Standard Interfaces
For Automated Valve Assemblies

Benefits

Users have much to gain from the introduction of standard interfaces between Actuators and Valves, Actuators and Solenoids, and Actuators and feed back instruments.

Automated Valves have to meet an infinite range of purposes and environmental conditions. This has led to an equally large number of Valve automation components. The correct attachment of these components, one to another, is essential for the efficient functioning of the valve assembly and it's protection against damage in the field.

Automated Valve assemblies are expensive with over 80% of the total cost (Fig. I) in the automation components. They are invariably installed in large control schemes where reliability and accuracy is the keynote and the cost of a breakdown is high.

Using standard interfaces leads to lower installation costs, reduces piping and possible site damage, easier and quicker maintenance and component replacement. Retrofitting to meet change of circumstances is promoted as the user is not "locked in" to a particular supplier. Correct alignment of drives to eliminate wear dead band or malfunction of the Actuator/Valve drive train is more readily achieved.

These are obvious advantages but the standards need to be applied with knowledge and care to obtain maximum benefit, to protect expensive installations and obtain optimum life and efficiency. Hytork® Valve Automation Centers use these interfaces and encourage all users to adopt them in their own interests.

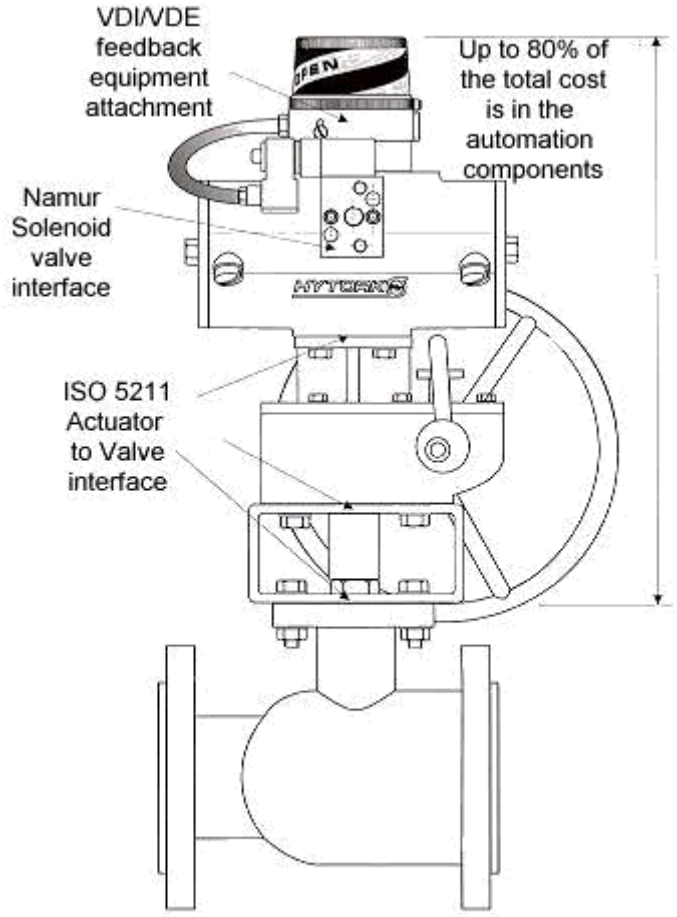
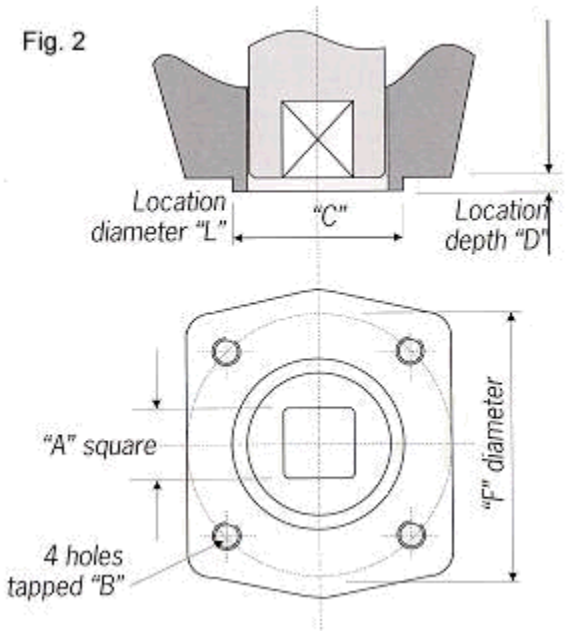


Fig. 1

Fig. 2



ISO 5211 - Interfaces between Valves and Actuators for Quarter-turn Movement

ISO 5211 Flange Dimensions *UNC Threads are supplied on **Hytork**® Actuators supplied to the USA

Maximum torque transmitted		Flange type	"F" diameter		"A" square preferred size		"B" diameter holes		No. of "B" holes	Location diameter "C"		Location - tion depth "D"	
Nm	inch.lbs.		mm	inches	mm	inches	mm	*UNC		mm	inches	mm	inches
32	283	F3	36	1.42	9	0.35	M6	1/4	4	25	0.98	3	0.12
63	558	F4	42	1.65	11	0.43	M6	1/4	4	30	1.18	3	0.12
125	1106	F5	50	1.97	14	0.55	M6	1/4	4	35	1.38	3	0.12
250	2213	F7	70	2.76	17	0.67	M8	5/16	4	55	2.17	3	0.12
500	4425	F10	102	4.02	22	0.87	M10	3/8	4	70	2.76	3	0.12
1000	8850	F12	125	4.92	27	1.06	M12	1/2	4	85	3.35	3	0.12
2000	17700	F14	140	5.51	36	1.42	M16	5/8	4	100	3.94	4	0.16
4000	35400	F16	165	6.50	46	1.81	M20	3/4	4	130	5.12	5	0.20
8000	70800	F25	254	10.00	55	2.17	M16	5/8	8	200	7.87	5	0.20
16000	141600	F30	298	11.73	75	2.95	M20	3/4	8	230	9.06	5	0.20

This standard lists the attachment dimensions for the interface between the Actuator/Valve or the Actuator/Intermediate Bracket/Valve. Brackets are bolted to the Valve mounting face, thus avoiding the need for keyways or dowels, as torque transmission is catered for by the compression force between the two components parts.

The attachment dimensions are listed against a maximum allowable transmitted torque value and are:

- The pitch diameter, number and size of attachment screws.
- A location spigot for alignment.
- The Actuator driver and driven Valve stem/adaptor dimensions.

Indirect Mounting

Hytork® Valve automation experience shows that the following conditions make indirect mounting the preferred option for the majority of applications.

The standard allows Actuators to be mounted directly on to Valve flanges without any intermediate bracketry or adaptors. However there are a number of reasons why it is unlikely that this method will be widely used, particularly with regard to pneumatic Actuators.

Actuator sizing:

- There is a very wide range of outputs possible from any one size of pneumatic Actuator. The torque requirement of a single valve size can vary widely due to different seat materials and the nature, quality, pressure and temperature of the controlled medium. Pneumatic Quarter-turn Actuators are designed to operate safely in the Double Acting mode at the maximum pressure which is commonly 120 psi (8 bar). However as this pressure is seldom used in practice, the pressure normally chosen for the attachment features is the more common line pressure of 80 psi (5.5 bar) but can be as low as 30 psi (2 bar). Comparatively an 80 psi (5.5 bar) Double Acting mode Actuator will yield about seven times the end of stroke output of a similar size of Actuator used in the Spring Return mode at 30 psi (2 bar). However the Actuator must be designed to meet the most severe condition as the manufacturer has no control over possible usage. Therefore, the interface on the Actuator will be related to the torque generated in the Double Acting mode at a stated maximum pressure. (In the UK members of the British Valve and Actuator Manufacturers Association (BVAMA) must certify Actuators according to the BVAMA Code of Practice No 001/1292 for the torque output under stated test conditions.)

Gland adjustment:

- Some Valves have glands which require access for adjustment.

Maintenance and safety checks:

- Many plant operators insist on access to examine Valve Stem Seals and Stem function at frequent intervals and do not want them obscured.

Figure 3

Valve line pressure psi (bar)	Valve torque inch lbs	Double Acting Actuator Hytork® Model Number at various pressures psi (bar)			Spring Return Actuator Hytork® Model Number at various pressures psi (bar)		
	(Nm)	40 (2.7)	60 (4)	80 (5.5)	40 (2.7)	60 (4)	80 (5.5)
50 (3.4)	900 (101)	425DAG	280DAG	185DAG	680S40	425S65	280S80
100 (6.8)	1200 (136)	425DAG	280DAG	280DAG	680S40	680S65	425S80
200 (13.6)	1600 (180)	680DAG	425DAG	280DAG	1125S40	680S65	425S80
400 (27.2)	2500 (282)	1125DAG	680DAG	425DAG	1370S40	1125S65	680S80
600 (41)	3400 (384)	1125DAG	1125DAG	680DAG	2585S40	1370S65	1125S80

This example shows a typical 4" reduced bore class 300 soft seated ball valve. The chart demonstrates how the actuator sizes can vary with a single valve size. In the example there are seven (7) different actuator models which use four different "ISO" flanges -
F07, F10, F12, F16

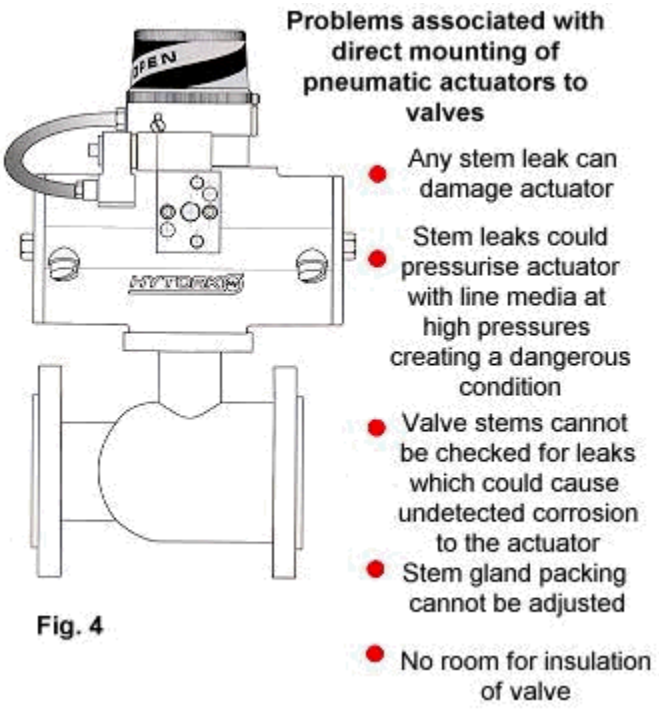


Fig. 4

ISO 5211 Valve flanges for direct mounting are not universal: Only a small number of Ball and Plug Valves currently manufactured provide an ISO Actuator mounting flange and this is unlikely to change in the short or even the medium term. Butterfly Valves are perhaps a little more common with this feature.

Cross pressurisation due to Valve Stem Seal failure: There are recorded cases of direct mounting where stem Seal failure allowed cross leaks between the controlled medium and the Actuator The medium can be at high pressure and will damage the Actuator in extreme cases or cause it to act against the air pressure or Springs.

Remote mounting is often necessary: Pipe insulation for high or low temperatures or hazardous controlled media often require remote access to the automation components for maintenance purposes.

Valve stems are widely variable: There are many different sizes and shapes (Squares, Double DEE, and Keyed) of Valve stems, some for historical and some for technical reasons. Valve manufacturers are reluctant to change their designs and ISO 5211 has compromised in recognising a number of alternatives but at the same time giving preferred sizes and shapes. It is anticipated and hoped that new Valve designs will follow these sizes but it is also certain that diverse stems will persist for many years to come.

These reasons explain why, (and Fig. 3 demonstrates in chart form), it is unlikely that direct mounting of Actuators to Valves will be widely used and indirect mounting will continue to dominate.

Low Quality Materials

Poor Quality / Cheap Intermediate Brackets and Adaptors are expensive in the long run. It is surprising, but true, that some users will waste their money by paying high prices for quality Valves and Actuators and then limit their life and efficiency by having cheap mounting Brackets and Adaptors made and fitted by inexperienced suppliers. This can cause side loads, wear, back-lash, misalignment and even malfunction or failure in extreme cases. **Hytork® Valve Automation Centers** have WIDE experience in the design, manufacture and fitting of indirect mounting components and hold stocks of commonly used items for quick delivery purposes.

Essential Features

Essential features for Mounting Brackets

- The Mounting Bracket must be sufficiently rigid to transmit the given torque without twisting or imparting side loads or eccentric camming forces on the Actuator and Valve Stem Bearings.
  The whole automated assembly relies on correct alignment and adequate design to perform its full function efficiently and consistently. The Actuator drive must position the valve correctly and simultaneously signal this achievement via the switch box mounted on top of the Actuator. It follows that as much attention to detail is needed for mounting Brackets as is given to the selection of the Valve and Actuator.

Essential features for Adaptors

- The Adaptor fits in the drive train and compensates for the gap, introduced by fitting the Bracket, between the Valve stem and the female Actuator drive. Fig. 3 shows how the Actuator size can vary considerably within a single Valve size and the Adaptor is used to adapt the Actuator drive to the Valve stem. Most Actuator drives are female squares but many Valve stems are flatted (Double DEE) or keyed as well as square. The dimensions for these alternative drives are given in the ISO 5211 standard.
  Some Valve Stems have been made from high tensile material as the Valve torque requirements have been increased. This avoids major design changes to the Valve body but they are often smaller than the ISO 5211 preferred sizes. If the driving component is of material with a lower bearing stress limit than the stem this can lead to gradual wear, back-lash and possible failure.

  Care in the manufacture of Adaptors is also needed to prevent eccentricity which can introduce side loads and cause wear and malfunction to the Valve or Actuator. Users should also be sure that the Actuator sizing matches the Valve requirements. Too little torque can lead to incorrect Valve operation, too much may shear the Valve stem if the valve jams for any reason.
  The successful automation of Valves needs knowledge and experience. **Hytork® Valve Automation Centers** bring this specialisation to the aid of users who are aware of the potentially high cost of shut down time and the possibility of dangerous incidents due to inadequate automation design.

  (In the UK, The British Valve and Actuator Manufacturers Association (BVAMA) have issued a Code of Practice No BVAMA 002/0393 entitled valve Actuator Mounting Kits.)

The NAMUR Solenoid Control Valve Interface

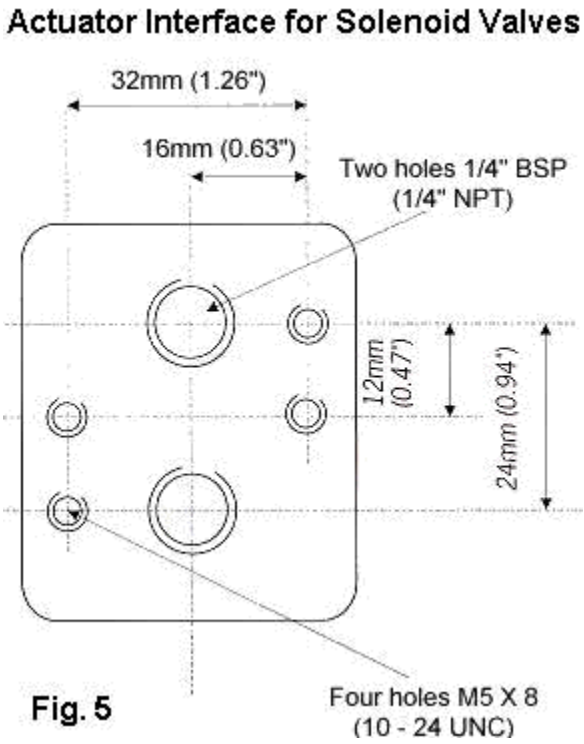


Fig. 5

(Fig. 5). NAMUR is the acronym for the German Chemical Industry Working Party that produced this standard. - **N**ormen **A**rbeitgemeinschaft fur **M**ass **U**nd **R**egeltechnik.

This is a specification for a standard interface between pneumatic Actuators and Solenoid/directional control Valves. This has been generally accepted by users and manufacturers alike. It provides for attachment directly to a matching interface on the Actuator and for direct connection to the pressure supply/exhaust ports.

By adopting this standard the user reduces significantly the piping and bracketry involved in fitting directional control Valves. This saves cost and reduces the chances of pipework being damaged during use. It gives the user the facility to change from one supplier to another or change the function to match a change of conditions as all Solenoids ranging from intrinsically safe to normal non-hazardous conditions can be made using the same interface.

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The VDI/VDE 3845 Auxiliary Equipment Attachment

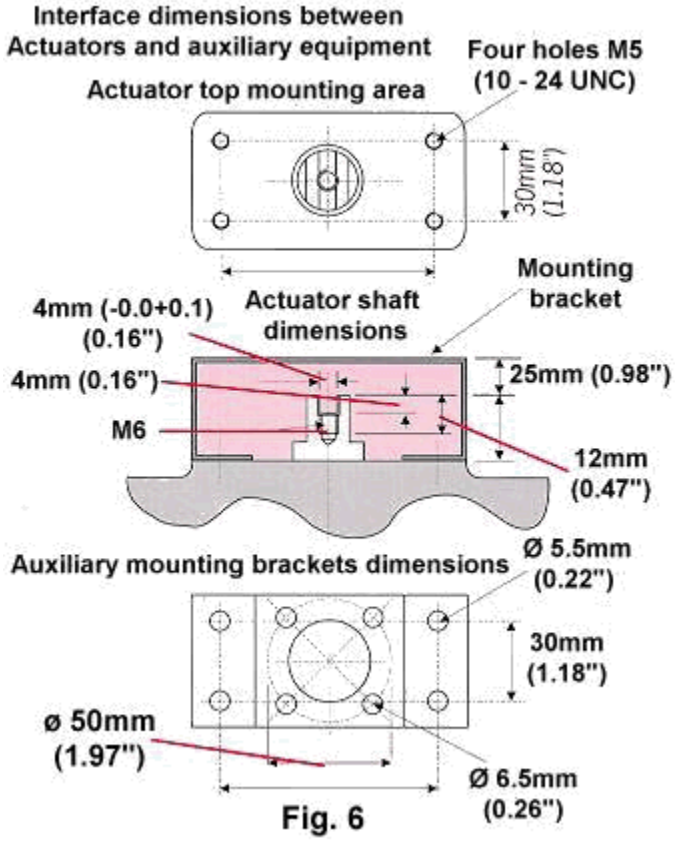

Fig. 6

(Fig. 6). The German organisations **V**erein **D**eutscher **I**ngenieure and the **V**erband **D**eutscher **E**lectrotechniker have proposed a specification for the mounting and drive arrangements for top mounted auxiliary instruments such as switch boxes and positioners. This is a useful specification and is being used by many Actuator and Valve automation equipment manufacturers including **HYTORK® Valve Automation Centers**

A	80	80	130	130
	3.15"	3.15"	5.12"	5.12"
B	20	30	30	50
	0.79"	1.18"	1.18"	1.97"

Fig. 6

Benefits Of Standard Interfaces

Standard Interfaces for Automated Valve Assemblies Benefit Hytork® Customers.

- **Hytork®** Actuators and Accessories meet ALL the above standards.
- Provide lower assembled costs due to fewer package components.
- Provide engineered, rugged attachments of all components.
- Provide greater flexibility in the selection of components.
- Provide a more compact, rugged overall package.
- High Quality **Hytork®** Mounting Brackets and Adaptors prevent damage to
- Valves and Actuators and save expensive downtime.