TM Tecnomatic SpA has been a leading Manufacturer of flow measurement devices and temperature measurement devices for more than 48 years. TM began its activities in 1962 in the town of Cremona, located in Italy’s northern industrial area. TM issued its first QUALITY MANUAL for the supply of products for Nuclear Power Plants in 1975 and the last revision is dated 1988 after closing of the Nuclear Activities in Italy. TM Quality STD are in accordance with latest ISO 9001:2008 and 14001:2004 + HSE. TM spa is also PED and ATEX Certified.

Actually TM is the 1° European Company for Flow Measurement Devices in terms of Turn Over.
TM TECNOMATIC

WORLD-WIDE PRESENCE
TM is a Multinational Company with its presence in 16 Countries Worldwide:

UNITED KINGDOM, SPAIN, LYBIA, EGYPT, TURKEY, IRAN, KUWAIT, QATAR, OMAN, UAE, INDIA, PAKISTAN, INDONESIA, CHINA, SOUTH KOREA, JAPAN AND CANADA

WORLD WIDE END USER CLIENTS
ARAMCO, TOTAL, EXXONMOBIL, KNPC, PDVSA, TAKREER, GASCO, ADMA OPCO, ADCO, ADGAS, BOROUGE, PETROBRAS, PETROBEL, PETROJET, SABIC, PETRORABIGH, SEC, ENI, ENEL, REPSOL, GALP, HELLENIC PETROLEUM PT PERTAMINA, PETRONAS, BP, STATOIL, SHELL, IOC

WORLD WIDE EPC’S CLIENTS
SAMSUNG E&C, DAELIM INDUSTRIES, SK ENGINEERING, GS E&C, TECNIMONT, TECHNIP, BECHTEL, FLUOR, KBR, CHIYODA, SAIPEM, ENEL, EIL, PDIL, ONGC, TECNICAS REUNIDAS, EMERSON, ABB, FMC, J RAY MCDERMOTT, NPCC, PUNJ LLOYD, JACOBS ENGINEERING, TOYO ENGINEERING, BHEL, MOTOR OIL HELLAS, DODSAL ENGINEERING, FOSTER WHEELER……
ORIFICE PLATES
For Orifice Flange Unions

Accurate workmanship and high quality of finishing distinguishes TM orifice plates.
Specially built up-to-date machinery ensures:
Calibrated bore with burr free sharp edge, smooth ground upstream and downstream faces and orifice plates surfaces parallel with a maximum deviation under 0.01” in 1” measured in any direction.

Technical specifications

Materials
Standard AISI 316 Stainless Steel for immediate delivery.
Other materials to request.

Types
Concentric with sharp Edge, 45° Bevel, quarter-circle, conical entrance, eccentric type, segmental type, etc.

Construction
In accordance with AGA-ASME reccomendations.

Flow calculations
When requested, flow calculations can be made for determining bore diameter according to ISO 5167-2 : 2003, ASME 3M (2004), ANSI 2530/AGA-3/API – Ch.14

Surface finish ANSI B46.1
Orifice plates for “RF” union flanges are supplied as follow:
a) Concentric groved in accordance with standard MSS-SP6 for compressed asbestos type gaskets
b) 125RMS Smooth finished faces for spiral wound metal, flat metal jacketed grooved metal and solid flat metal Gaskets

Standards
ARAMCO STD, ENI STD, TOTAL STD, SHELL STD etc….

FLOW MEASUREMENT DEVICES
ved and interchangeable, plate surfaces parallel with a maximum deviation under 0.01” in 1” measured in any direction. Calibrated bore with burr free sharp edge. Smooth ground upstream and downstream faces.

**Technical specifications**

**Ring materials**
ARMCO steel for carbon steel flanges. AISI 316 Stainless Steel for St. St. Union Flanges.

**Other materials** available upon request.

**Orifice plate materials**
Standard AISI 316 stainless steel for immediate delivery. Other materials to request.

**Ring joint types**
Octagonal shaped ring standard. At request also oval ring is supplied.

**Orifice plate types**
Concentric type with sharp edge, 45° - bevel, quarter circle, conical entrance, eccentric type, conical entrance etc..

**Constructions**
In accordance with AGA-ASME recommendations

**Flow calculations**
When requested, flow calculations can be made for determining bore diameter according to ISO 5167-2 : 2003, ASME 3M (2004), ANSI 2530/AGA-3/API – Ch.14

**Restriction Orifices**
Restriction Orifices are used for limiting a flow rate or for creating a certain permanent pressure loss. They find application in distribution lines and in blending operations when different fluids are to be mixed.

**Technical specifications**

**Type of construction**

**Union Type** (union screwed or socket welding ends)
Consist of a plate with calibrated bore inserted in an union with screwed or socket-welding ends.

Minimum size: 1” (DN25)
Maximum size: 1.1/2” (DN40)

**Flange Type**
Consist of a plate with calibrated bore inserted between couple of line flanges with studs, nuts and jack screws
Minimum size: 1” (DN25)
Maximum size: unlimited

**Standard materials**

**Orifice Plate**
Supplied in AISI 316 st. st. as standard. Other materials available upon request

**Flanges and Union**
In the same material of the line.
Carbon steel, st. st., alloy steel, etc.
Gasketing depend on fluid type.

**Restriction orifice calculation**
When requested, flow calculations can be made for determining bore diameter according to ISO 5167-2 : 2003, ASME 3M (2004), ANSI 2530/AGA-3/API – Ch.14

**Venturi Tubes**
Venturi Tubes are used for measurement of flows when it is important to keep the net pressure permanent loss at a minimum.
They are noted for their long life, their flow coefficient stability, and their ability to provide a dependable relationship between differential pressure and fluid velocity. They return from 75% up to 95% of the velocity head depending on diffuser outlet cone angle.

**Technical specifications**

**TYPE OF CONSTRUCTION**

Non-truncated type
Conical divergent outlet not truncated

Truncated
Conical divergent outlet truncated at 65%
Conical divergent outlet diffuser angle
Outlet Angle from 7° to 15° depend on required pressure loss recovery
One piece Type by forging
For sizes from 2” to 8”. Can be supplied with or without piezometer rings
Welding-in insert type
For sizes from 4” to 24”.
For high pressure, temperature and velocity applications. Supplied with or without flow-section.
Insert fabricated type
For sizes from 10” and above. Manufactured from welding sheet.
Supplied with or without flow section
Fabricated type
For sizes from 10” ad up. Manufactured by welding sheet.
Can be supplied with or without piezometer rings.
Rigidity of the body is obtained by the use of longitudinal stiffeners. Connections can be flanged or beveled
For direct welding to the line.

**Flow nozzles long-radious type**

Definitive advantages result from the use of flow nozzles. For a given ratio of throat pipe to diameter, flow nozzles permits approximately 60% greater capacity than an orifice plate.

TM manufacture all type of low nozzle according to ASME, ISA, UNI, DIN, B.S. etc. standards

**Technical specifications**

**Construction**

From forged piece.
The nozzle is a curved convergent entry leading a short cylindrical throat without a discharge cone.

**Types**

High Beta Type
Inlet pressure taps located in the pipe wall at “D” preceding the plane of the nozzle elliptical inlet section, outlet pressure taps located in the pipe wall at “1/2 D” following the plane of the beginning of the elliptical inlet section of the nozzle.

Low Beta Type with or without throat taps
Inlet pressure taps located in the pipe wall at “D” preceding the plane of the nozzle elliptical inlet section, outlet pressure taps located in the pipe or on the nozzle at “1.5 d” following the entrance plane of the nozzle.

**STANDARD EXECUTION**

Flanged Type
Manufactured in all sizes.
Can be supplied complete with companion flanges.
**Welding-in Type with holding-ring**

For sizes from 4” and up. Can be supplied completely assembled in a proper honed flow-section. Metering flow-section is of the same material of the line and reamed over the whole length after the pressure taps have been fitted. The ends of flow-section can be flanged or beveled as required.

Holding ring material: same to the flow-section material

**Options**

Upon request flow nozzles can be supplied complete with: seal pots, stop valves, flow straightening vanes, experimental calibration test to an international approved laboratory.

**FLOW NOZZLE ISA 1932**

Manufactured according to ISA 1932

**Technical specifications**

**Construction**

From forged piece. The nozzle is a curve shaped convergent entry leading to a short cylindrical throat without a discharge cone.

**Standard execution**

**Flanged Type with piezometer rings**

Manufactured in all sizes

Supplied in two executions: with separate or integral piezometric rings.

Can be supplied complete with companion flanges. Recommended for pipe size up to 16”

**Flanged type with corner taps**

Manufactured in all sizes.

Can be supplied complete with companion flanges with corner taps.

**MULTISTAGE RESTRICTION ORIFICES**

If it becomes necessary to break-down a pressure in excess of 300 psi, it is advisable to use a series of orifices instead of a single orifice in order to reduce the wear on the individual orifices and to eliminate the excessive noise incidental to the degradation of high pressure through a single orifice.

The TM multiple pressure reducing orifices are specially designed for these two purposes.

The main application is for service on boiler feed water by-pass lines.

**Technical specifications**

**Type of construction**

**Flanged Type**

With or without taps to check the pressure drop.

Sizes from 2” (DN50) and above

**Butt welding type**

With or without taps to check the pressure drop.

Sizes from 2” (DN50) and above

**Socket welding type**

With or without taps to check the pressure loss.

From ½” (DN20) to 1 1/2” (DN40)

**Standard Materials**

Inner parts (Orifices) in AISI 316 st. st. as standard.

Sheel and Flanges in the same material as the process line.
Calculation and Design
To carry out calculation and design of the multiple pressure reducing orifices is necessary to specify:
required permanent pressure loss, fluid and medium conditions, inlet pressure, flow rate, working temperature, Inside and outside pipe diameter, pipe material, specific gravity at base and working conditions, absolute viscosity, Centipoises at working conditions.

PITOT TUBE AND MAPFLOW (ANNUBAR)
Pitot tubes are used to measure flow when a great accuracy is not required and in pipes and ducts of large Dimensions, where to use orifice flanges, flow nozzles or Venturi tubes would result unpractical or too expensive.
Pitot tubes are also used when the static pressure is very low.
Pitot tubes offer the following advantages: simple construction, low cost, easy of mounting in place and none or disregarded line pressure loss.
The tip of Pitot tubes is generally placed in the center of pipes, taking in due account the ratio between mean velocity of fluid in the duct and velocity in the centre, such ratio is normally between 0,83 to 0,85.
This ratio is called traverse and will be included in the calculation to have correct dp.
For accurate measurement it is necessary to know the velocity and ratio exactly, this is done by the traverse method, measuring the velocity in different points on two traverse diameters at 90°.
Besides, the straight smooth pipe length (without restrictions, widenings or bends) upstream of Pitot tube must be at least of 50 pipes diameters.
For Annubar flow elements can be reduced down to 8 times the pipe diameter or less.

Pitot tube factor "Kp"
The pitot tube factor (k_p) is the ratio between the average fluid velocity and the maximum velocity at the Point of measurement.
The ratio is:
\[ k_p^2 = \frac{h_m}{h_M} \]
\[ h_m = \text{Average dp} \]
\[ H_m = \text{Maximum dp} \]
The pitot tube factor is constant if the flow is in turbulent condition.
The exact value of Kp is obtained from experimental calibration test.
Amplification factor Z
Amplification factor Z is a fuction of Kp. Exactly it is the reciprocal of Kp^2.
\[ Z = \frac{1}{k_p^2} \]
Z is another constant and depend from the fluid and from Pitot tube characteristics.
Tecnomatic SpA Venturi cone-meters are manufactured to meet stringent industry standards and safety guidelines and are designed to meet the end user’s expectations.

This family of products represents all that is beneficial about modern designs!

All our products are designed using DFM (Design For Manufacture) and DFA (Design For Assembly) techniques. This has resulted in products differentiated by their simplicity, reduced level of complex parts, and consequently provide the end user with a product that is remarkably simple to use, and is virtually maintenance free.

The “Venturi cone-meter” product range has been rationalised to the extent that we can offer significantly reduced lead times on this range.

The Venturi cone-meter can be installed into horizontal or vertical lines. Special wall taps are used for the vertical upflow condition. Each product has been fully FEA (Finite Element Analysis) tested at design stage ensuring maximum safety to the user and the system. Upon product assembly, each product is fully pressure tested to satisfy industry safety, European pressure guidelines and product expectations.

**Benefits**
- Extremely durable, precision machined cone element.
- Minimal maintenance required.
- Repeatability of +/-0.1% or better.
- Flow Ranges of 10:1 or higher.
- Compact space saving design.
- Accuracy up to +/-0.5%, with calibration.

**Options**
- Exotic Materials for demanding service
- Super Duplex, Inconel, 254SMO.
- High Pressure solutions (10,000PSI).
- Wide Temperature ranges.
- Stainless Internals as standard
- Custom lengths and pressure taps are available.
- Wide range of pipe sizes and end connections are available.
SIZE AND PRESSURE RATING

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>ANSI Pressure Class</th>
<th>PSI Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; (50)</td>
<td>150, 300, 600, 900, 1500, 2500</td>
<td>4000 to 1000</td>
</tr>
<tr>
<td>3&quot; (80)</td>
<td>150, 300, 600, 900, 1500, 2500</td>
<td>4000 to 1000</td>
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<td>4&quot; (100)</td>
<td>150, 300, 600, 900, 1500, 2500</td>
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<td>6&quot; (150)</td>
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</tr>
<tr>
<td>36&quot; (900)</td>
<td>150, 300, 600, 900*</td>
<td>4000 to 1000</td>
</tr>
</tbody>
</table>

Notes:
For sizes not listed, contact sales@tmtecnomatic.com
* Additional pressure ratings available upon request

Typical Materials of Construction
- Body Pipe A312 TP316SS; A106B CS.
- Pressure Taps A182 F316 3K 0.5in FNPT.
- Internal components – Stainless Steel 316
- Flanges A182 F316SS; A105 CS.
- Flange x Flange, Flange x Weld or Weld x Weld
- FF (Flat Face), RF (Raised Face), RTJ (Ring Type Joint)
Connections available in the following formats;
- ANSI 16.5, 16.47
- Graylok, Vector & SPO
- Compact Flanges
- API 6A

Body Configurations
- External Bolting – ASTM A194 L7 (HDG)
- Other materials are available upon request

Design Codes
- ASME B31.8 Gas Transmission and Distribution Piping
- NACE MR-01-75
- ASME B31.1 Power Piping
- ASME B31.3 Process Piping Systems
- PED 97/23/EC – Pressure Equipment Directive

WIDE RANGE OF APPLICATIONS
Petrochemical
Oil and Gas: all applications including:
- Compressor Control
- Separators
- And FPSO installations
Waste Water
Steam
High Turndown with stacked Transmitters
Low dP applications with low noise dP measurements.
THERMOCOUPLES ASSEMBLY

Thermocouples are the temperature sensing elements most widely used throughout industry for temperature measurements. Their inherent simplicity and low cost together with good characteristics of accuracy and reproducibility, make them precious and handy tools to answer the many challenging problems encountered in modern producing processes. TM thermocouple assemblies are produced in a wide variety of design to fit practically all applications.

Complete Thermocouple Unit Includes
Sensing Element (thermocouple)
Insulating terminal block
Terminal connection head
Extension nipple or union
Thermowell or protecting tube

Thermocouples types
Type E (Chromel-Constntan)
Type J (Iron-Constantan)
Type K (Chromel-Alumel)
Type R (Platinum/13% Rhodium – Platinum)
Type S (Platinum/10% Rhodium – Platinum)
Type T (Copper-Constantan)
Type B (Platinum 30% Rhodium - Platinum 6% Rhodium)
Type C (Tungsten 5% Rhenium - Tungsten 26% Rhenium)
Type N (Nicrosil - Nisil)

Standard Hot or Measuring Junctions

Exposed junction
Thermocouple wire are but welded. Insulation is sealed against liquid or gas penetration. Recommended where fast response is desired and corrosive conditions are non-existent.

Grounded junction
End is welded, with the wires welded securely into the closure end of the sheath, becoming an integral part of the Weld. Recommended in presence of liquid, moisture, gas or high pressure. The wire is protected from corrosive or erosive conditions.

Ungrounded junction
Thermocouple hot junction is fully insulated from welded sheath end. Excellent for electrical applications where stray emf’s would affect the reading and for frequent or rapid temperature cycling.

SKIN POINT AND PAD TYPE THERMOCOUPLES
These thermocouples are built in such a way to guarantee the most intimate contact with the controlled surface together with better accuracy and high speed of response. Suitable for boilers, furnaces, super heaters process tubes, heater tubes etc…

Thermocouples and Thermowell
Thermoelements
Multipoint Thermocouples For Reactors
MULTI POINT THERMOCOUPLE ASSEMBLIES (RADIAL OR THERMOWELL TYPE)

Multi Point thermocouple assembly obtain fast temperature readings at different levels in deep or tall vessels reactors, catalyst beds, furnaces and other applications where individual thermocouple would be too difficult or costly to install. Because of the many different conditions peculiar to each application, Multi Point Thermocouples Radial or Thermowell Type generally are custom designed. They are built with the proper number of protecting tubes with thermocouples inside, protecting tubes diameter, thickness, lengths, materials, fittings, flange, extension wires, Flexible conduits, supporting frame and junctions boxes to suit your individual installation.

RESISTANCE TEMPERATURE DETECTOR

TM RTD are carefully selected to meet the basic resistance values and accuracies specified from IEC 60751 Nominal resistance value is 100ohm at 0° C. Standard bulbs have platinum or Nickel wound resistance elements, with hardglass or ceramic base. One, two or three windings are available on the same bulb. Resistance thermometer bulbs always take up the mean value of the temperature operating over the full winding length, therefore it is important that the full length of the element be exposed to the medium whose temperature is to be measured. Trouble free working of resistance thermometer bulbs is dependent on proper care being taken in their installation and the selection of associated components used for this purpose. For this reason we recommend the use of TM resistance inserts.

TM resistance thermometer inserts are built-up from nickel or st. st. tube. Standards inserts size are 4, 6 or 8mm O.D. Resistance thermometer bulbs conforming to most other known international standard are already available upon request.

BAR-STOCK TYPE THERMOWELLS

Bar-stock type thermowells are precise components serving as protective devices for the primary or sensing temperature elements, as thermocouples, resistance thermometer bulbs, bimetallic thermometers, filled system, etc. of all types of temperature indicating, recording and controlling instruments. Particular care, together with long experience and special designed drilling machines, guarantee the choice of materials and construction of TM thermowells.

Technical specifications

Design
TM offers the capability to design and manufacture thermowells to meet virtually any customer requirement. Standard types are listed on the side of this specification. Bore concentricity
TM thermowells are drilled with a special designed deephole drilling machines. The concentricity is held to within ± 5% of wall thickness, depending on length of well. Polishing
Solid drilled thermowell are polished to minimize machine tool marks, surface discontinuities and unbedded tool. Also steel particles that might have a deleterious effect on the corrosion resistance of the thermowells.
Material Tests
Every bar-stock thermowell is pressure-tested to insure soundness of metal structure.
Facilities are available for testing up to 20,000 psi. If requested, and at extra cost, Gamma or X-Ray inspection can be made, also ultrasonic checks.

Heat and chemical treating
Many type of thermowells require heat or chemical treatment to eliminate stress, carbide precipitation, etc. Heat or chemical treatment is done on special order.

Internal Bores
Bore sizes are available from 9/64” to 5/8” in steps of 0.2”

Length
Thermowells drilled from barstock can be supplied with a total length up to 60”.

Coatings
Upon request can be supplied with plastic coatings, glass coatings and hard metal coatings.

TUBE MADE THERMOWELLS
Thermowells built up from metal tubes. For longer and continued accuracy most thermocouples and Thermometer sensing elements in industrial application are protected for physical damage, corrosion and Contamination by some types of thermometer protecting tubes. Metal tubes are generally used with base Temperature sensing elements and selected to suit the temperature pressure and corrosion process conditions.

Technical specifications

Design
TM offers the capability to design and manufacture thermometer protecting tubes to meet virtually any customer requirement. Thermometer protecting tubes are built-up exclusively from seamless draw pipes with material resulting in rigid conformation to chemical and physical specifications. In addition to the supplier’s certificate of ladle analysis, check analysis test are carried out from our laboratory. Our internal inspection certificate completes the arrangement of every supply.

Polishing
The outer surface of every thermometer protecting tube is accurately polished.

Material Tests
Every thermometer protecting tube is pressure tested to insure soundness of metal structure.
If requested, and at extra cost, Gamma or X-Ray inspection may be made, also ultrasonic checks.

Heat or chemical treating
Many type of thermometer protecting tubes require heat or chemical treatment to eliminate stress, carbide precipitation etc. Heat or chemical treatment is done on special order.

Lengths
Immersion length “L” is without limitation.