:1	21.9
100	7.91	2,726,103	77,195	32,653	925	83:1	12.5	4,673,320	132,334	52,189	1,478	90:1	28.0
125	9.63	3,320,129	94,016	36,035	1,020	92:1	15.2	5,691,650	161,170	57,595	1,631	99:1	34.1
200	14.80	5,102,206	144,478	44,672	1,265	114:1	23.3	8,746,640	247,677	71,398	2,022	123:1	52.5
300	21.70	7,478,310	211,762	54,082	1,531	138:1	34.2	12,819,959	363,021	86,439	2,448	148:1	76.9
400	28.59	9,854,413	279,046	62,082	1,758	159:1	45.0	16,893,279	478,364	99,225	2,810	170:1	101.4
500	35.49	12,230,516	346,330	69,163	1,958	177:1	55.9	20,966,599	593,708	110,543	3,130	190:1	125.8
600	42.38	14,606,619	413,613	75,583	2,140	193:1	66.8	25,039,919	709,051	120,804	3,421	207:1	150.2
700	49.28	16,982,722	480,897	81,500	2,308	208:1	77.6	29,113,238	824,395	130,260	3,689	224:1	174.7
800	56.17	19,358,826	548,181	87,014	2,464	222:1	88.5	33,186,558	939,739	139,074	3,938	239:1	199.1
900	63.07	21,734,929	615,465	92,200	2,611	236:1	99.4	37,259,878	1,055,082	147,362	4,173	253:1	223.6
1000	69.96	24,111,032	682,748	97,109	2,750	248:1	110.2	41,333,198	1,170,426	155,208	4,395	266:1	248.0
1100	76.86	26,487,135	750,032	101,782	2,882	260:1	121.1	45,406,517	1,285,769	162,677	4,606	279:1	272.4
1200	83.75	28,863,238	817,316	106,249	3,009	272:1	131.9	49,479,837	1,401,113	169,817	4,809	291:1	296.9
1300	90.65	31,239,341	884,600	110,536	3,130	283:1	142.8	53,553,157	1,516,456	176,668	5,003	303:1	321.3
1400	97.54	33,615,445	951,883	114,662	3,247	293:1	153.7	57,626,477	1,631,800	183,264	5,189	314:1	345.8

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

PERFORMANCE DATA OF INSTROMET GAS TURBINE METERS ON NATURAL GAS - MAX. FLOWRATE IN ACFH: 600,000 - METER SIZE: 24 INCH

24 INCH		45° Rotor Angle						30° Rotor Angle					
		Standard Model Q & X Turbine Flow Rates						Increased Capacity Model Q & X Turbine Flow Rates					
		Operating pressure		Max. flow rate		Min. flow rate		Turn Down Ratio	Approx. Maximum Press. loss in. W.C.	Max. flow rate		Min. flow rate	
PSIG	Bar (abs)	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h			SCFH	Nm³/h		
0	1.01	600,000	16,990	18,700	530	32:1	1.6	900,000	25,485	29,350	831	31:1	3.6
0.25	1.03	610,183	17,278	18,858	534	32:1	1.6	915,275	25,918	29,598	838	31:1	3.7
1	1.08	640,733	18,144	19,324	547	33:1	1.7	961,100	27,215	30,330	859	32:1	3.8
10	1.70	1,007,332	28,524	24,230	686	42:1	2.7	1,510,998	42,787	38,029	1,077	40:1	6.0
25	2.74	1,618,330	45,826	30,711	870	53:1	4.3	2,427,495	68,739	48,202	1,365	50:1	9.7
50	4.46	2,636,660	74,662	39,201	1,110	67:1	7.0	3,954,990	111,993	61,526	1,742	64:1	15.8
75	6.18	3,654,990	103,498	46,154	1,307	79:1	9.7	5,482,485	155,247	72,440	2,051	76:1	21.9
100	7.91	4,673,320	132,334	52,189	1,478	90:1	12.5	7,009,980	198,500	81,912	2,319	86:1	28.0
125	9.63	5,691,650	161,170	57,595	1,631	99:1	15.2	8,537,475	241,754	90,396	2,560	94:1	34.1
200	14.80	8,746,640	247,677	71,398	2,022	123:1	23.3	13,119,959	371,516	112,061	3,173	117:1	52.5
300	21.70	12,819,959	363,021	86,439	2,448	148:1	34.2	19,229,939	54,531	155,667	3,842	142:1	76.9
400	28.59	16,893,279	478,364	99,225	2,810	170:1	45.0	25,339,919	717,547	155,736	4,410	163:1	101.4
500	35.49	20,966,599	593,708	110,543	3,130	190:1	55.9	31,449,898	890,562	173,499	4,913	181:1	125.8
600	42.38	25,039,919	709,051	120,804	3,421	207:1	66.8	37,559,878	1,063,577	189,605	5,369	198:1	150.2
700	49.28	29,113,238	824,395	130,260	3,689	224:1	77.6	43,669,857	1,236,593	204,446	5,789	214:1	174.7
800	56.17	33,186,558	939,739	139,074	3,938	239:1	88.5	49,779,837	1,409,608	218,280	6,181	228:1	199.1
900	63.07	37,259,878	1,055,082	147,362	4,173	253:1	99.4	55,889,817	1,582,623	231,288	6,549	242:1	223.6
1000	69.96	41,333,198	1,170,426	155,208	4,395	266:1	110.2	61,999,796	1,755,639	243,603	6,898	255:1	248.0
1100	76.86	45,406,517	1,285,769	162,677	4,606	279:1	121.1	68,109,776	1,928,654	255,324	7,230	267:1	272.4
1200	83.75	49,479,837	1,401,113	169,817	4,809	291:1	131.9	74,219,756	2,101,669	266,530	7,547	278:1	296.9
1300	90.65	53,553,157	1,516,456	176,668	5,003	303:1	142.8	80,329,735	2,274,685	277,284	7,852	290:1	321.3
1400	97.54	57,626,477	1,631,800	183,264	5,189	314:1	153.7	86,439,715	2,447,700	287,636	8,145	301:1	345.8

Based at operating temperature of 60° F; SCFH defined at 60° F and 14.73 psia.; Specific gravity assumed to be 0.6.; Supercompressibility is not included in these calculations; Designed for sizing purposes.

MEASUREMENT OF VARIOUS GASES

Applicable to clean dry gases from -10° C to +65° C. Other temperature ranges by special request.

S = Standard Materials

T = Corrosion resistant coated body and internals (except plastic and stainless steel parts)

1) = Special O-rings

2) = Special lubrications

3) = Special turbine wheels

4) = Except food industry

5) = For super-critical Ethylene and Propylene use SM-RI-P

6) = For oxygen special conditions apply

Gas	Formula	Density at 0°C 1.013 bar (kg/m ³)	Meter housing	Remarks
Natural gas	CH ₄	0.8	S	
Acetylene	C ₂ H ₂	1.17	T	Teflon coated
Ammonia	NH ₃	0.77	S	1) 2)
Argon	Ar	1.78	S	
Butane	C ₄ H ₁₀	2.70	S	
Biogas	-	-	T	1) 2) 3)
Ethane	C ₂ H ₆	1.36	S	
Ethylene	C ₂ H ₄	1.26	S	1) 5)
Freon 12 (gas)	CCl ₂ F ₂	5.66	S	1) 2)
Helium	He	0.18	S	higher Q _{min}
Carbon Dioxide	CO ₂	1.98	S	4)
Carbon Monoxide	CO	1.25	S	
Air	N ₂ + O ₂	1.29	S	
Methane	CH ₄	0.72	S	
Pentane	C ₅ H ₁₂	3.46	S	
Propane	C ₃ H ₈	2.02	S	
Propylene (gaseous)	C ₃ H ₆	1.92	S	1) 5)
Sewer / Manure gas	-	-	T	1) 2)
Town gas	-	-	S	
Sulphide gas	-	-	T	1)
Nitrogen	N ₂	1.25	S	
Hydrogen	H ₂	0.09	T	higher Q _{min}
Oxygen (pure)	O ₂	1.43	S	1) 2) 6) special constr.
Sulphur dioxide	SO ₂	2.93	T	1) special constr.
Hydrogen sulphide	H ₂ S	1.54	T	1) 2)

NOTE :

- For wet gases, a special coating can be applied to the body's inside surfaces.
- For corrosive environment, external surfaces and index head can be coated.
- For higher or lower temperatures special lubrication and materials can be supplied.

PRESSURE LOSS FORMULA

The average pressure loss (see tables pages 6-10) of the X turbine meter using atmospheric natural gas with a relative density of 0.6 and measured at one (1) diameter upstream to one (1) diameter downstream of the meter on straight pipe of the same size as the meter.

The pressure loss across the X turbine meter for various gases and other operating pressures may be approximated from the following equation :

$$\Delta P_2 = \Delta P_1 \cdot \frac{d}{0.6} \cdot \left(\frac{P_m}{P_{atm}} \right) \cdot \left(\frac{Q}{Q_{max}} \right)^2 \text{ [mbar]}$$

ΔP_2 = Pressure drop at P_m and Q_{mbar}

ΔP_1 = Pressure drop at Q_{max} (see tables pages 6-15)

P_m = Operating pressure absolute

P_{atm} = Atmospheric Pressure 1.013 bara

Q = Instantaneous flow rate in m³/h

Q_{max} = Max. flow rate in m³/h

d = Relative density of the gas (air = 1)

HOW TO ORDER

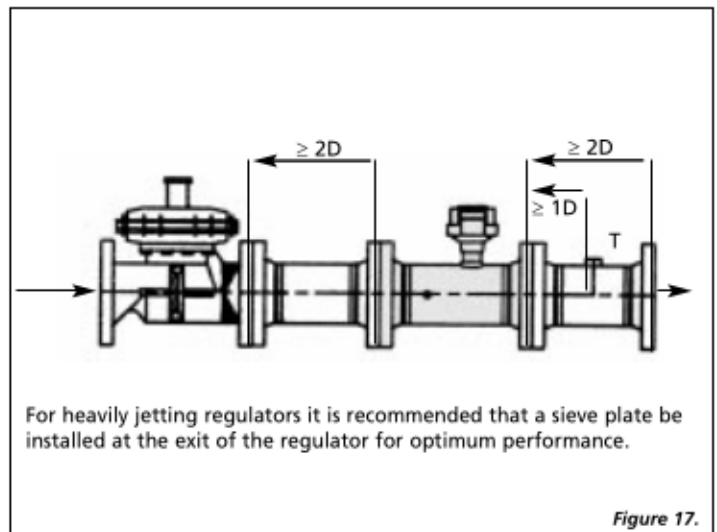
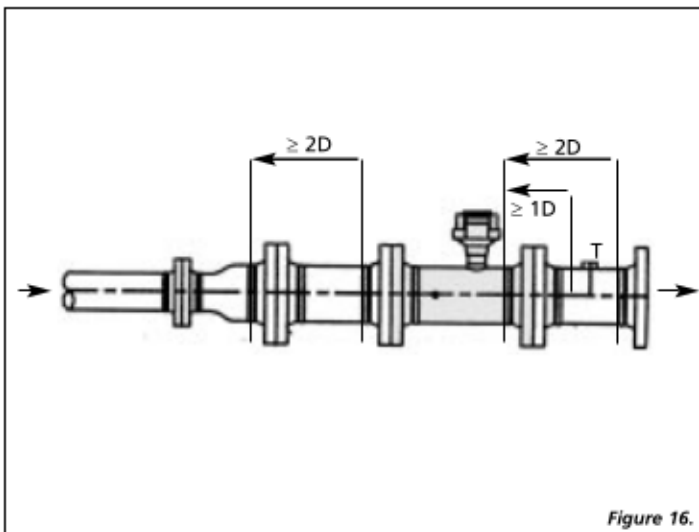
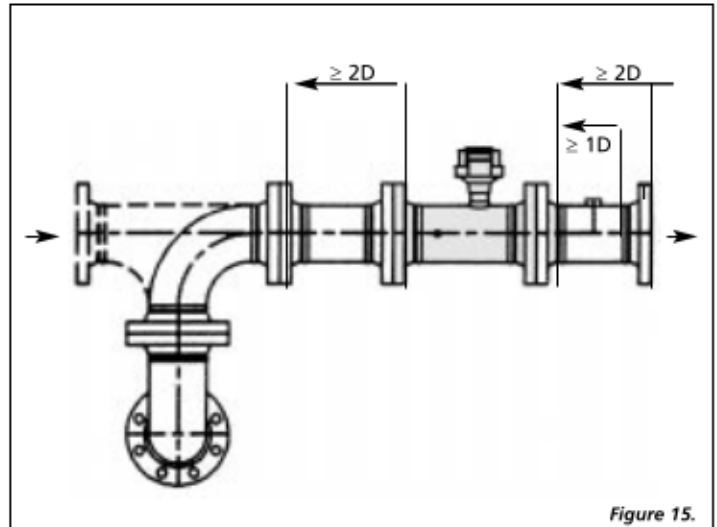
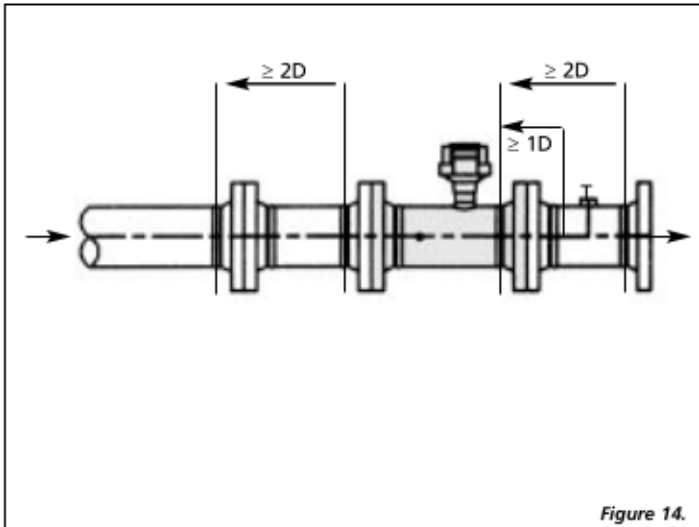
In order to provide the meter best-suited for your application, please provide the following information :

- Pipe diameter
- Gas flow quantity, min & max
- Gas flow direction
- Operating pressures, min & max
- Operating temperatures, min & max
- Ambient temperatures, min & max
- Type of gas
- Flange class, DIN or ANSI
- Type of Index - pulse options
- Proximity Switch(es) - Turbine, reference wheel
- High Pressure Calibration required
- Metrological and / or materials certificates required.

INSTALLATION GUIDELINES

- The X-Series fulfills all the requirements of the European and major international directives, standards and guidelines, in particular those of OIML, ISO and DVGW.
- With the integrated X4X® (patented) flow straightener, the X-Series eliminates the effect of perturbations on gas measurement and satisfies the exacting requirements of the International Standard ISO 9951 with only 2 x diameter of upstream piping. This permits the design of very compact installations without a significant effect on accuracy.
- The superior performance of the X4X flow straightener was confirmed by tests carried out by a number of European gas transmission companies. Copies of this report are available on request.

Possible Installation Configurations



The gas piping must be clean and free of sand, dirt, metal filings, and other foreign particles and liquids. It is recommended that a filter of 5 micron mesh be installed upstream of the meter.

Position the gaskets with care, ensuring that there is no protrusion into the flow which would cause a disturbance to the flow.

Tighten the bolts evenly and with equal force.

The Multi-index can be rotated up to 350° for easier reading.

Slowly pressurize the installation, to prevent overspeeding or damaging the meter. Bringing the meter into service should also be done slowly.

LUBRICATION

The frequency of lubricating a meter depends on the operating conditions. A meter operating in dirty gas needs to be lubricated more often than a meter operating in clean gas.

Under normal conditions meters should be lubricated 2 to 3 times a year.

Recommended quantity of oil :

2 / 3"	(50 / 80 mm)	meters	0.2 cc
4"	(100 mm)	"	2 cc
6"	(150 mm)	"	3 cc
8"	(200 mm)	"	4 cc
10"	(250 mm)	"	5 cc
12"	(300 mm)	"	6 cc
16"	(400 mm)	"	8 cc
20"	(500 mm)	"	10 cc
24"	(600 mm)	"	12 cc

Lubricating oil : ISOFLEX PDP 38. For special applications contact Instromet for advice.

Special lubrication systems are available minimizing the risk of pollution of the oil.

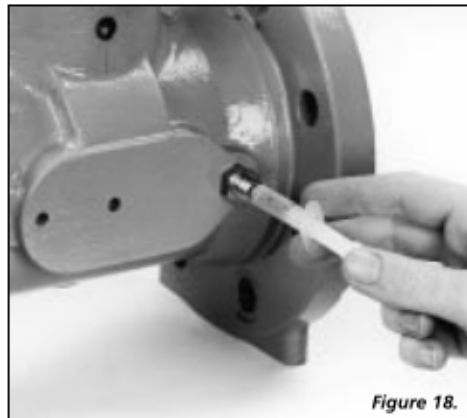


Figure 18.

Oil Injection-System

Supplied with 2" (50 mm) to 8" (200 mm) meters with a pressure rating of PN 10/16 and ANSI 125.



Figure 20.

Push Button Pump

Standard on 2" (50 mm) and 3" (80 mm) meters in pressure ranges above 232#. 0.1 cc per push.



Figure 19.

Small Oil Pump

Standard on 4" (100 mm), 6" (150 mm) and 8" (200 mm) meters in all pressure ranges. 0.5 cc per stroke.



Figure 21.

Large Oil Pump

Standard on 10" (250 mm) meters and larger in all pressure ranges. 1 cc per stroke.

HIGH PRESSURE CALIBRATION FACILITY

Instromet possesses a unique high pressure calibration facility, approved by the Dutch legal metrology service NMI. Systematic testing of meters with high pressure natural gas gives Instromet a powerful tool to further improve its turbine meters within the framework of its ISO 9001 approval.



Figure 22.

Instromet Natural Gas High Pressure Calibration Facility in Utrecht, the Netherlands.

DIMENSIONS AND WEIGHTS

Sizes inch	A	B	E	H	Overall length	Pressure rating	Body material	Approx. wgt. lbs.	Pressure rating	Body material	Approx. wgt. lbs.	
2	2.36	N.A.	N.A.	9.25	6	ANSI 125 / 150	DI / CS	22	ANSI 150	CS	57	
								22			ANSI 300	40
								44			ANSI 400	44
								44			ANSI 600	44
								51				44
3	3.78	N.A.	N.A.	8.07	9	ANSI 125 / 150	DI / CS	33	ANSI 150	CS	75	
								33			ANSI 300	53
								57			ANSI 400	62
								57			ANSI 600	62
								66				62
4	4.72	5.12	8.27	8.58	12	ANSI 125 / 150	DI / CS	62	ANSI 150	CS	101	
								62			ANSI 300	77
								66			ANSI 400	93
								84			ANSI 600	93
								88				110
6	7.09	7.09	9.72	10.75	18	ANSI 125 / 150	DI / CS	97	ANSI 150	CS	192	
								97			ANSI 300	106
								93			ANSI 400	146
								110			ANSI 600	170
								159				216
8	9.45	9.45	10.75	11.73	24	ANSI 125 / 150	DI / CS	154	ANSI 150	CS	216	
								154			ANSI 300	276
								154			ANSI 400	355
								168			ANSI 600	200
								168				258
196		298										
											342	
10	11.81	14.17	12.87	12.36	30				ANSI 150	CS	238	
											ANSI 300	326
											ANSI 400	375
											ANSI 600	520
											520	
12	14.17	15.35	13.86	13.31	36				ANSI 150	CS	353	
											ANSI 300	463
											ANSI 400	529
											ANSI 600	639
											639	
16	18.90	20.08	15.55	14.96	42				ANSI 150	CS	882	
											ANSI 300	1014
											ANSI 400	1080
											ANSI 600	1279
											1279	
20	23.62	24.80	17.52	16.97	60				ANSI 150	CS	1433	
											ANSI 300	1764
											ANSI 400	1830
											ANSI 600	2161
											2161	
24	28.35	29.52	19.49	18.98	72				ANSI 150	CS	2315	
											ANSI 300	2866
											ANSI 400	2976
											ANSI 600	3307
											3307	

N.A. = Not Applicable



SUMMARY OF SPIN TIMES

The below spin times are approximate and were established at the factory with open outlet piping.

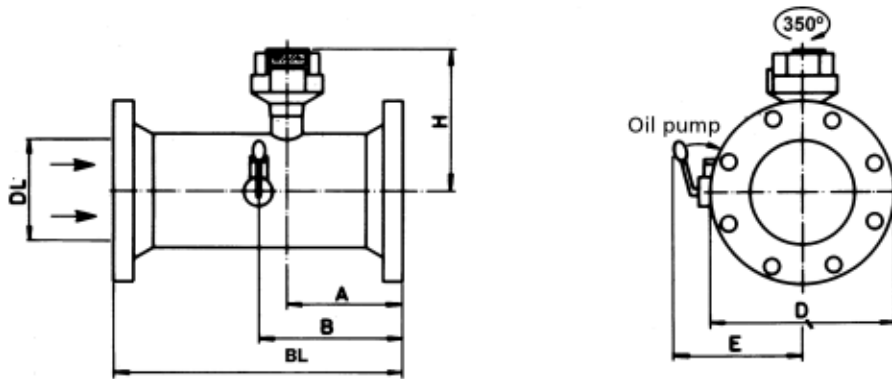
Meter Size in Inches	Turbine Rotor Material	Minimum Spin Time (sec.)
2"	Aluminum 45°	90
3"	Aluminum 30°	130
	Aluminum 45°	140
4"	Aluminum 30°	120
	Aluminum 45°	180
6"	Aluminum 30°	380
	Aluminum 45°	410
8"	Aluminum 30°	320
	Aluminum 45°	330
10"	Aluminum 30°	250
	Aluminum 45°	250
12"	Aluminum 30°	390
	Aluminum 45°	390
16"	Aluminum 30°	490
	Aluminum 45°	490

PULSE DATA SERIES Q AND X-SERIES

Meter Size Q & X-Series	Q _{max} (CHF)	# Rotor Blades	Hz from Rotor	Hz Slot Sensor	1 LF Pulse = ft ³
2"	3,500	12	2,577	213	10
3"	10,000	12	2,085	167	100
4"	18,000	16	2,297	204	100
6"	35,000	20	1,799	229	100
8"	60,000	20	1,187	87	1,000
8"	100,000	20	1,012	74	1,000
10"	100,000	24	1,316	136	1,000
10"	150,000	24	1,180	125	1,000
12"	150,000	24	1,226	75	1,000
12"	250,000	24	1,195	73	1,000
16"	250,000	24	1,095	268	1,000
16"	350,000	24	871	213	1,000
20"	350,000	24	871	213	1,000
20"	600,000	24	806	197	1,000
24"	600,000	24	702	75	1,000
24"	900,000	24	634	67	1,000



DIMENSIONS



Meter length L equals 3 x the nominal pipe diameter DL. For A, B, E and H

Figure 23.

MATERIAL SPECIFICATIONS

Body :

Meter with DIN Flanges :
 Connection DN 50 - DN 200, PN 10/16
 Ductile Iron GGG40
 Connection DN 50 - DN 600, PN 10 - PN 100
 Steel [DN 50, (2") - flangeless]

Meter with ANSI Flanges :
 Connection DN 50 - DN 200, (2" - 8")
 ANSI 125/150 Ductile Iron GGG40

Connection DN 50 - DN 600, (2" - 24") Steel
 [DN 50, (2") - flangeless]
 ANSI 150 - ANSI 600

Meter bodies are constructed in accordance with many pressure vessel codes. The standard construction is in accordance with the Dutch Stoomwezen Code.

Turbine Rotor : Aluminum Standard ALL SIZES.

Surface Coating :

Ductile Iron : phosphate, primer, top coat
 Steel : sand blasting, primer, top coat

Bearings :

Stainless steel

Shafts :

Stainless steel

Magnetic Coupling :

Ferroxdure magnets in stainless steel bushing

Screws and Bolts :

Stainless steel

Meter Module :

Aluminum

O-rings :

Viton

Gears :

In contact with gas : Delrin and stainless steel

In the index : Delrin

Oil Pumps :

Chrome plated brass or steel

Index Head :

Aluminum

Note :

Special materials available on request. The internals can be coated for service with corrosive gases.

Publications by INSTROMET :

- Turbine Gas Meter Handbook.
- P-Meter Handbook (Ethylene).
- X-Series Turbine Gas Meters - Installation and Maintenance Instructions.
- Systems Handbook.
- Regulator Station Handbook.

International Reference Material :

- AGA Report No. 7, Measurement of fuel gas by turbine meters.
- ISO 9951 : 1993, Measurement of gas flow in closed conduits - Turbine meters.
- OIML R6, General specifications for gas volume meters.
- OIML R32, Rotary piston meters and turbine gas meters.

