



SECTION 6.0 HD PUF CRYOGENIC PIPE SHOES & TRUNNION SUPPORTS

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HD PUF CRYOGENIC PIPE SHOE (High Density Polyurethane Foam)

BG600-BG601-BG602-BG603

1.0 GENERAL

All Binder HD PUF cradles are manufactured from “**NON CFC**” polyurethanes which are classified as self extinguishing with a 90% retention of weight when tested in accordance with BS4735 and ASTM D-3014 respectively.

2.0 HD PUF Material

Pipe Size	(in)	Less than 8"	8" to 24"	over 24"
Density (Overall/Average)	(kg/m ³)	160 +10/-0	240 +/-5	320 +/-5
Ultimate Compressive Strength at 20°C (ASTM D1621 min)	(kPa) (psi)	2000 290	4000 580	7000 1015
Design Stress (5:1 Safety Factor Under Cold Service Conditions)	(KPa) (psi)	735 107	1150 167	2035 295
Thermal Conductivity @ -160°C	(W/m.K)	0.022	0.027	0.035
Minimum Percentage of closed cells Maximum leachable halides content		90% per ASTM D-2856 30 ppm		
Application Temperature		-196°C to 100°C -321°F to 212°F		
Fire Resistive Properties		BS4735 Self – extinguishing (Extent of Burn 30mm). ASTM D-3014 - 90% retention of weight		
Linear coefficient of thermal expansion/contraction (BS 4370)		70 x 10 ⁻⁶ per °C		

3.0 HD PUF Cradle construction

The Standard Binder HD PUF pipe support is a single/multi layer (depending on pipe size) monolithically moulded high density polyurethane cradle in two 180° sections without longitudinal or circumferential seams. Where the line insulation thickness exceeds 60mm a step is provided at each end to prevent a direct vapour path to the insulated surface. (Shiplap Joint)

All Binder HD PUF support cradles are moulded under rigidly controlled temperature and humidity conditions and over packing is used to ensure complete filling of the mould and to produce sharp square corners for “no gap” joining to the line insulation.

Binder HD PUF supports are clamped to the pipe. Specific Disc Spring washer configurations and bolts are used to accommodate the shrinkage of the pipe during plant operation.

Binder supports are sized to match the outside diameter of the mating line insulation. Standard Binder HD PUF supports are sized in accordance with ASTM C-585.

Binder HD PUF supports are shipped with a factory installed weather/vapour barrier mastic layer to all exposed surface of the PUF. The weather/vapour barrier mastic is fire retarded and has a vapour permeance of not more than 0.02 perms

4.0 BEARING PLATE ASSEMBLIES

Full 360° Bearing plate assemblies are manufactured with formed ears or welded lugs to accept bolts and nuts.

5.0 MARKING

Major components will be clearly marked with pipe support or mark number.

6.0 PACKING

All HD PUF supports will be individually wrapped and sealed in moisture proof plastic packages. They will be suitably crated or otherwise to avoid mechanical damage to PUF and steel components.

7.0 RECOMMENDED FIELD INSTALLATION INSTRUCTIONS

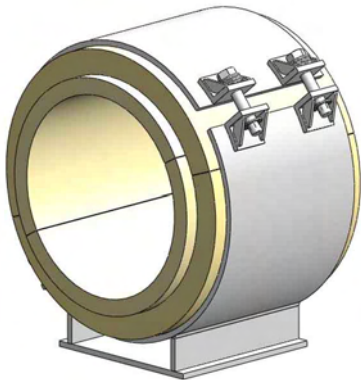
7.1 Trial fit the shoe and trim where required to overcome any excessive ovality in the pipe. Shoe must be kept moisture free at all times.

7.2 Installation of the shoe is to be performed in a dry environment and all necessary steps must be taken to ensure that the pipe/shoe interface remains dry.

7.3 First, lower support assembly is placed in position under the pipe and then the upper assembly. Check for least gap between the pipe and HD PUF, due to eccentricity of pipe. A minimum 60 degree contact area is required to ensure even distribution of clamping force. A layer of glass wool shall be applied to the longitudinal faces of each layer of the lower support. Now the upper HD PUF cradle assembly will be placed on the pipe. The gaps between the upper and lower bolting lugs shall be equalized on both sides of the support.

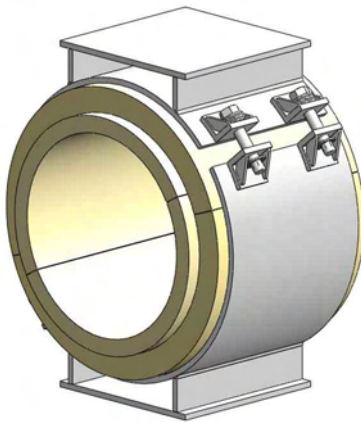
7.4 The bolts and correct number of Disc Springs are installed based on the loads to avoid slipping, and to accommodate the possible shrinkage.

7.5 Care is to be taken throughout the installation and curing activities to avoid damage to the insulation or the protective seals. The support assembly is to be kept dry throughout the whole of the fitting operation.



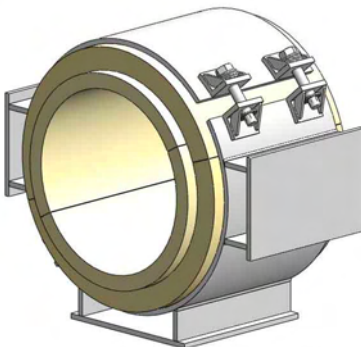
BG600

1. The BG600 standard HD PUF Shoe is fitted with Disc Spring Washers on each bolt which ensures that the cradle is adequately clamped even after shrinkage has occurred due to the cryogenic operating temperature of the supported pipe.
2. The clamping force is calculated so that the cradle will not rotate or slip axially on the pipe as the base experiences frictional resistance when the shoe is free to slide (un-guided) on the support structure.
3. The frictional resistance is a result of the Vertical Design Load of the pipe and the shoe's Self Weight.
4. A PTFE Slide Plate is recommended for larger diameter supports to reduce the sliding resistance and hence the clamping force required to prevent rotation.
5. This design is applicable to 100NB pipe and greater sizes. For pipe size 80NB and lesser please see Pg 161 .



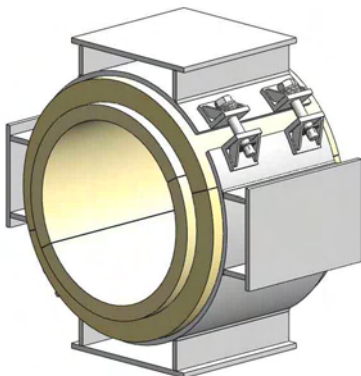
BG601

1. The BG601 HD PUF Shoe is similar to the BG600 except it has an extra base attached to the top cradle to prevent the pipe lifting up during operation.
2. For small up-lift forces, the BG600 can be used instead with hold-downs acting at the shoe base; however this may result in higher clamping forces to prevent rotational slippage and will require calculations to be carried out as needed.



BG602

1. The BG602 HD PUF Shoe is similar to the BG600 except it has guide bases attached to the each side to resist large lateral forces.
2. The effect of the guide bases mounted at the pipe centreline level is such that the shoe can handle large lateral loading without the need for high clamping forces to resist slippage.
3. For small lateral forces, the BG600 can be used instead with guides acting at the shoe base; however this will result in higher clamping forces to prevent rotational slippage and will require calculations to be carried out as needed.



BG603

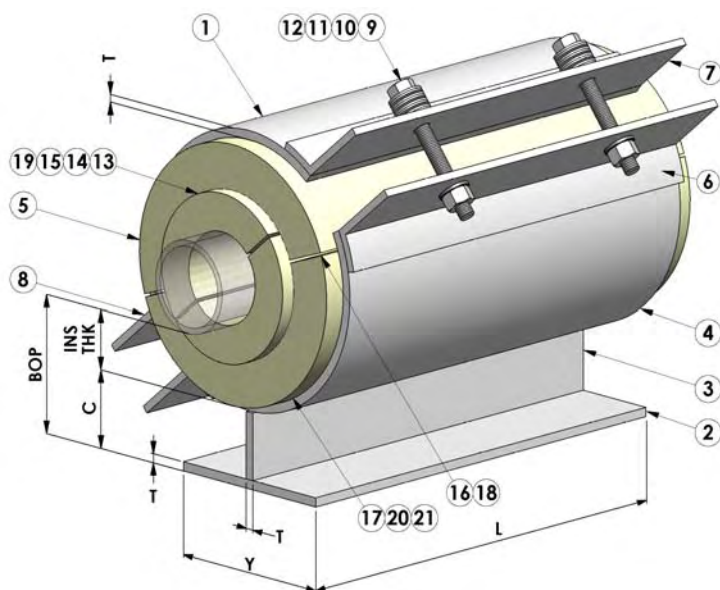
1. The BG603 HD PUF Shoe has both the upper base of the BG601 and the guide bases of the BG602 to resist large up-lift and lateral forces.
2. As with the BG602, effect of the guide bases mounted at the pipe centreline level is such that the shoe can handle large lateral loading without the need for high clamping forces to resist slipping.
3. For small lateral and up-lift forces, the BG600 can be used with hold-down guides acting at the shoe base; however this will result in higher clamping forces to prevent rotational slippage and will require calculations to be carried out as needed.

HD PUF CRYOGENIC PIPE SHOE (High Density Polyurethane Foam)

General Notes :-

1. Total Insulation thickness is determined by the required operating temperature. Please refer to the insulation thickness v operating temperature table.
2. Disc springs and bolting arrangements are calculated using design loads to prevent axial and rotational slippage. Bolting torques for installation are provided.

Please provide vertical and lateral design loads if they exceed the design loads shown in design data table.
3. Insulation is available in the following colour coded densities of 160, 240 and 320kg/m³ dependant on load requirements.
4. Please contact Binder Group for pipe shoes requiring lateral, vertical or axial restraint.
5. Standard batch traceability complete with type 2.2 material certificates
6. Pipe Shoes are welded to AWS D1.1 pre-qualified procedures
7. BG550 type Teflon slide plates recommended for supports size 24" (600NB) and above. Please order separately.
8. Alternative corrosion protection finishes available on request.



	Material	Specification	
Surface Finish	Steelwork	ASTM A123	HDG
	Nuts & Bolts	ASTM A153	HDG
	Washers & Disc Springs	Plain	

Ordering Information

When ordering please specify the following :-

Type – Pipe Size – Insulation Thickness – Density

i.e. BG600 – 10 – 150– 160

	Item No.	Description	Material
Materials	1,2,3,4,6,7,8	Steelwork (Cradle)	ASTM A36/SS400
	5	HD PUF	High Density Polyurethane Foam
	9	Bolting	ASTM A193 Gr. B7
	10	Nuts	ASTM A194 Gr. 2H
	11	Flat Washer	Stainless Steel Gr.304
	12	Disc Springs	Stainless Steel Gr.301
	13	Vapour Barrier Tape	Slion Tape No. 9830
	14	Vapour Barrier Primary (Bottom Overlap 50)	Aluminium Mylar Foil 3 Layer 12 Polyester Film, 25 Aluminium Foil, 12 Polyester Film,
	15	Adhesive HD PUF to Vap. Barrier	Foster 85-75
	16	Mastic Cut Edge	Foster 60-90
	17	Metal Protection Shield (Aluminized Steel)	A463 T2 300 ASTM
	18	Joint Seal (Gap Cut Edge Top-Bottom HD PUF)	Textrafine 9000
	19	Adhesive HD PUF to HD PUF	Foster 81-84
	20	Adhesive Vapour Barrier to Metal Protection Shield	3M 4323/Vitro Bond
	21	Adhesive Metal Protection Shield to Cradle Steel (Bottom)	3M 4323/Vitro Bond



HD PUF CRYOGENIC PIPE SHOE (High Density Polyurethane Foam)

BG600-BG601-BG602-BG603

SUSTAINABLE LOADS

Density: 160 kg/m³
Design Bearing Arc: 60 deg
Design Stress: 0.735 Mpa

NPS Inch	Nom.	HD PUF Cradle Length			
		150mm	300mm	450mm	600mm
		kN	kN	kN	kN
0.5	12.5	1.4	2.7	4.1	5.4
0.75	20	1.6	3.1	4.7	6.3
1	25	2.0	3.9	5.9	7.9
1.5	40	2.8	5.7	8.5	11.4
2	50	3.6	7.1	10.7	14.2
2.5	65	4.3	8.6	12.9	17.2
3	80	5.2	10.5	15.7	20.9
4	100	6.7	13.5	20.2	26.9
5	125	8.3	16.6	25.0	33.3
6	150	9.9	19.8	29.7	39.6
8	200	12.9	25.8	38.7	51.6

Density: 240 kg/m³
Design Bearing Arc: 60 deg
Design Stress: 1.15 Mpa

NPS Inch	Nom.	HD PUF Cradle Length			
		150mm	300mm	450mm	600mm
		kN	kN	kN	kN
0.5	12.5	2.1	4.2	6.4	8.5
0.75	20	2.5	4.9	7.4	9.8
1	25	3.1	6.1	9.2	12.3
1.5	40	4.4	8.9	13.3	17.8
2	50	5.5	11.1	16.6	22.2
2.5	65	6.7	13.4	20.1	26.8
3	80	8.2	16.3	24.5	32.7
4	100	10.5	21.0	31.5	42.0
5	125	13.0	26.0	39.0	52.0
6	150	15.5	30.9	46.4	61.9
8	200	20.1	40.3	60.4	80.6
10	250	25.1	50.2	75.3	100.4
12	300	29.8	59.5	89.3	119.1
14	350	32.7	65.4	98.1	130.8
16	400	37.4	74.7	112.1	149.4
18	450	42.0	84.0	126.0	168.0
20	500	46.7	93.4	140.1	186.8
22	550	51.4	102.8	154.2	205.5
24	600	56.1	112.1	168.2	224.3

Layering Configuration	
Total Insulation Thickness (mm)	Layering Thicknesses (mm)
25	25
30	30
35	35
40	40
45	45
50	50
55	25/30
60	30/30
65	30/35
70	30/40
75	30/45
80	40/40
85	45/40
90	50/40
95	55/40
100	60/40
105	65/40
110	70/40
115	75/40
120	40/40/40
125	40/45/40
130	40/50/40
135	40/55/40
140	40/60/40
145	40/65/40
150	40/70/40
155	50/50/55
160	50/50/60
165	50/50/65
170	50/60/60
175	50/60/65
180	60/60/60
185	60/60/65
190	60/60/70
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200	60/65/75
205	75/65/65
210	75/65/70
215	75/65/75
220	75/70/75



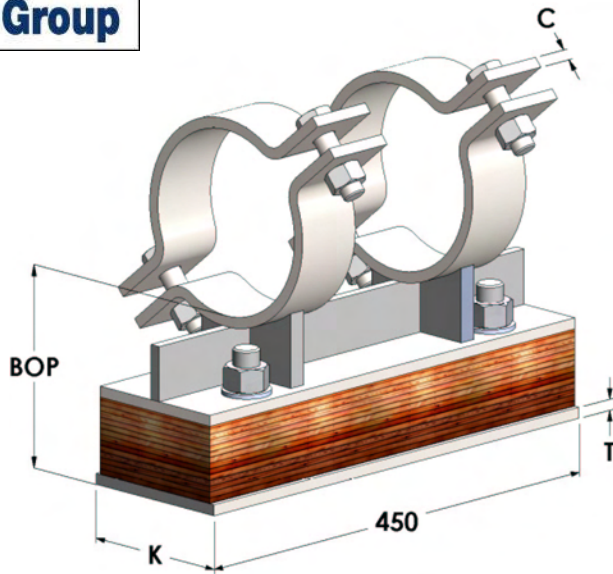
HD PUF CRYOGENIC PIPE SHOE **(High Density Polyurethane Foam)**

BG600-BG601-BG602-BG603

SUSTAINABLE LOADS

Density: 320 kg/m³
 Design Bearing Arc: 60 deg
 Design Stress: 2.035 Mpa

NPS Inch	Nom.	HD PUF Cradle Length			
		150mm	300mm	450mm	600mm
		kN	kN	kN	kN
0.5	12.5	3.8	7.5	11.3	15.0
0.75	20	4.3	8.7	13.0	17.4
1	25	5.4	10.9	16.3	21.7
1.5	40	7.8	15.7	23.5	31.4
2	50	9.8	19.6	29.4	39.2
2.5	65	11.9	23.7	35.6	47.4
3	80	14.4	28.9	43.3	57.8
4	100	18.6	37.1	55.7	74.3
5	125	23.0	45.9	68.9	91.8
6	150	27.3	54.7	82.0	109.4
8	200	35.6	71.2	106.8	142.4
10	250	44.4	88.8	133.1	177.5
12	300	52.6	105.3	157.9	210.5
14	350	57.8	115.6	173.3	231.1
16	400	66.0	132.1	198.1	264.1
18	450	74.3	148.5	222.8	297.0
20	500	82.5	165.1	247.6	330.2
22	550	90.8	181.7	272.5	363.3
24	600	99.1	198.2	297.4	396.5
26	650	107.2	214.5	321.7	429.0
28	700	115.5	231.1	346.6	462.1
30	750	123.8	247.6	371.5	495.3
36	900	148.5	297.0	445.6	594.1
40	1000	165.1	330.2	495.3	660.4
42	1050	173.4	346.8	520.1	693.5
48	1200	198.1	396.2	594.2	792.3
54	1350	222.9	445.9	668.8	891.8
60	1500	247.6	495.3	742.9	990.5
72	1800	297.2	594.4	891.6	1188.8



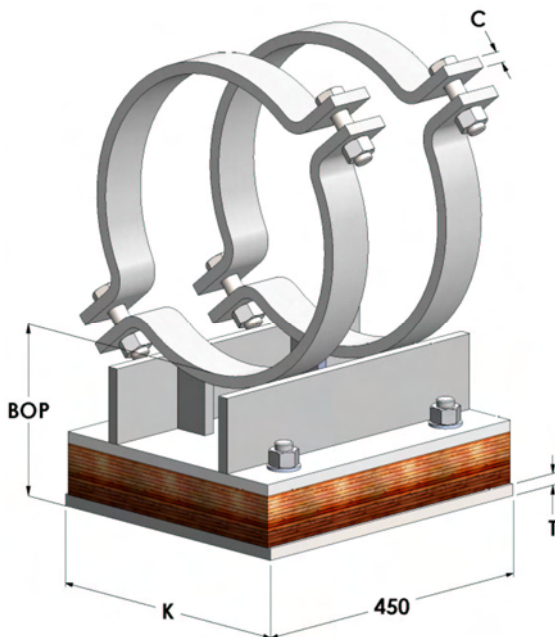
For line sizes up to 150NB

When ordering, please quote the Part No. for required size.

General Notes

1. Insulation Block thickness is 70mm standard.
2. BOP dimension includes shoe height, insulation block and carbon steel base plate.
3. Insulation Block is compressed laminated wood with Marine Varnish coating.
4. Please contact Binder Group for pipe shoes requiring lateral, vertical and axial restraints.
5. Standard batch traceability complete with type 2.2 material certificates.
6. Pipe Shoes are welded to AWS D1.1 pre-qualified procedures.
7. Alternative corrosion protection finishes available on request.
8. As an alternative material to Permali, DuroStone or Micarta are also available.

	Item No.	Description	Specification	Material
Materials	1	Upper Shoe	ASTM A240	SS 304
	2	Clamp Spacers	ASTM A312	SS 304
	3	Bolts	ASTM A193 B8M Class 1	SS 316
	4	Nuts	ASTM A194 8M	SS 316
	5	Flat Washer	ASTM A240	SS 304
	6	Insulation block	DIN7707 Gr.20227	Compressed Laminated Wood
	7	Base Plate (Including Studs)	ASTM A36	CS
	8	Nuts	ASTM A193 Gr.2H	CS
	9	Flat Washer	ASTM A36	CS



For line sizes 200NB to 1050NB

	Material	Specification	
Surface Finish	Upper Shoe	ASTM A967	Pickle & Passivated
	Spacers, Nuts, Bolts & Washers	-	Mill
	Insulation Block	-	Marine Varnish
	Base Plate, Nuts, Studs & Washers	ASTM A123	HDG

BG615 - Dimensional Details							
Nominal Size (NB)	BOP (mm)	Dim K (mm)	Clamp Thickness C (mm)	Clamp Bolt (mm)	Plate Thickness T (mm)	Base Bolt (mm)	Part No.
25	150	135	5	8	10	M16	615001
40	150	135	5	8	10	M16	615002
50	150	135	8	12	10	M16	615003
80	150	135	8	12	10	M16	615004
100	150	135	10	16	10	M16	615005
150	150	135	10	20	10	M16	615006
200	200	200	10	20	10	M20	615007
250	200	200	16	24	16	M20	615008
300	200	320	16	24	16	M20	615009
350	200	320	16	24	16	M20	615010
400	200	370	16	24	16	M20	615011
450	200	400	20	30	20	M24	615012
500	200	450	20	30	20	M24	615013
600	200	550	20	30	20	M24	615014
650	200	550	20	42	20	M24	615015
700	200	550	20	42	20	M24	615016
750	200	550	20	42	20	M24	615017
800	200	550	25	48	20	M24	615018
850	200	650	25	48	20	M24	615019
900	200	650	25	48	25	M24	615020
950	200	650	25	56	25	M24	615021
1000	200	650	25	56	25	M24	615022
1050	200	750	25	56	25	M24	615023