Test Report

Report No	2371/3375396 — This Report consists of 15 pages
Licence/Certificate No	VC 743696 (Application)
Client	Crane Limited T/A Crane Building Services and Utilities 46-48 Wilbury Way Hitchin SG4 0UD
Authority & date	BSI Service Management Order No 3375396
Items tested	MaxiFit - Ductile iron wide tolerance couplings and flange adaptors
Specification	BS EN 14525:2004 Clauses 4.1.1, 4.1.2, 4.1.3.1, 4.1.3.2, 4.1.3.3, 4.1.3.4, 4.1.3.5, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.2, 4.4.3, 4.5.1, 4.5.2 and 4.6.2 Immersive Testing – Level 1 Type test for verification certificate
Results	Pass - See Summary of Results on Page 2
Prepared by	C Higby — Senior Engineer
Authorized by	M Manito — Team Manager
Issue Date	16 June 2021
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EVALUATION, EXAMINATION AND ASSESSMENT OF MAXIFIT DUCTILE IRON WIDE TOLERANCE COUPLINGS AND FLANGE ADAPTORS SUBMITTED AS TYPE EVALUATION SAMPLES

INTRODUCTION

For the purpose of the verification certification the MaxiFit ductile iron wide tolerance couplings and flange adaptors detailed below, submitted on behalf of Crane Limited T/A Crane Building Services and Utilities, were evaluated and assessed against the requirements of BS EN 14525:2004 Clauses 4.1.1, 4.1.2, 4.1.3.1, 4.1.3.2, 4.1.3.3, 4.1.3.4, 4.1.3.5, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.2, 4.4.3, 4.5.1, 4.5.2 and 4.6.2 as indicated on the following pages of this Report. This request was made on a BSI Service Management Order.

It is emphasised that assessments were not made against the other clauses of the Specification.

The evaluations and assessments contained in this report was performed immersively at the client's site at Crane Limited T/A Crane Builidng Services and Utilities, 46-48 Wilbury Way, Hitchin, SG4 0UD from 19-22 April 2021, in the presence of BSI and technically evaluated by the test report author.

TEST ITEMS

Sample No	Nominal Size (mm)	Component Description
1	DN 100	MaxiFit, Non-restrained flange adaptor
2	DN 200	MaxiFit, Non-restrained flange adaptor
3	DN 50	MaxiFit, Non-restrained flange adaptor
4	DN 50	MaxiFit, Non-restrained coupler
5	DN 100	MaxiFit, Non-restrained flange adaptor
6	DN 100	MaxiFit, Non-restrained coupler
7	DN 200	MaxiFit, Non-restrained flange adaptor
8	DN 200	MaxiFit, Non-restrained coupler
9	DN 300	MaxiFit, Non-restrained flange adaptor
10	DN 300	MaxiFit, Non-restrained coupler

Note: Test items 1 and 2 were subject to the required performance tests in accordance with Clause 4.6.2

SUMMARY OF RESULTS

The test items assessed met the requirements or parts thereof, of the Specification against which evaluations were made.

BS EN 14525:2004

PRODUCT EVALUATION

CLAUSE				ASSESSMENT
4	**Technical Requirements**			
4.1	**General**			
4.1.1	**Diameter Range**			
	The working range defined by the minimum and maximum outside diameter range was declared by the manufacturer and was within the range as detailed with Table 1.			Pass
		Minimum	**Declared**	
	Maximum DN of the pipes to be connected			
	40<DN ≤100	10 mm	20.0 - 40.0mm	Pass
	125< DN ≤150	15 mm	20.0 - 40.0mm	Pass
	175< DN ≤200	15 mm	25.0 - 50.0mm	Pass
	225< DN ≤250	20 mm	25.0 - 50.0mm	Pass
	DN 300	20mm	25.0 – 50.0mm	Pass
4.1.2	**Surface condition and repairs**			
	The manufacturer declared that no repairs were undertaken on the ductile iron castings.			Pass
4.1.3	**Type of joints and interconnection**			
4.1.3.1	**General**			
	The manufacturer supplied documentary evidence detailing that the rubber gaskets used complied with the requirements of EN 681-1 type WA.			Pass
4.1.3.2	**Flanged joints**			
	The flanged joints were constructed in such a way that they may be attached to flanges whose dimensions and tolerances comply with EN 1092-2. See sample tables 1-4.			Pass
4.1.3.3	**Flexible joints**			
	The non-restrained flexible joints met the performance requirements of clause 5.			Pass
4.1.3.4	**Mechanical properties of bolts and nuts**			
	The manufacturer declared that the bolts and nuts complied with DIN 125 grade 4.8.			Pass
	The manufacturer declared that the stainless steel washers (A2 ST/ST) complied with BS4320.			Pass
4.1.3.5	**Materials in contact with water intended for human consumption.**			
	The manufacturer provided valid WRAS certificates for the materials in contact with water intended for human consumption.			Pass

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PRODUCT EVALUATION (CONTINUED)

CLAUSE				ASSESSMENT
4	**Technical Requirements (Continued)**			
4.2	**Dimensional requirements**			
4.2.1	**Wall thickness**	**Specified**	**Actual**	
	DN 50 Flange Adaptor (mm)	4.0 min	4.01 min	Pass
	DN 50 Flange Coupler (mm)	4.0 min	4.50 min	Pass
	DN 100 Flange Adaptor (mm)	4.0 min	4.08 min	Pass
	DN 100 Coupler (mm)	4.0 min	4.53 min	Pass
	DN 200 Flange Adaptor (mm)	4.0 min	4.18 min	Pass
	DN 200 Coupler (mm)	4.0 min	4.69 min	Pass
	DN 300 Flange Adaptor (mm)	5.0 min	5.55 min	Pass
	DN 300 Coupler (mm)	5.0 min	5.04 min	Pass
4.2.2	**Joint gap and depth of engagement**			
	The manufacturer declared the maximum allowable joint gap			Pass
	Declared maximum joint gap	**Specified**	**Declared**	
	DN 50 Flange Adaptor (mm)	15 min	40 max	Pass
	DN 100 Flange Adaptor (mm)	15 min	40 max	Pass
	DN 100 Coupler (mm)	20 min	40 max	Pass
	DN 200 Flange Adaptor (mm)	20 min	40 max	Pass
	DN 200 Coupler (mm)	25 min	50 max	Pass
	DN 300 Flange Adaptor (mm)	30 min	60 max	Pass
	DN 300 Coupler (mm)	35 min	50 max	Pass
4.3	**Mechanical properties of ductile iron**			
4.3.1	**Tensile properties**			
	The manufacturer provided documentary evidence that the minimum tensile strength was 480 MPa and a minimum elongation of 20.5% at fracture. The minimum requirement was 420/5.			Pass
4.3.2	**Hardness**			
	The manufacturer provided documentary evidence that the Brinell hardness was 164-165 HB. The maximum value allowed was 250 HB.			Pass
4.4	**Coatings**			
4.4.1	**General**			
	The coupling and flange adaptors were coated internally and externally. The coating complied with NFA 490713, NF 49-714 and AWWA-C224-01. No relevant EN standard currently exists at the time of publication of this Test Report.			Pass
4.4.2	**Coating of ductile iron components**			
	The coating used was Rilsan Fine Powder T Black 7450 AC with Primgreen LAT 12035 primer and was works- applied.			Pass
4.4.3	**Coating of bolts and nuts**			
	The bolts and nuts were suitably protected to inhibit corrosion. The bolts and nuts were protected by a zinc based corrosion protection.			Pass

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PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
4	**Technical Requirements (Continued)**	
4.5	**Product information**	
4.5.1	**Marking requirements**	
	The couplers and flange adaptors were legibly and durably marked	Pass
	Specified marking:	
	- manufacturer's name or mark	Pass
	- identification of year of manufacture	Pass
	- identification of ductile iron	Pass
	- DN and PN rating of flanges were applicable	Pass
	- reference to this Standard	Pass
	- an identification of the minimum and maximum outside diameters (range of external diameters over which the product works)	Pass
	- PFA of the coupling or of the flange adaptor	Pass
	The first five corresponding markings were cast. Additionally the other specified markings were applied by means of a label.	Pass
4.5.2	**Additional information**	
	The following information was supplied by means of a label attached to the coupler or flange adaptor or available within the manufacturers jointing instruction literature.	Pass
	Specified Marking:	
	- maximum joint gap	Pass
	- minimum depth of engagement	Pass
	- maximum allowable angular deflection	Pass
	- pipe materials for which the coupling or flange adaptor is intended to be used with non-restrained joints	Pass
	- need for supporting sleeves (insert)	-
	- bolt torque	Pass
	Jointing instructions were available on the manufacturers website and supplied with the product.	Pass

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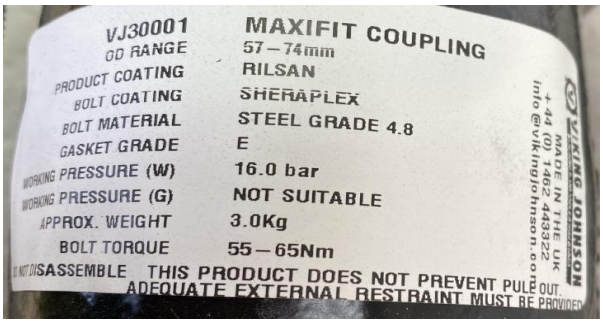
PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
4	**Technical Requirements (Continued)**	
4.5	**Product information (continued)**	
4.5.1/4.5.2	**Marking requirements/ Additional information (Continued)**	
	Actual marking	

DN 50 Coupler
Cast on body and flange
VJ MAXIFIT 12390-15 D 18X20 YL3 57-74MM
12418-1 13J20 YL VJ MAXIFIT (LOGO) DN50 EN 14525 SG PN10-16
Label



DN 50 Flange adaptor
Cast on body and flange
VJ MAXIFIT 12390-15 D10L20 YL2 57-74MM SG PN10-16 EN14525
Label

DN100 Flange adaptor
Cast on body and flange
VJ MAXIFIT 107-132MM 13371-3 TL1D 06L20 YL 14L20 13374 SG PN10-16 DN100
Label

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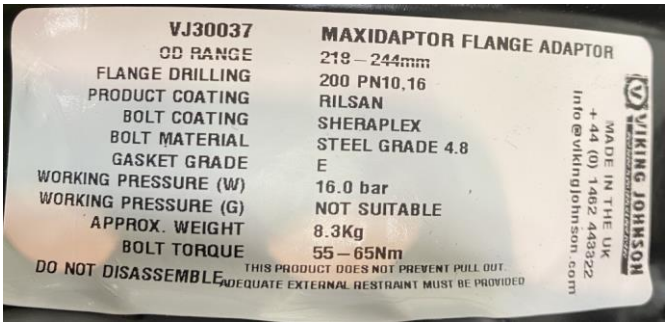
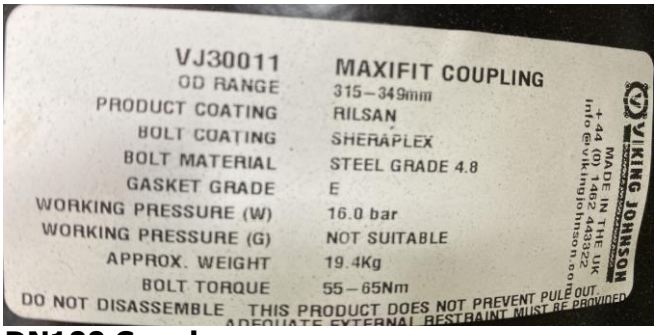
PRODUCT EVALUATION (CONTINUED)

CLAUSE		**ASSESSMENT**
4	**Technical Requirements (Continued)**	
4.5	**Product information (continued)**	
4.5.1/4.5.2	**Marking requirements/ Additional information (Continued)**	
	Actual marking	

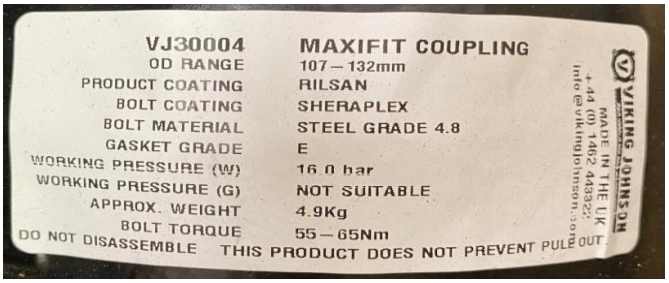
DN200 Flange adaptor
Cast on body and flange
YL D 128K20 218-244MM VIKING JOHNSON MAXIFIT 12390-9
12403 MAXIFIT PN10-16 DN200 EN 14525 SG YL13K20
Label



DN300 Coupler
Cast on body and coupler
315-349MM VIKING JOHNSON MAXIFIT 12390-13 (LOGO)
D06L20 YL
YL 12418-14 03L20 (LOGO) SG VJ DN300 MAXIFIT EN 14525
Label



DN100 Coupler
Cast on body and coupler
VJ MAXIFIT 12390-3 107-132MM YL4 10J20
VJ DN100 MAXIFIT EN 14525 (LOGO) SG YL 12418-4 03J20
Label



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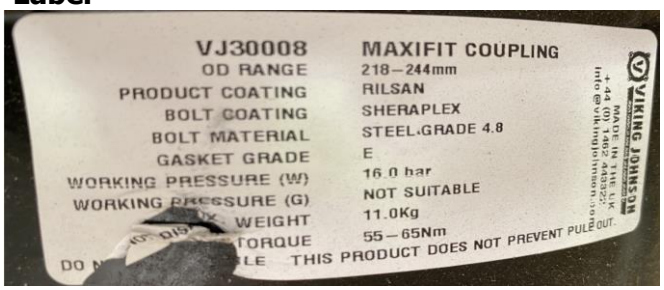
PRODUCT EVALUATION (CONTINUED)

CLAUSE		**ASSESSMENT**
4	**Technical Requirements (Continued)**	
4.5	**Product information (continued)**	
4.5.1/4.5.2	**Marking requirements/ Additional information (Continued)**	
	Actual marking	

DN 200 Coupler
Cast on body and coupler
VIKING JOHNSON 218-244MM YLD 05L20 12390-9
YL-1 12418-10 09M20 (LOGO) SG VJ DN200 MAXIFIT EN 14525
Label



DN300 Flange adaptor
Cast on body and flange
VJ MAXIFIT VIKING JOHNSON (LOGO) YL V6L20 315-349MM 12390-18
25L20 SG EN 14525 PN10-16 DN300 MAXIFIT 12406 YL
Label

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PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
5	**Performance requirements for joints**	
5.3	**Flexible joints**	
5.3.1	**General**	
	The performance requirements were carried out in accordance with Table 4 and Clause 7.	
7	**Performance tests**	
7.1	**Leak tightness of joints to positive internal pressure.**	
	Assemblies of socketed flange adaptors were tested in accordance with the method described in this clause using the relevant test conditions detailed in clause 5.3 and Table 4.	
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 133mm rolled steel pipe (Maximum OD)** **Joint position: Deflected** A flange adaptor assembly was pressurized to 29 bar for 2 hours with an angular deflection of 3.5°.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 133mm rolled steel pipe (Maximum OD)** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 29 bar for 2 hours with a shear load of 2000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 108mm rolled steel pipe (Minimum OD)** **Joint position: Deflected** A flange adaptor assembly was pressurized to 29 bar for 2 hours with an angular deflection of 4.0°.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 108mm rolled steel pipe (Minimum OD)** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 29 bar for 2 hours with a shear load of 2000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass

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PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
7	**Performance tests (Continued)**	
7.1	**Leak tightness of joints to positive internal pressure (Continued)** Assemblies of socketed flange adaptors were tested in accordance with the method described in this clause using the relevant test conditions detailed in clause 5.3 and Table 4.	
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 244.5mm rolled steel pipe (Maximum OD)** **Joint position: Deflected** A flange adaptor assembly was pressurized to 29 bar for 2 hours with an angular deflection of 4.0°.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 244.5mm rolled steel pipe (Maximum OD)** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 29 bar for 2 hours with a shear load of 4000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 219mm rolled steel pipe (Minimum OD)** **Joint position: Deflected** A flange adaptor assembly was pressurized to 29 bar for 2 hours with an angular deflection of 4.0°.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 219mm rolled steel pipe (Minimum OD)** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 29 bar for 2 hours with a shear load of 4000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass

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PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
7	**Performance tests (Continued)**	
7.1	**Leak tightness of joints to positive internal pressure (Continued)**	
	Assemblies of socketed flange adaptors were tested in accordance with the method described in this clause using the relevant test conditions detailed in clause 5.3 and Table 4.	
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 110mm PVC PN10 pipe** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 20 bar for 2 hours with a shear load of 2000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 110mm PVC PN16 pipe** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 29 bar for 2 hours with a shear load of 2000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 225mm PVC PN6 pipe** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 14 bar for 2 hours with a shear load of 4000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 225mm PVC PN10 pipe** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was pressurized to 20 bar for 2 hours with a shear load of 4000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass

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PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
7	**Performance tests (Continued)**	
7.2	**Leak tightness of joints to negative internal pressure (Continued)**	

Assemblies of socketed flange adaptors were tested in accordance with the method described in this clause using the relevant test conditions detailed in clause 5.3 and Table 4.

Product: MaxiDaptor (Plus) 100mm Flange Adaptor
Pipe : 108mm rolled steel pipe (Minimum OD)
Joint position: Aligned with shear load and withdrawn
A flange adaptor assembly with a maximum annular gap was evacuated to -0.81 bar for 2 hours with a shear load of 2000N

	Specified	**Actual**	
Change in internal pressure (bar)	0.08 max	0.01	Pass

Product: MaxiDaptor 200mm Flange Adaptor
Pipe : 219mm rolled steel pipe (Minimum OD)
Joint position: Aligned with shear load and withdrawn
A flange adaptor assembly with a maximum annular gap was evacuated to -0.80 bar for 2 hours with a shear load of 4000N

	Specified	**Actual**	
Change in internal pressure (bar)	0.08 max	0.00	Pass

Product: MaxiDaptor (Plus) 100mm Flange Adaptor
Pipe : 110mm PVC PN16 pipe
Joint position: Aligned with shear load and withdrawn
A flange adaptor assembly with a maximum annular gap was evacuated to -0.83 bar for 2 hours with a shear load of 2000N

	Specified	**Actual**	
Change in internal pressure (bar)	0.08 max	0.01	Pass

Product: MaxiDaptor 200mm Flange Adaptor
Pipe : 225mm PVC PN6 pipe
Joint position: Aligned with shear load and withdrawn
A flange adaptor assembly with a maximum annular gap was evacuated to -0.80 bar for 2 hours with a shear load of 4000N

	Specified	**Actual**	
Change in internal pressure (bar)	0.08 max	0.00	Pass

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PRODUCT EVALUATION (CONTINUED)

CLAUSE		ASSESSMENT
7	**Performance tests (Continued)**	
7.3	**Leak tightness of joints to dynamic internal pressure (Continued)**	
	Assemblies of socketed flange adaptors were tested in accordance with the method described in this clause using the relevant test conditions detailed in clause 5.3 and Table 4.	
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 108mm rolled steel pipe (Minimum OD)** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was tested with the pressure cycled between 9 bar and 18 bar for 24000 cycles with a shear load of 2000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 219mm rolled steel pipe (Minimum OD)** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was tested with the pressure cycled between 9 bar and 18 bar for 24000 cycles with a shear load of 4000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	
	Product: MaxiDaptor (Plus) 100mm Flange Adaptor **Pipe : 110mm PVC PN10 pipe** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was tested with the pressure cycled between 3 bar and 8 bar for 24000 cycles with a shear load of 2000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass
	Product: MaxiDaptor 200mm Flange Adaptor **Pipe : 225mm PVC PN6 pipe** **Joint position: Aligned with shear load and withdrawn** An assembly with a maximum annular gap was tested with the pressure cycled between 3 bar and 8 bar for 24000 cycles with a shear load of 4000N min at 50mm from the coupling face.	
	During the test there was no leakage from the joint	Pass

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PRODUCT EVALUATION (CONTINUED)

Sample Table No 1 : DN 50 PN10-PN16 flange adaptor

Refer to clause 4.1.3.2 of BS EN 14525:2004

Flange dimension: DN50 PN10-16	Specified	Actual	Assessment
Outside diameter D (mm)	165 nom(1)	165	-
Diameter of bolt circle K (mm)	125 nom(1)	128	-
Diameter of bolt holes L (mm)	19-20.5	19.1	Pass
Number of bolt holes	4	4	Pass
Flange thickness C (mm)	19 nom(1)	18.3	-
Flange thickness b (mm)	13-20	17.2	Pass
Raised face height f (mm)	1 min	1.1	Pass
Raised face diameter d (mm)	95 min	95.1	Pass

Flange dimensions from Tables 5 and 9 of EN 1092-2:1997
Flange dimension tolerances taken from Table 13 of EN 1092-2:1997

(1) No tolerance specified for these dimensions.

Sample Table No 2 : DN 100 PN10-PN16 flange adaptor

Refer to clause 4.1.3.2 of BS EN 14525:2004

Flange dimension: DN100 PN10-16	Specified	Actual	Assessment
Outside diameter D (mm)	220 nom(1)	232	-
Diameter of bolt circle K (mm)	180 nom(1)	185	-
Diameter of bolt holes L (mm)	19-20.5	19.9	Pass
Number of bolt holes	8	8	Pass
Flange thickness C (mm)	19 nom(1)	20.6	-
Flange thickness b (mm)	13-20	19.4	Pass
Raised face height f (mm)	1 min	1.2	Pass
Raised face diameter d (mm)	152 min	152.9	Pass

Flange dimensions from Tables 5 and 9 of EN 1092-2:1997
Flange dimension tolerances taken from Table 13 of EN 1092-2:1997

(1) No tolerance specified for these dimensions.

BS EN 14525:2004

PRODUCT EVALUATION (CONTINUED)

Sample Table No 3 : DN 200 PN10-PN16 flange adaptor

Refer to clause 4.1.3.2 of BS EN 14525:2004

Flange dimension: DN200 PN10-16	Specified	Actual	Assessment
Outside diameter D (mm)	340 nom(1)	335	-
Diameter of bolt circle K (mm)	295 nom(1)	300	-
Diameter of bolt holes L (mm)	21.5-23	22.0	Pass
Number of bolt holes	12	12	Pass
Flange thickness C (mm)	20 nom(1)	20.9	-
Flange thickness b (mm)	14-21	19.4	Pass
Raised face height f (mm)	1 min	1.5	Pass
Raised face diameter d (mm)	261.5 min	265	Pass

Flange dimensions from Tables 5 and 9 of EN 1092-2:1997
Flange dimension tolerances taken from Table 13 of EN 1092-2:1997

(1) No tolerance specified for these dimensions.

Sample Table No 4 : DN 300 PN10-PN16 flange adaptor

Refer to clause 4.1.3.2 of BS EN 14525:2004

Flange dimension: DN300 PN10-16	Specified	Actual	Assessment
Outside diameter D (mm)	455 nom(1)	457	-
Diameter of bolt circle K (mm)	410 nom(1)	410	-
Diameter of bolt holes L (mm)	28-29.5	28.0	Pass
Number of bolt holes	12	12	Pass
Flange thickness C (mm)	24.5 nom(1)	24.1	-
Flange thickness b (mm)	17.5-24.5	21.7	Pass
Raised face height f (mm)	1 min	2.4	Pass
Raised face diameter d (mm)	365 min	369	Pass

Flange dimensions from Tables 5 and 9 of EN 1092-2:1997
Flange dimension tolerances taken from Table 13 of EN 1092-2:1997

(1) No tolerance specified for these dimensions.

End of Report