10/2/6
24 June 2003

National Standards Commission

12 Lyonpark Road, North Ryde NSW

Cancellation

Certificate of Approval No 10/2/6

This is to certify that the approval for use for trade granted in respect of the

Acme Model VTM 150 Bulk LPG Flowmetering System

submitted by Liquip Acme Fluid Handling Pty Ltd
50 Greens Road
Dandenong VIC 3175

has been cancelled in respect of new instruments as from 1 July 2003.

Signed by a person authorised under Regulation 60 of the National Measurement Regulations 1999 to exercise the powers and functions of the Commission under this Regulation.

National Standards Commission

Certificate of Approval

No 10/2/6

Issued under Regulation 9
of the
National Measurement (Patterns of Measuring Instruments) Regulations

This is to certify that an approval for use for trade has been granted in respect of the

Acme Model VTM 150 Bulk LPG Flowmetering System

submitted by Acme Fluid Handling Pty Ltd
50 Greens Road
Dandenong VIC 3175.

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

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CONDITIONS OF APPROVAL

This approval becomes subject to review on 1 June 1998, and then every 5 years thereafter.

Instruments purporting to comply with this approval shall be marked NSC No 10/2/6 and only by persons authorised by the submittor.

It is the submittor's responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the Commission and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with the Commission's Document 106.

The Commission reserves the right to examine any instrument or component of an instrument purporting to comply with this approval.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificate No S1/0/A.

Special: (for Provisional Variants 3 and 4)

This approval becomes subject to review on 1 June 1998, and then every year thereafter.

Instruments purporting to comply with this approval shall be marked NSC No P10/2/6 and only by persons authorised by the submittor.

In the event of unsatisfactory performance this approval may be withdrawn.

DESCRIPTIVE ADVICE

Pattern: approved 11 May 1993

- An Acme model VTM 150 turbine bulk flowmetering system for the delivery of liquefied petroleum gas.

Technical Schedule No 10/2/6 describes the pattern.

Variant: approved 15 March 1996

1. With an Acme model VTM 100 turbine flowmeter.

Technical Schedule No 10/2/6 Variation No 1 describes variant 1.

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Variant: approved 26 February 1997

2. For use with anhydrous ammonia.

Technical Schedule No 10/2/6 Variation No 2 describes variant 2.

Variants: provisionally approved 16 December 1997

3. With an Acme model VTM 075 turbine flowmeter.

4. With an Acme model VTM 200 turbine flowmeter.

Technical Schedule No 10/2/6 Variation No 3 describes variants 3 and 4.

FILING ADVICE

Certificate of Approval No 10/2/6 dated 27 October 1997 is superseded by this Certificate and may be destroyed.

The documentation for this approval now comprises:

Certificate of Approval No 10/2/6 dated 16 February 1998
Technical Schedule No 10/2/6 dated 23 August 1993 (incl. Test Procedure)
Technical Schedule No 10/2/6 Variation No 1 dated 19 June 1996
Technical Schedule No 10/2/6 Variation No 2 dated 27 October 1997 (incl. Test Procedure and Tables 1 & 2)
Technical Schedule No 10/2/6 Variation No 3 dated 16 February 1998
Figures 1 to 3 dated 23 August 1993

Signed and sealed by a person authorised under Regulation 9 of the National Measurement (Patterns of Measuring Instruments) Regulations to exercise the powers and functions of the Commission under this Regulation.

National Standards Commission

TECHNICAL SCHEDULE No 10/2/6

Pattern: Acme Model VTM 150 Bulk LPG Flowmetering System.

Submittor: Acme Fluid Handling Pty Ltd
50 Greens Road
Dandenong VIC 3175

1. Description of Pattern

An Acme model VTM 150 bulk flowmetering system for the delivery of liquefied petroleum gas of density between 0.500 and 0.600 kg/L at 15°C, for liquid temperatures between 0°C and 40°C. The maximum and minimum flow rates are 500 L/min and 100 L/min respectively. The flowmetering system may be in a fixed installation or may be as a portable module (including vehicle-mounted). The minimum quantity is 100 litres. A typical system is shown in Figure 1.

1.1 Flowmetering System Component Structure

(i) Supply Tank

The supply tank is located above the pump and is of adequate capacity to ensure that at maximum flow rate the pressure in the tank does not drop to the point where vapour occurs. A low-level detection device may be fitted.

(ii) Pump

The pump is positioned as close as possible to the outlet of the supply tank and is mounted lower than the minimum height of the liquid in the supply tank. The pump inlet pipe from the tank has a continuous fall to the pump and must be of larger diameter than the pump outlet. A strainer may be installed upstream of the pump.

If the pump is not for the exclusive use of the meter, the flow rate through the meter must stay within the appropriate flow rate range for all combinations of alternative uses of the pump. A non-return valve may be fitted between the pump and the meter.

(iii) Gas Purger (Figure 2)

The meter is protected from the measurement of vapour by correct installation and by a Schlumberger (Neptune), or Liquid Controls, 38 mm float-operated gas purger with integral strainer. A larger capacity gas purger may be used. A thermometer well is situated in the strainer cover.

The gas purger is vented through a non-return valve, via a vapour return line not less than 20 mm in diameter to the vapour space in the supply tank.

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(iv) Meter (Figure 3)

An Acme model VTM 150 38 mm turbine LPG flowmeter is used.

The meter is installed between straightening elements (as specified in AS 2651-1983 for *Liquid hydrocarbons - volumetric measurement by turbine meter systems*) consisting of flow conditioners of at least 10 pipe diameters and 5 pipe diameters in length, installed respectively upstream and downstream of the meter; the upstream conditioner includes straightening vanes.

(v) Indicator

An Acme 502 series indicator is used as described in the documentation of NSC approval No S170A. The indicator incorporates an electronic volume conversion for temperature facility for indicating the volume at 15°C. The temperature probe for the volume conversion facility is inserted in the lower part of the gas purger.

The indicator has a linearisation correction facility which may or may not be used. When linearisation is used, the minimum flow rate is 80 L/min.

The indicator may be fitted with an integral or with a separate (remote) printer.

(vi) Pressure Differential Valve

A Schlumberger (Neptune) spring-loaded diaphragm, or Liquid Controls spring-loaded piston or spring-loaded diaphragm, pressure differential valve maintains a pressure of at least 100 kPa above the vapour pressure at the meter to prevent the formation of vapour. A pressure-equalising pipe is connected from the differential valve to the supply tank, through the vapour return line from the gas purger vent.

(vii) Outlet Piping/Transfer Device

The outlet pipe from the pressure differential valve has provision for a pressure gauge, and is fitted with a non-return valve and a control valve. A flow rate control valve may also be fitted.

If fitted with a delivery hose it shall comply with the SA code for hoses in use with liquefied petroleum gases. A shut-off device is fitted at the end of the hose.

The control valve/shut-off device shall be the transfer device for the measurement and there shall be no intermediate outlets between the meter and the device.

1.3 Sealing and Verification/Certification Provision

No sealing is required for the meter.

Provision is made for a verification/certification mark to be applied.

1.4 Markings

Instruments are marked with the following data, together in the one location:

Manufacturer's name or mark	
Meter model	
Serial number	
NSC approval number	10/2/6
Maximum flow rate	..... L/min
Minimum flow rate	..... L/min
Liquid temperature range	0°C to 40°C
Approved for LPG of density	0.500 to 0.600 kg/L
Density for which volume converter is set (#)	..... kg/L
Minimum Quantity	 L
Maximum operating pressure	..... kPa

(#) If the indicator does not have the facility to display the set density and is connected to a printer, the ticket printed by the printer shall show the set density (kg/L), volume delivered (L) and a transaction identification (delivery) number.

TEST PROCEDURE

Instruments should be tested in accordance with any tests included in the approval documentation for the indicator used, and in accordance with any relevant tests specified in the Inspector's Handbook.

Maximum Permissible Errors at Verification/Certification

The maximum permissible errors applied during a verification test from normal flow rate to the minimum flow rate specified in the Certificate of Approval or Technical Schedule are:

±1.0% with the volume conversion device deactivated, and

±1.2% with the volume conversion device activated.

1. **Meter Tests For Linearisation Facility** (when used)

Complete 3 runs at the minimum flow rate to establish that the correct linearisation factors have been entered.

NOTE: When linearisation facility is used, the minimum flow rate is 80 L/min.

National Standards Commission

TECHNICAL SCHEDULE No 10/2/6

VARIATION No 1

Pattern: Acme Model VTM 150 Bulk LPG Flowmetering System.

Submittor: Acme Fluid Handling Pty Ltd
50 Greens Road
Dandenong VIC 3175

1. Description of Variant 1

With an Acme model VTM 100 25 mm flowmeter instead of the meter described for the pattern.

The maximum and minimum flow rates are 300 L/min and 60 L/min respectively.

The minimum quantity is 100 litres.

TECHNICAL SCHEDULE No 10/2/6

VARIATION No 2

Pattern: Acme Model VTM 150 Bulk LPG Flowmetering System.

Submittor: Acme Fluid Handling Pty Ltd
50 Greens Road
Dandenong VIC 3175.

1. Description of Variant 2

For use with anhydrous ammonia having a density as given in Table 2, for liquid temperatures between 0^0C and 40^0C.

This variant uses an Acme 502 series indicator similar to that described in Technical Schedule No 10/2/6 dated 23 August 1993 for the pattern, but with conversion factors for anhydrous ammonia. (Refer Table 2)

The indicator may be configured to indicate either mass (kg) or volume (L) and is so marked. An electronic conversion for temperature facility is used; this facility is described for the pattern in clause **1.1 (v) Indicator** in Technical Schedule No 10/2/6 dated 23 August 1993.

TEST PROCEDURE

1. For Variant 2

1.1 Density and Conversion Factors

For testing the meter measuring anhydrous ammonia and indicating in either mass or volume units, the density and conversion factors applicable to the measurement are given in Tables 1 and 2 respectively.

1.2 Maximum Permissible Errors

The maximum permissible errors applied during a verification/certification test are:

±1.0% with the volume conversion device activated;

±0.6% with the volume conversion device de-activated; and

±0.4% for the volume conversion device.

1.3 For Mass Indication

Test in accordance with the Inspector's Handbook and the following procedure.

1.3.1 Set the flowmeter indicator with the conversion device activated.

Make a delivery into the weigh tank on a certified weighing instrument. The difference between the mass indicated on the flowmeter and the mass indicated on the weighing instrument should not exceed the maximum permissible error of ±1.0%.

Note: Buoyancy corrections are insignificant for the weighing of a closed tank and can be ignored.

1.3.2 Set the flowmeter indicator with the conversion device de-activated.

Make a delivery into the weigh tank. For this delivery multiply the mass indicated on the flowmeter by the temperature conversion factor given in Table 1, for the temperature indicated by the reference thermometer (see clause **1.1 (iii) Gas Purger** in Technical Schedule No 10/2/6 dated 23 August 1993.) The difference between the mass indicated on the weighing instrument and the mass calculated from the flowmeter indicator should not exceed the maximum permissible error of ±0.6%.

1.3.3 In addition, the difference between the results obtained in 1.3.1 and 1.3.2 should not exceed ±0.4%.

1.4 For Volume Indication

1.4.1 Test in accordance with the Inspector's Handbook using Tables 1 and 2, where applicable for anhydrous ammonia.

NOTE: The values in Table 2 were calculated from the equation:

$$r = \frac{1 \times 10^6 + 424805\sqrt{(133 - t)} + 15938\,(133 - t)}{4283.0 + 813.055\sqrt{(133 - t)} - 8.2861\,(133 - t)}$$

where ρ = kg/m^3 (density); and
t = ^{o}C (temperature)

TABLE 1 — ANHYDROUS AMMONIA
Conversion Factors to 15°C

Degrees C	0	0.2	0.4	0.6	0.8
0	1.0341	1.0336	1.0332	1.0327	1.0323
1	1.0318	1.0314	1.0309	1.0305	1.0301
2	1.0296	1.0292	1.0287	1.0283	1.0278
3	1.0274	1.0269	1.0265	1.0260	1.0256
4	1.0252	1.0247	1.0243	1.0238	1.0234
5	1.0229	1.0225	1.0220	1.0216	1.0211
6	1.0207	1.0202	1.0197	1.0193	1.0188
7	1.0184	1.0179	1.0175	1.0170	1.0166
8	1.0161	1.0157	1.0152	1.0148	1.0143
9	1.0138	1.0134	1.0129	1.0125	1.0120
10	1.0116	1.0111	1.0106	1.0102	1.0097
11	1.0093	1.0088	1.0083	1.0079	1.0074
12	1.0070	1.0065	1.0060	1.0056	1.0051
13	1.0047	1.0042	1.0037	1.0033	1.0028
14	1.0023	1.0019	1.0014	1.0009	1.0005
15	1.0000	0.9995	0.9991	0.9986	0.9981
16	0.9977	0.9972	0.9967	0.9963	0.9958
17	0.9953	0.9948	0.9944	0.9939	0.9934
18	0.9930	0.9925	0.9920	0.9915	0.9911
19	0.9906	0.9901	0.9896	0.9892	0.9887
20	0.9882	0.9877	0.9873	0.9868	0.9863
21	0.9858	0.9853	0.9849	0.9844	0.9839
22	0.9834	0.9829	0.9825	0.9820	0.9815
23	0.9810	0.9805	0.9801	0.9796	0.9791
24	0.9786	0.9781	0.9776	0.9771	0.9767
25	0.9762	0.9757	0.9752	0.9747	0.9742
26	0.9737	0.9732	0.9728	0.9723	0.9718
27	0.9713	0.9708	0.9703	0.9698	0.9693
28	0.9688	0.9683	0.9678	0.9673	0.9668
29	0.9664	0.9659	0.9654	0.9649	0.9644
30	0.9639	0.9634	0.9629	0.9624	0.9619
31	0.9614	0.9609	0.9604	0.9599	0.9594
32	0.9589	0.9584	0.9579	0.9574	0.9569
33	0.9563	0.9558	0.9553	0.9548	0.9543
34	0.9538	0.9533	0.9528	0.9523	0.9518
35	0.9513	0.9508	0.9503	0.9497	0.9492
36	0.9487	0.9482	0.9477	0.9472	0.9467
37	0.9461	0.9456	0.9451	0.9446	0.9441
38	0.9436	0.9430	0.9425	0.9420	0.9415
39	0.9410	0.9404	0.9399	0.9394	0.9389
40	0.9384				

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TABLE 2 — ANHYDROUS AMMONIA
Density in kg/m^3

Degrees C	0	0.2	0.4	0.6	0.8
0	638.6	638.3	638.0	637.7	637.5
1	637.2	636.9	636.7	636.4	636.1
2	635.8	635.6	635.3	635.0	634.7
3	634.5	634.2	633.9	633.6	633.3
4	633.1	632.8	632.5	632.2	632.0
5	631.7	631.4	631.1	630.9	630.6
6	630.3	630.0	629.7	629.5	629.2
7	628.9	628.6	628.3	628.1	627.8
8	627.5	627.2	626.9	626.7	626.4
9	626.1	625.8	625.5	625.2	625.0
10	624.7	624.4	624.1	623.8	623.5
11	623.3	623.0	622.7	622.4	622.1
12	621.8	621.6	621.3	621.0	620.7
13	620.4	620.1	619.8	619.6	619.3
14	619.0	618.7	618.4	618.1	617.8
15	617.5	617.3	617.0	616.7	616.4
16	616.1	615.8	615.5	615.2	614.9
17	614.6	614.4	614.1	613.8	613.5
18	613.2	612.9	612.6	612.3	612.0
19	611.7	611.4	611.1	610.8	610.6
20	610.3	610.0	609.7	609.4	609.1
21	608.8	608.5	608.2	607.9	607.6
22	607.3	607.0	606.7	606.4	606.1
23	605.8	605.5	605.2	604.9	604.6
24	604.3	604.0	603.7	603.4	603.1
25	602.8	602.5	602.2	601.9	601.6
26	601.3	601.0	600.7	600.4	600.1
27	599.8	599.5	599.2	598.9	598.6
28	598.3	598.0	597.7	597.4	597.1
29	596.8	596.5	596.1	595.8	595.5
30	595.2	594.9	594.6	594.3	594.0
31	593.7	593.4	593.1	592.8	592.4
32	592.1	591.8	591.5	591.2	590.9
33	590.6	590.3	590.0	589.6	589.3
34	589.0	588.7	588.4	588.1	587.8
35	587.4	587.1	586.8	586.5	586.2
36	585.9	585.6	585.2	584.9	584.6
37	584.3	584.0	583.6	583.3	583.0
38	582.7	582.4	582.0	581.7	581.4
39	581.1	580.8	580.4	580.1	579.8
40	579.5				

TECHNICAL SCHEDULE No 10/2/6

VARIATION No 3

Pattern: Acme Model VTM 150 Bulk LPG Flowmetering System.

Submittor: Acme Fluid Handling Pty Ltd
50 Greens Road
Dandenong VIC 3175.

1. Description of Variants

1.1 Description of Variant 3

With an Acme model VTM 075, 20 mm flowmeter.

The maximum and minimum flow rates are 75 L/min and 15 L/min respectively.

The minimum measured quantity is 15 litres.

1.2 Description of Variant 4

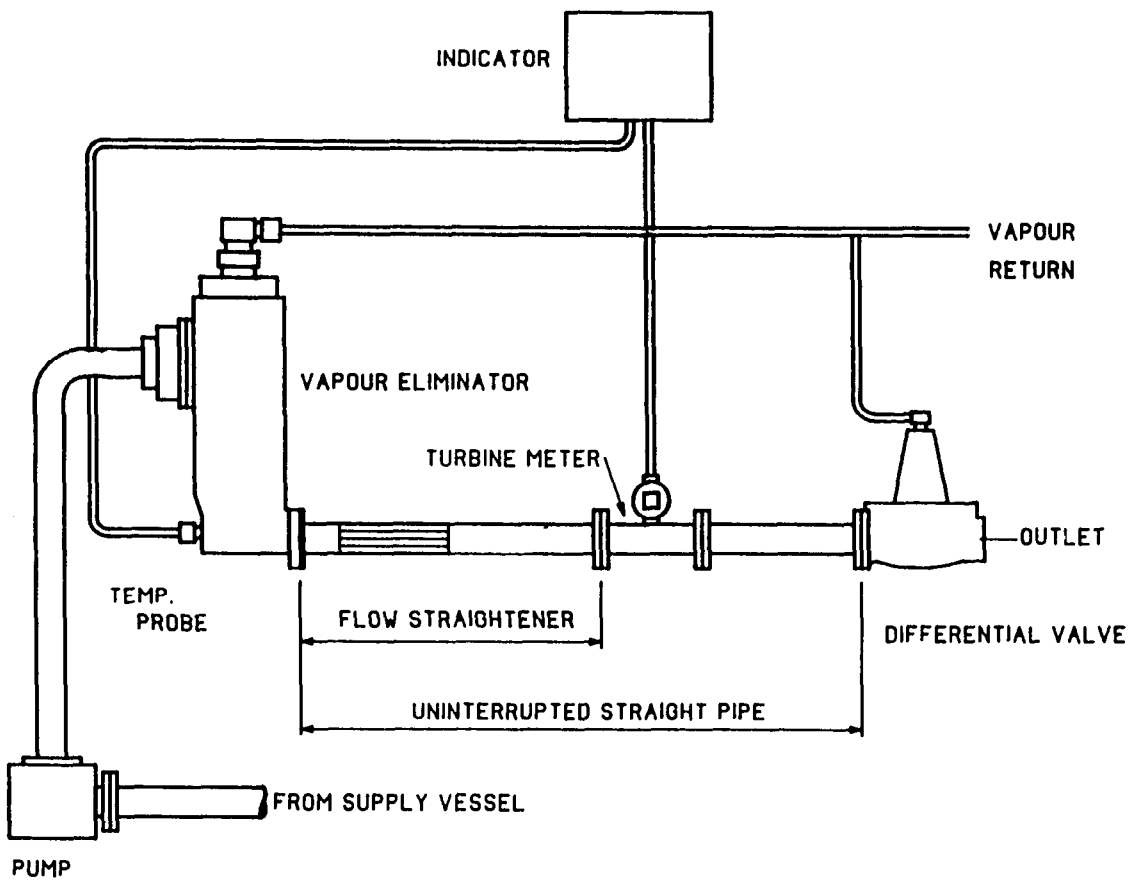
With an Acme model VTM 200, 50 mm flowmeter.

The maximum and minimum flow rates are 1000 L/min and 200 L/min respectively.

The minimum measured quantity is 200 litres.

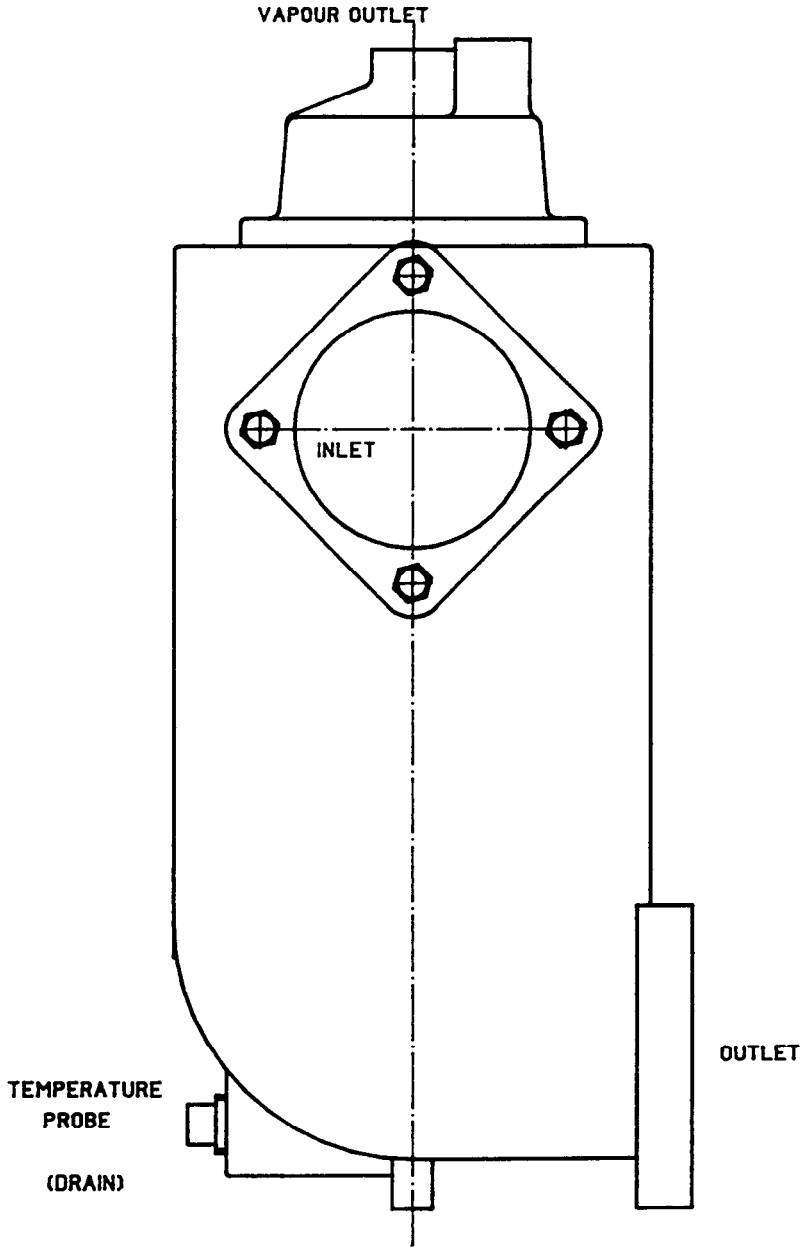
The gas purger and the pressure differential valve are of 50 mm nominal size for this variant.

FIGURE 10/2/6 - 1



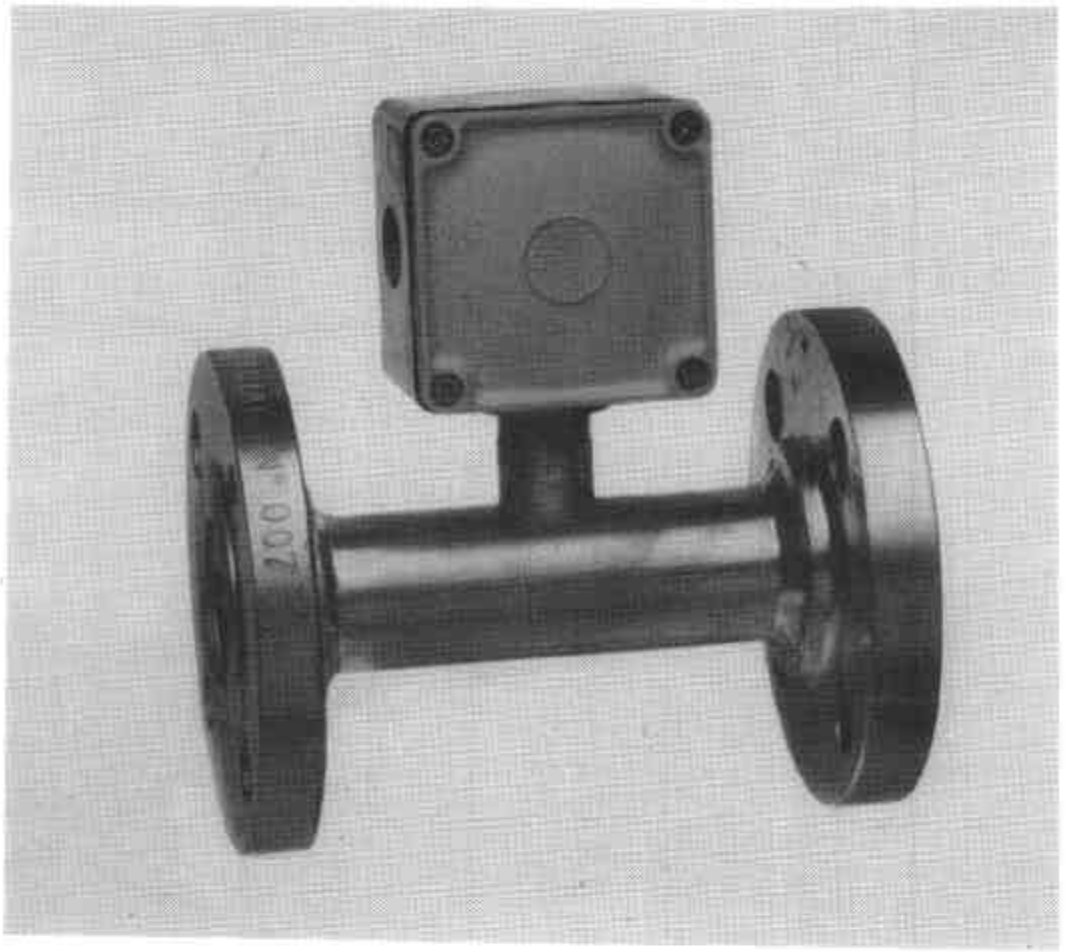
Typical Acme Model VTM 150 Bulk LPG Flowmetering System

FIGURE 10/2/6 - 2



Schlumberger (Neptune) Gas Purger

FIGURE 10/2/6 - 3



Acme Model VTM 150 Turbine LPG Flowmeter