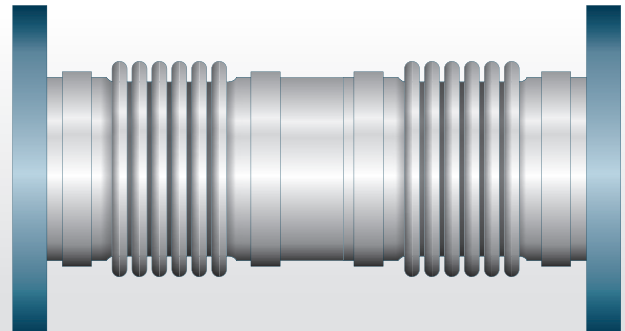


**DESIGN CONDITIONS**

Max. Design Pressure	<b>3 Bar</b>
Max. Design Temperature	<b>450°C</b> ( <i>higher temperature on application</i> )
Test Pressure	<b>4.5 Bar</b>
Bellow Options	<b>Stainless Steel 321/316</b>
Flange Options	<b>Carbon Steel/Stainless Steel</b>
Drilling Options	<b>PN6, PN16, PN25 or PN40</b>

**NOTE:** If not specified our engineers will automatically select the first option.  
i.e. 321, carbon steel, PN6.

**GENERAL INFORMATION**

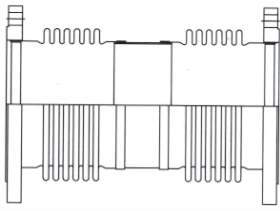
The standard DAF range is comprised of two sets of stainless steel bellows convolutions and an interconnecting pipe spool welded to carbon steel flanges. Having two sets of stainless steel convolutions allows axial and lateral movement. Recommendations contained in our literature (see Application and Installation section) should be followed upon installation and joints positioned, if practical, adjacent to anchors or fixed points. Guides should be positioned to allow freedom for axial and lateral movement of the pipework and also to prevent sag and pressure deflection. These expansion joints are supplied at a neutral length but can be "cold drawn" on installation.

NOMI- NAL SIZE (mm)	PIPE DIAM- ETER (mm)	PART NUMBER	AXIAL MOVE- MENT	AXIAL SPRING RATE	EFFEC- TIVE AREA	LATERAL MOVEMENT (+ or - 50 mm)		LATERAL MOVEMENT (+ or - 75 mm)		LATERAL MOVEMENT (+ or - 100 mm)		LATERAL MOVEMENT (+ or - 150 mm)	
			+ or - mm	n/mm	cm <sup>2</sup>	Overall length	Spring rate	Overall length	Spring rate	Overall length	Spring rate	Overall length	Spring rate
50	60.3	DAF/0050/03/001	20	32	37	540	0.6	740	0.27	940	0.15	1300	0.07
65	76.1	DAF/0065/03/001	20	41	56	540	1.17	740	0.53	940	0.3	1300	0.14
80	88.9	DAF/0080/03/001	20	48	75	540	1.84	740	0.83	940	0.47	1300	0.22
100	114.3	DAF/0100/03/001	20	62	118	540	3.75	740	1.69	940	0.96	1300	0.46
125	139.7	DAF/0125/03/001	32	67	187	562	8.19	728	3.84	895	2.21	1230	1
150	168.3	DAF/0150/03/001	32	80	261	562	13.8	728	6.5	895	3.8	1230	0.7
200	219.3	DAF/0200/03/001	42	88	441	610	21.5	804	9.7	996	5.5	1380	2.5
250	273	DAF/0250/03/001	42	111	665	610	40.8	804	18.3	996	10.4	1380	4.6
300	323.9	DAF/0300/03/001	42	132	918	610	67.2	804	30	996	17	1380	7.7
350	357	DAF/0350/03/001	45	338	1200	776	113	1026	53	1276	31	1776	14
400	406	DAF/0400/03/001	45	387	1530	776	164	1026	78	1276	45	1776	21
450	457	DAF/0450/03/001	45	338	1929	776	181	1026	86	1276	50	1776	23
500	508	DAF/0500/03/001	45	375	2342	952	141	1309	63	1666	36	2380	16
550	559	DAF/0550/03/001	45	560	2895	1215	138	1715	61	2215	35	3215	15
600	610	DAF/0600/03/001	45	571	3394	1215	164	1715	73	2215	41	3215	18
700	711	DAF/0700/03/001	45	1354	4561	1215	524	1715	233	2215	131	3215	58
750	762	DAF/0750/03/001	45	1406	5187	1215	618	1715	275	2215	155	3215	69
800	813	DAF/0800/03/001	45	1452	5802	1215	719	1715	320	2215	810	3215	80
900	914	DAF/0900/03/001	45	1585	7317	1215	980	1715	436	2215	245	3215	109
1000	1016	DAF/1000/03/001	45	1762	8936	1215	1332	1715	593	2215	334	3215	148

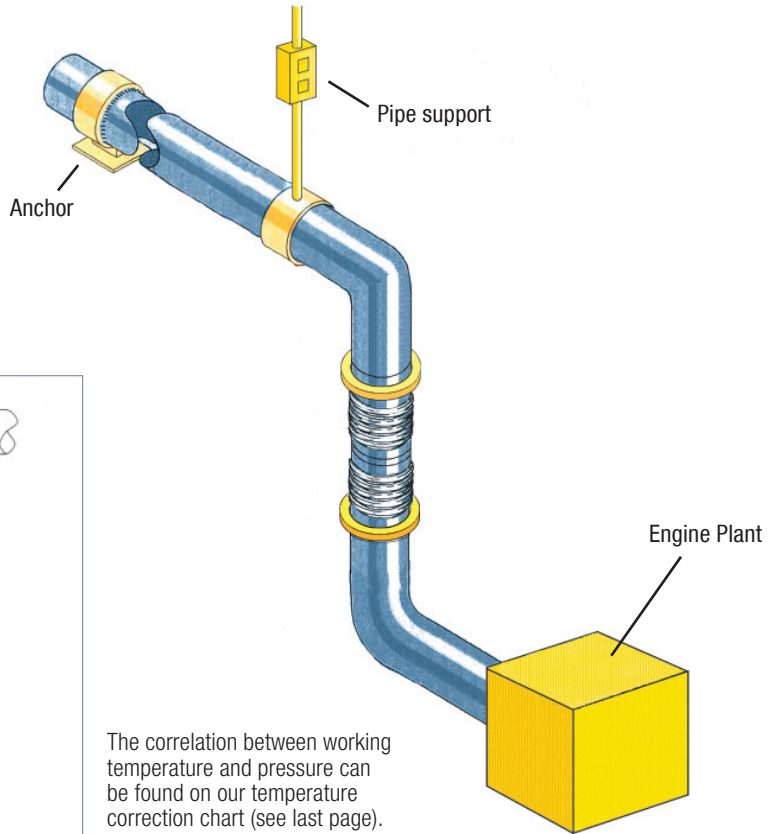
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PLAN VIEW FOR A FLANGED DOUBLE AXIAL EXPANSION JOINT

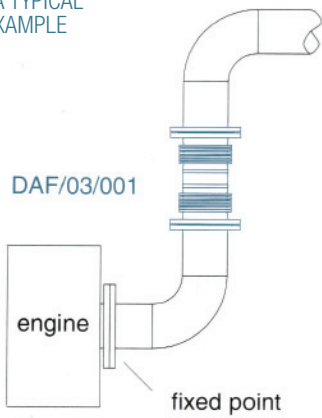


A TYPICAL APPLICATION EXAMPLE OF DOUBLE AXIAL SYSTEM

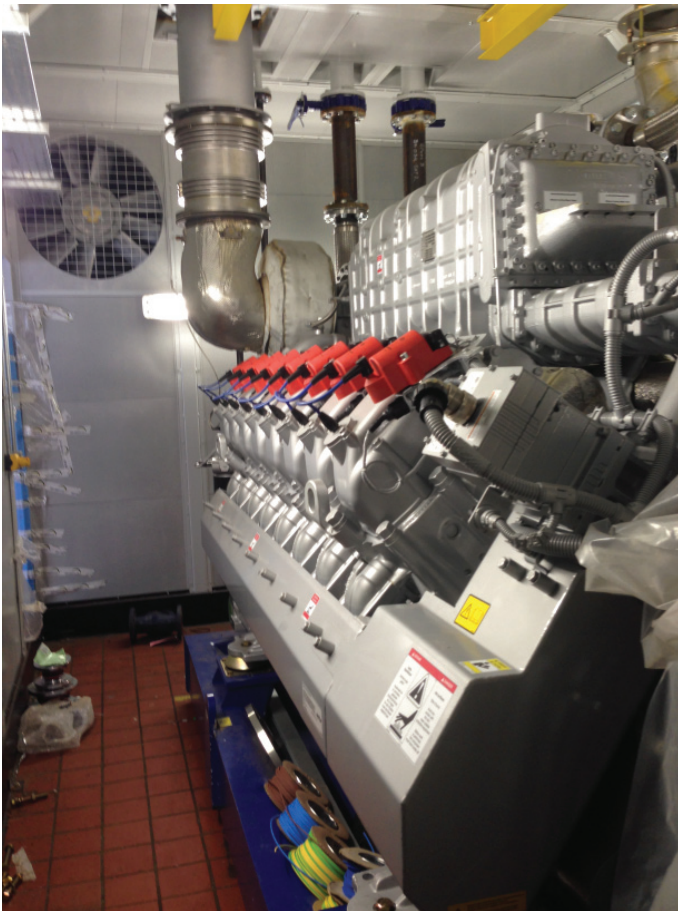


The correlation between working temperature and pressure can be found on our temperature correction chart (see last page).

PLAN VIEW OF A TYPICAL APPLICATION EXAMPLE



APPLICATION IMAGE EXAMPLES



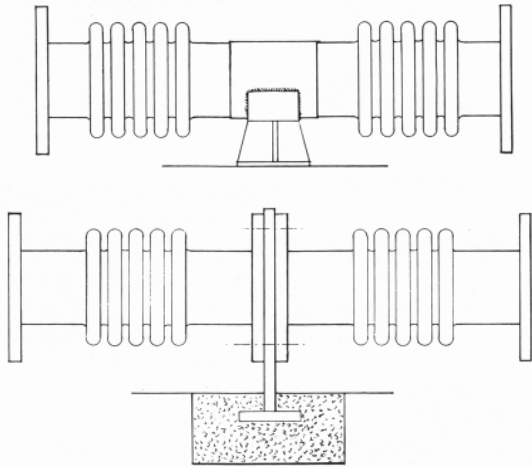
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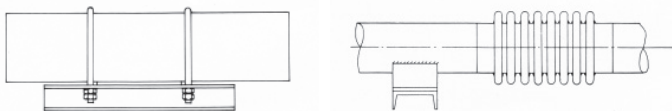


## INSTALLATION REQUIREMENTS

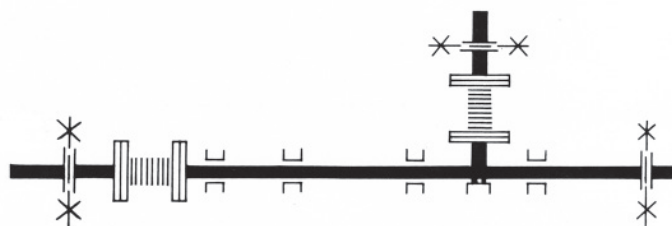
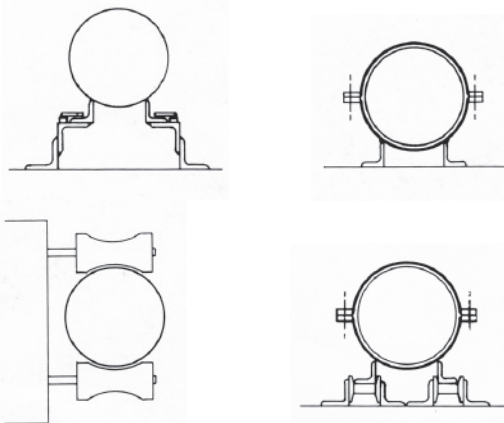
Main anchors by definition are installed where directional changes take place, at the end of a line or between expansion joints of different size. They have to carry the full pressure thrust, the spring forces, and the frictional forces due to alignment guides and supports, and in some cases, the weight of piping, fittings and contents.



The design of such anchors is therefore, beyond the scope of the design engineer, unless full details of the entire structure are provided. In these cases, anchors may be furnished as an integral part of the expansion joint.



An intermediate anchor divides a pipe system into an individual expanding section, and is only responsible for the forces imposed upon it by this section, i.e. it includes only for the spring forces, friction of guides and possibly the wind load and weight etc., as it effects each section of pipe. Intermediate anchors may be built into expansion unit assemblies by arrangement with the manufacturer and may lead to economies by the elimination of flanges or other fittings. Directional anchors or guides are designed to absorb loading in one direction whilst permitting motion in another. It may constitute either a main or an intermediate anchor, depending upon the application. Clearly, such guides are required to have a minimum of friction in order to reduce the loading elsewhere, and ensure its proper functioning as a guide.



## INSTALLATION INSTRUCTIONS

The position of anchors and guides relative to expansion joints will vary with each installation and type of joint. The following is a list of basic rules for expansion joints, in accordance with E.J.M.A. (Expansion Joint Manufacturers Association), and the new British Standard Code of Practice for metallic bellows expansion joints, which provide a useful guide and will ensure a satisfactory installation.

- 1 Divide the pipe length into sections ensuring that the expansion of each section is within the allowable movement of a bellows joint. Locate intermediate anchors at the end of each section and main anchors at each end of the pipe run.
- 2 Locate expansion joints adjacent to each other and position the guides so that the first is not more than 4 pipe diameters from the expansion joint and the second not more than 14 pipe diameters from the first guide.
- 3 Position other guides and supports according to the piping weight, diameter and internal pressure to ensure freedom from sag or pressure deflection, refer to Data Sheet 1 (004/79/1)
- 4 Check that each guide is approximately 1.5 pipe diameters in length for pipes up to 8" diameter and approximately 12" long for larger sizes. Some approved designs are illustrated.
- 5 Never use more than one expansion joint between two anchors, unless they form part of a expansion joint assembly, such as an articulated joint and have been supplied with full knowledge of the pipe layout.
- 6 Thermosel® expansion joints may be cold drawn from their neutral position by up to half the total rated expansion. Data Sheet 1 (004/79/1) provides for installation at different ambient temperatures.
- 7 Pipe anchors should be located at changes in pipe direction, or whenever necessary to divide straight lengths to suit maximum expansion joint movement. Joints should be at least 4 pipe diameters from dampers, gate valves, butterfly valves or other accessories.
- 8 Expansion joints should never be used to correct pipe alignment or fitting errors beyond the design parameters of the joint. Torsional strain for example is not permitted and flange holes must therefore be carefully aligned.
- 9 When internal sleeves are fitted, directional flow arrows indicate the correct way to install the unit with respect to the actual direction of flow.
- 10 Shipping restraints (painted red) when supplied, maintain the overall length of the assembly for shipment. These devices may also be used to pre-compress, pre-extend or laterally offset the bellows, to facilitate correct installation, and must be removed prior to test or commissioning.
- 11 The convolutions of stainless steel expansion joints must be protected from weld splatter. Foreign material entering the space between the convolutions, either internally or externally, will prevent correct operation of the joint and may result in premature failure.
- 12 Standard expansion joints are pressure tested prior to despatch to 1.5 times the operating pressure, and pipework should not be tested in excess of this. Testing should not be carried out until the anchors are secure and the pipework correctly guided.
- 13 Where a gaseous system is to be hydraulically tested, determine whether the piping and bellows joints require additional temporary support to carry the weight of water to be used during the test.
- 14 Main anchors must be designed to withstand the highest combined effects of pressure thrust, spring rate force and the friction force generated by guides. See Data Sheet 4 (007/79/1).
- 15 Insulation materials containing sulphides, chlorides or other contaminants must not be used on stainless steel expansion joints and must not be allowed to fall between the convolutions. Aluminium, lead or zinc bearing paints, must not be used on stainless steels.

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## SAFETY RECOMMENDATIONS

### Inspection prior to Start-up or Pressure Test

Expansion joints are usually considered to be non-repairable items and generally do not fall into the category for which maintenance procedures are required. However, immediately after the installation is complete a careful visual inspection should be made of the entire piping system to ensure that there is no evidence of damage, with particular emphasis on the following:

- 1 Are anchors, guides, and supports installed in accordance with the system drawings?
- 2 Is the proper expansion joint in the proper location?
- 3 Are the flow direction and pre-positioning of the expansion joint correct?
- 4 Have all of the expansion joint shipping devices been removed?
- 5 If the system has been designed for gas, and is to be tested with water, has provision been made for proper support of the additional dead weight load on the piping and expansion joint? Some water may remain in the bellows convolutions after the test. If this is detrimental to the bellows or system operation, means should be provided to remove this water.
- 6 Are all guides, pipe supports and the expansion joints free to permit pipe movement?
- 7 Has any expansion joint been damaged during handling and installation?
- 8 Is any expansion joint misaligned? This can be determined by measuring the joint overall length, inspection of the convolution geometry, and checking clearance at critical points on the expansion joint and at other points in the system.
- 9 Are the bellows and other movable portions of the expansion joint free of foreign objects?

### Inspection during and immediately after pressure test

**WARNING: Extreme care must be exercised while inspecting any pressurised system or component**

A visual inspection of the system should include the following:

- 1 Evidence of leakage or loss of pressure.
- 2 Distortion or yielding of anchors, expansion hardware, the bellows and other piping components.
- 3 Any unanticipated movement of the piping due to pressure.
- 4 Evidence of instability in the bellows.
- 5 The guides, expansion joints, and other movable parts of the system should be inspected for evidence of binding.
- 6 Any evidence of abnormality or damage should be reviewed and evaluated by competent design authority.

### Periodic Inservice Inspection

**WARNING: Extreme care must be exercised while inspecting any pressurised system or component.**

- 1 Immediately after placing the system in operation, a visual inspection should be conducted to insure that the thermal expansion is being absorbed by the expansion joints in the manner for which they were designed.
- 2 The bellows should be inspected for evidence of unanticipated vibration.
- 3 A program of periodic inspection should be planned and conducted throughout the operating life of the system. The frequency of these inspections should be determined by the service and environmental conditions involved. Such inspections can pinpoint the more obvious potential problems such as external corrosion, loosening of threaded fasteners, and deterioration of anchors, guides and other hardware. It must be understood that this inspection programme, without any other backup information cannot give evidence of damage due to fatigue, stress corrosion or general internal corrosion. These can be the cause of sudden failures and generally occur without any visual or audible warning.
- 4 When any inspection reveals evidence of malfunction, damage or deterioration, this should be reviewed by competent design authority for resolution. Additionally, any changes in the system operating conditions such as pressure, temperature, movement, flow, velocity, etc that may adversely affect the expansion joint should be reported to, and evaluated by, a competent design authority.

PTO...

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## DESIGN STANDARDS

All standard units are designed to Thermosel® standard formulae which have been verified by tests witnessed by independent testing authorities.

The designs also conform to the requirements of the internationally recognised standard E.J.M.A. (Expansion Joint Manufacturers Association) and the British Standard Code of Practice for selection joints for use in pressure systems.

Pearwalk Engineering Ltd is represented on the British Standard Committee responsible for the preparation of the latter.

## QUALITY

It is our policy to maintain our product reliability and company service to industry at the highest level compatible with realistic costs.

The quality control and manufacturing procedures as specified on our website [www.pearwalkengineering.com](http://www.pearwalkengineering.com) meet the requirements of all major company, national and international quality standards.

## SURVEY SOCIETIES

Thermosel® units are acceptable to all National and International Survey Societies. Pearwalk Engineering has received either type approval or is approved by individual societies as a manufacturer of bellows expansion joints in accordance with the societies' Conditions of Survey and Witness of Tests during the course of manufacture.

Copies of type approval certificates are available upon request. An additional charge will be made for certification covering survey society approval on individual units which are not type approved.

## ORDERING

The purchase order for standard units must identify the type of unit required by reference to the ordering code as follows:

**Typical Part number:** SAF/0100/16/001/NP16/150

Unit description / Nominal bore / Pressure rating / Type Number / End fittings / Lateral Movement (Double units only).

The unit price for standard units will be quoted on the current price list. Flange details must be stated on the purchase order in addition to the ordering code.

## TEMPERATURE CORRECTION CHART

### Pressure/Temperature compensation

20°C	100%
100°C	80%
200°C	68%
300°C	64%
400°C	60%
500°C	58%
600°C	55%

## ALTERNATIVE COMPONENTS OR MATERIALS

Where the operating or environmental conditions exceed the limits specified for the standard unit range or where special end fittings are required, alternative units can be designed and supplied.

Typical variations include choice of material for the membranes and end fittings, multi-ply membrane construction and alternative end fittings such as screwed pipe ends, vee flanges or swivel flanges.

Please discuss your special requirements with our sales engineers.

## RESERVATIONS

We reserve the right:

- in the interest of design improvement to alter the design specification without prior notice.
- to invoice at prices ruling at date of dispatch

## FURTHER INFORMATION

For further information about Thermosel® products please visit our website at [www.pearwalkengineering.com](http://www.pearwalkengineering.com)

### Below is our list of standard parts:

#### UNIT DESCRIPTION

APS - Axial Pipe End Screwed  
SAP - Single Axial Pipe End  
SAPV - Single Axial Pipe End (Victaulic)  
SAF - Single Axial Flanged  
DAP - Double Axial Pipe End  
DAF - Double Axial Flanged  
DUP - Double Universal Pipe End  
DUF - Double Universal Pipe End  
SAV - Single Axial Van-Stone  
DAV - Double Axial Van-Stone  
STF - Single Tied Flanged  
STP - Single Tied Pipe End  
STPV - Single Tied Pipe End (Victaulic)  
DTF - Double Tied Flanged  
DTP - Double Tied Pipe End  
DHF - Double Hinge Flanged  
DHP - Double Hinge Pipe End  
SHF - Single Hinge Flanged  
SHP - Single Hinge Pipe End  
SGF - Single Gimbal Flanged  
SGP - Single Gimbal Pipe End  
DGF - Double Gimbal Flanged  
DGP - Double Gimbal Pipe End  
SMP - Single Multi-Ply Pumpflex  
SMT - Single Multi-ply Pumpflex Tied  
TRB - Thermosel Rubber Bellows  
MFS - Metallic Flexible Hose with Swivel Ends  
HEX - Heat Exchanger Joint

#### TYPE NUMBERS:

001 - Carbon steel fittings no internal sleeve  
002 - Carbon steel fittings single internal sleeve  
003 - Carbon steel fittings telescopic internal sleeves  
004 - Carbon steel fittings single internal sleeve, telescopic external sleeves  
005 - Carbon steel fittings single internal sleeve, telescopic external sleeves  
006 - Carbon steel fittings telescopic internal sleeves, telescopic external sleeves  
007 - Carbon steel fittings no internal sleeve, shroud  
008 - Carbon steel fittings single internal sleeve, shroud  
009 - Carbon steel fittings telescopic sleeves, shroud  
010 - Stainless steel fittings no internal sleeve  
011 - Stainless steel fittings single internal sleeve  
012 - Stainless steel fittings telescopic internal sleeves  
013 - Stainless steel fittings no internal sleeve, telescopic external sleeves  
014 - Stainless steel fittings single internal sleeve, telescopic external sleeves  
015 - Stainless steel fittings telescopic internal sleeves, telescopic external sleeves  
016 - Stainless steel fittings no internal sleeve, shroud  
017 - Stainless steel fittings single internal sleeve, shroud  
018 - Stainless steel fittings telescopic internal sleeves, shroud  
020 - Twin Sphere Union (Neoprene)  
021 - Single Sphere Flanged (Neoprene)  
022 - Single Sphere Flanged Tied (Neoprene)  
030 - Galvanised Fittings (fixed male & swivel female)  
120 - Twin Sphere Union (E.P.D.M.)  
121 - Twin Sphere Flanged (E.P.D.M.)  
122 - Twin Sphere Flanged Tied (E.P.D.M.)

#### END FITTINGS:

PN6 - Drilled  
PN16 - Drilled  
PN25 - Drilled  
PN40 - Drilled  
BS10A - BS10 Table A  
BS10D - BS10 Table D  
BS10E - BS10 Table E  
BS10F - BS10 Table F  
BS10H - BS10 Table H  
ASA150  
ASA300  
JIS 5k - Drilled  
JIS 10K - Drilled  
JIS 16K - Drilled  
JIS 20K - Drilled

#### NOMINAL BORE:

0015 - 4000 mm

#### PRESSURE RATINGS:

2.5 bar  
10 bar  
16 bar  
25 bar

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