



DONIT[®]
Made in EU



DONIT[®]
A perfect fit

CASE STUDY: NUCLEAR REACTOR

Problem description

DONIT® – We are creating a perfect fit – Not only for the whole range of industries, but also in the field of research institutes. We are proud to present you a case study on a gasket product specially developed for nuclear research Institute. They operate one of the major high flux MTR type reactors in the world. In a face of overhaul, the Institute decided to replace 15 years old gaskets applied to the reactor.

The challenge undertaken in this project was to produce a proper welded, corrugated aluminum-jacketed gasket. The gasket had to fulfill very strict requirements in order to create a perfect fit between reactor vessel and its two covers. Leak rate ought to be lower than 0.1 mg/(s•m) at room temperature and 22.5 bar pressure. Test media was nitrogen. To prevent possible damages on reactor vessel the gasket had to be designed only one-side corrugated.

The old gasket was filled with asbestos. But at DONIT® we are committed to high environmental standards and no longer produce gaskets containing any form of asbestos. Besides that, asbestos is banned in the EU. Our research team then proposed even better solution: graphite filler. The Institute agreed with this.

Based on leak test results for different gasket compositions a decision was taken to use a special graphite composition and geometry to reduce the leak rate of the final gasket.

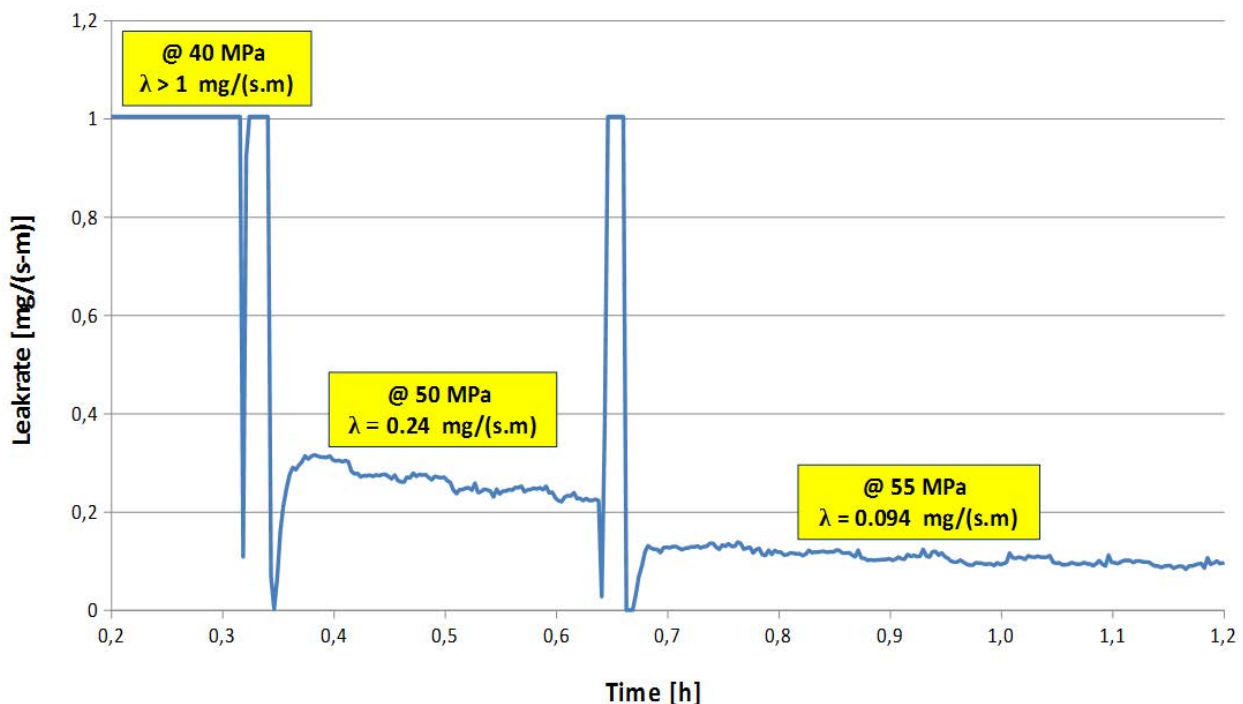


Figure 1: Leak rate MP14 Al f174Xf90X3.1 mm + special graphite composition & geometry inside - 30-55 MPa, 22.5 bar N₂, welded + polished

To get additional information about the gasket behavior inside the flange the Fuji Film was used. This was of great help to understand the correlation between the sealing surface roughness – flatness and the leak rate of the gasket in the real Application. Darker red areas represent higher pressure – up to 50 MPa. It can also be seen how the additional graphite layer improves sealing performance.



Figure 2: Fuji film, corrugated side

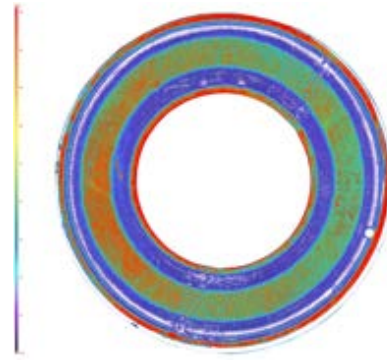


Figure 3: Fuji film, flat side

Solution

DONIT® successfully implemented everything required. It was a great challenge for DONIT® to apply latest state of the art technology to design the final gasket.



Figure 4: Final gasket solution

The result is:

- One side corrugated gasket
- Leak rate lower than 0.1 mg/(s•m) at 22.5 bar pressure
- TIG welded without additional material
- Weld polished on the sealing surface side
- Special graphite filler composition and geometry inside
- Inside diameter: 2159 mm
- Outside diameter: 2267 mm

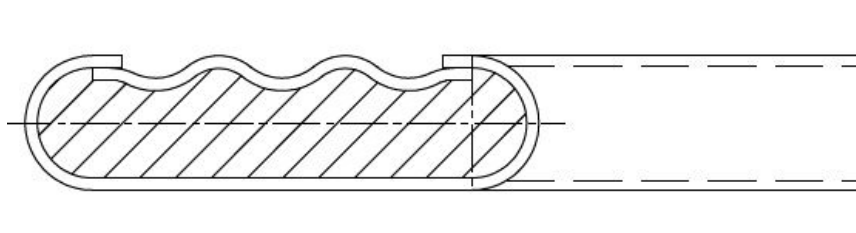


Figure 5: Standard one side corrugated gasket as a basis for development

As mentioned, the above metal-jacketed gasket was designed and made especially for the Institute. But it now belongs to a broader product family of metal-jacketed gaskets produced by DONIT®. You can find more information about it on the following pages.

METAL-JACKETED GASKETS



PROPERTIES AND APPLICATIONS

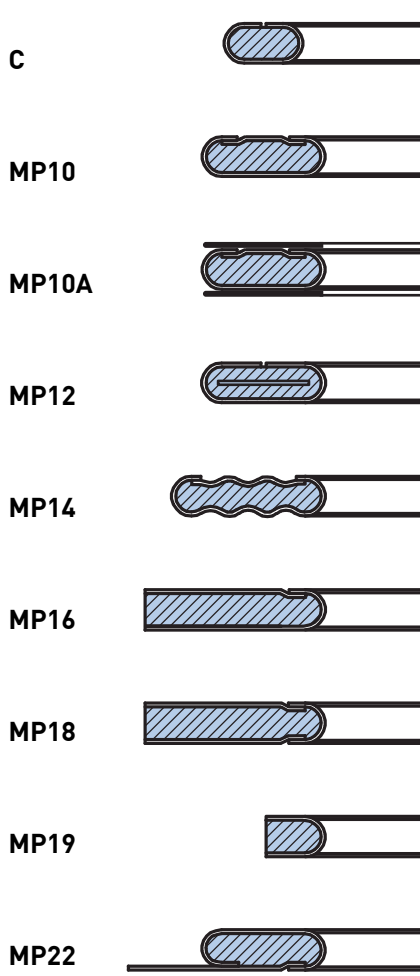
Metal-jacketed gaskets are particularly suitable for sealing flat surfaces of heat exchangers, gas pipes, cast iron flanges, autoclaves and similar. By their sealing efficiency, provided by exerting strong pressure on circular rims of the flanges, metal-jacketed gaskets can stand up to 30% deviation from the initial thickness, which is very useful in case of irregular or faulty flange rims. The chemical compatibility of the metal and the medium being sealed should be considered.

ADVANTAGES

Suitable for high assembly stress.
Highly resistant against blow-out.

SHAPE AND CONSTRUCTION

Metal-jacketed gaskets are produced in several types to meet the requirements of the most demanding applications. Inside a metallic jacket they feature a soft filler as shown in the figure.



SHAPE AND CONSTRUCTION

Material	ASTM	EN (DIN) Material No.
Low Carbon Steel	Soft iron (CS)	1.0333
Stainless steel	AISI 304	1.4301
Stainless steel	AISI 316, 316 L	1.4401, 1.4404
Stainless steel	AISI 316 Ti	1.4571
Stainless steel	AISI 321	1.4541
Monel (NiCu30Fe)	Alloy 400	2.4360
Copper	Copper	2.0090
Brass	Brass Ms 63	2.0321

The metallic jacket is normally 0.4 mm thick. Other materials are available on customer request.

Filler

The standard filler material is Flexible Graphite. Other fillers like ceramic, mineral or other can also be used.

SIZE

The metal-jacketed gaskets come in sizes according to EN 1514-4 ASME B 16.21 standards.

Maximum size:

Outside diameter: up to 4000 mm
Thickness: from 2 to 12 mm

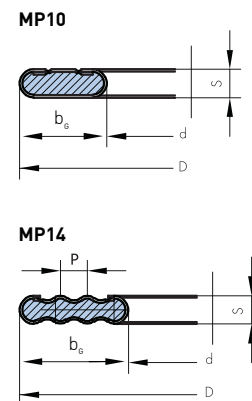
Gasket Type	MATERIAL (Jacket)	DIN 2505		ASME	
		ki [mm]	K0xKD [N/mm]	m	y [MPa]
MP10, MP12, MP16, MP18, MP19, MP22	Cr-Ni steel	2.0Xb _G	100xb _G	2.0	100
	Soft iron	1.8Xb _G	70xb _G	1.8	70
	Cu	1.6Xb _G	60XD _G	1.6	60
	Ms	1.6Xb _G	60xb _G	1.6	60

STANDARDS FOR METAL-JACKETED GASKETS USED WITH FLANGES	
METAL-JACKETED GASKETS - Standard	Flange Standard
EN 1514-4:1997	EN 1092-1
EN 1514-7:2004	EN 1092-1
ASME B16.20	ASME B16.5
ASME B16.20	ASME B16.47

EN 1514-7:2004 is valid for covered metal-jacketed gaskets

EN 1514-4:1997 Metal-jacketed Gaskets for EN 1092-1 Flanges

DN	Gasket inside diameter min. d [mm]	Gasket or center ring outside diameter D [mm]					
		PN10	PN16	PN25	PN40	PN63	PN100
10	18	48	48	48	48	58	58
15	22	53	53	53	53	63	63
20	27	63	63	63	63	74	74
25	34	73	73	73	73	84	84
32	43	84	84	84	84	90	90
40	49	94	94	94	94	105	105
50	61	109	109	109	109	115	121
65	77	129	129	129	129	140	146
80	89	144	144	144	144	150	156
100	115	164	164	170	170	176	183
125	141	194	194	196	196	213	220
150	169	220	220	226	226	250	260
200	220	275	275	286	293	312	327
250	273	330	331	343	355	367	394
300	324	380	386	403	420	427	461
350	356	440	446	460	477	489	515
400	407	491	498	517	549	546	575
450	458	541	558	567	574	-	-
500	508	596	620	627	631	660	708
600	610	698	737	734	750	768	819
700	712	813	807	836	-	883	956
800	813	920	914	945	-	994	-
900	915	1020	1014	1045	-	1114	-



ASME B16.20–2012 Metal-jacketed Gasket Dimensions for ASME B 16.5 Flanges

NPS [in]	d [mm]	D [mm]						
		Class 150	Class 300	Class 400	Class 600	Class 900	Class 1500	Class 2500
1/2"	22.4	44.5	50.8	50.8	50.8	60.5	60.5	66.8
3/4"	28.7	54.1	63.5	63.5	63.5	66.8	66.8	73.2
1"	38.1	63.5	69.9	69.9	69.9	76.2	76.2	82.6
1 1/4"	47.8	73.2	79.5	79.5	79.5	85.9	85.9	101.6
1 1/2"	54.1	82.6	92.2	92.2	92.2	95.3	95.3	114.3
2"	73.2	101.6	108.0	108.0	108.0	139.7	139.7	143.0
2 1/2"	85.9	120.7	127.0	127.0	127.0	162.2	162.2	165.1
3"	108.0	133.4	146.1	146.1	146.1	165.1	171.5	193.8
4"	131.8	171.5	177.8	174.8	190.5	203.2	206.5	231.9
5"	152.4	193.8	212.9	209.6	238.3	244.6	251.0	276.4
6"	190.5	219.2	247.7	244.6	263.7	285.8	279.4	314.5
8"	238.3	276.4	304.8	301.8	317.5	355.6	349.3	384.3
10"	285.8	336.6	358.9	355.6	397.0	431.8	431.8	473.2
12"	342.9	406.4	419.1	416.1	454.2	495.3	517.7	546.1
14"	374.7	447.8	482.6	479.6	489.0	517.7	574.8	
16"	425.5	511.3	536.7	533.4	562.1	571.5	638.3	
18"	489.0	546.1	593.9	590.6	609.6	635.0	701.8	
20"	533.4	603.3	651.0	644.7	679.5	695.5	752.6	
24"	641.4	714.5	771.7	765.3	787.4	835.2	898.7	

ASME B16.20–2012 Metal-jacketed Gasket Dimensions for ASME B 16.47 Series A Flanges

NPS (in)	d (mm)	D (mm)					
		Class (lb)	150	300	400	600	900
26"	673.1		771.7	831.9	828.8	863.6	879.6
28"	723.9		828.8	895.4	889.0	911.4	943.1
30"	774.7		879.6	949.5	943.1	968.5	1006.6
32"	825.5		936.8	1003.3	1000.3	1019.3	1070.1
34"	876.3		987.6	1054.1	1051.1	1070.1	1133.6
36"	927.1		1044.7	1114.6	1114.6	1127.3	1197.1
38"	977.9		1108.2	1051.1	1070.1	1101.9	1197.1
40"	1028.7		1159.0	1111.3	1124.0	1152.7	1247.9
42"	1079.5		1216.2	1162.1	1174.8	1216.2	1298.7
44"	1130.3		1273.3	1216.2	1228.9	1267.0	1365.3
46"	1181.1		1324.1	1270.0	1286.0	1324.1	1432.1
48"	1231.9		1381.3	1320.8	1343.2	1387.6	1482.9
50"	1282.7		1432.1	1374.9	1400.3	1444.8	
52"	1333.5		1489.2	1425.7	1451.1	1495.6	
54"	1384.3		1546.4	1489.2	1514.6	1552.7	
56"	1435.1		1603.5	1540.0	1565.4	1603.5	
58"	1485.9		1660.7	1590.8	1616.2	1660.7	
60"	1536.7		1711.5	1641.6	1679.7	1730.5	

ASME B16.20–2012 Metal-jacketed Gasket Dimensions for ASME B 16.47 Series B Flanges

NPS (in)	d (mm)	D (mm)				
	Class (lb)	150	300	400	600	900
26"	673.1	722.4	768.4	743.0	762.0	835.2
28"	723.9	773.2	822.5	797.1	816.1	898.7
30"	774.7	824.0	882.7	854.2	876.3	955.8
32"	825.5	877.8	936.8	908.1	930.4	1013.0
34"	876.3	931.9	990.6	958.9	993.9	1070.1
36"	927.1	984.3	1044.7	1019.3	1044.7	1120.9
38"	977.9	1041.4	1095.5	1070.1	1101.9	1197.1
40"	1028.7	1092.2	1146.3	1124.0	1152.7	1247.9
42"	1079.5	1143.0	1197.1	1174.8	1216.2	1298.7
44"	1130.3	1193.8	1247.9	1228.9	1267.0	1365.3
46"	1181.1	1252.5	1314.5	1286.0	1324.1	1432.1
48"	1231.9	1303.3	1365.3	1343.2	1387.6	1482.9
50"	1282.7	1354.1	1416.1	1400.3	1444.8	
52"	1333.5	1404.9	1466.9	1451.1	1495.6	
54"	1384.3	1460.5	1527.3	1514.6	1552.7	
56"	1435.1	1511.3	1590.8	1565.4	1603.5	
58"	1485.9	1576.3	1652.5	1616.2	1660.7	
60"	1536.7	1627.1	1703.3	1679.7	1730.5	

TOLERANCES [mm]

	up to 24"	above 24"
D	+ 1.5	+ 3.3
	0	0
d	+ 1.5	+ 3.3
	0	0
s	+ 0.8	+ 0.8
	0	0

GASKET ORDERING EXAMPLE**STANDARD DIMENSION:**

Metal-jacketed gasket MP
10, ASME B 16.5, 8"-600lbs
Material: AISI 304
Filler: Graphite

NON-STANDARD DIMENSION:

Metal-jacketed gasket MP 10
D = 836 mm, d = 804 mm, s = 3.2 mm
Material: 1.4301
Filler: Mineral

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Disclaimer

All information data quoted are based on years of experience in production and operation of sealing elements. However, in view of the wide variety of possible installation and operating conditions one cannot draw final conclusions in all application cases regarding the behaviour in a gasket joint. The data may not, therefore, be used to support and warranty claims. Whenever there is any doubt, our staff will be pleased to assist you finding the optimum sealing solution

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