

Technical catalogue

Energized seals



ENERGIZED SEALS
AND INDUSTRIAL SEALS



SEALS FOR OIL & GAS INDUSTRY

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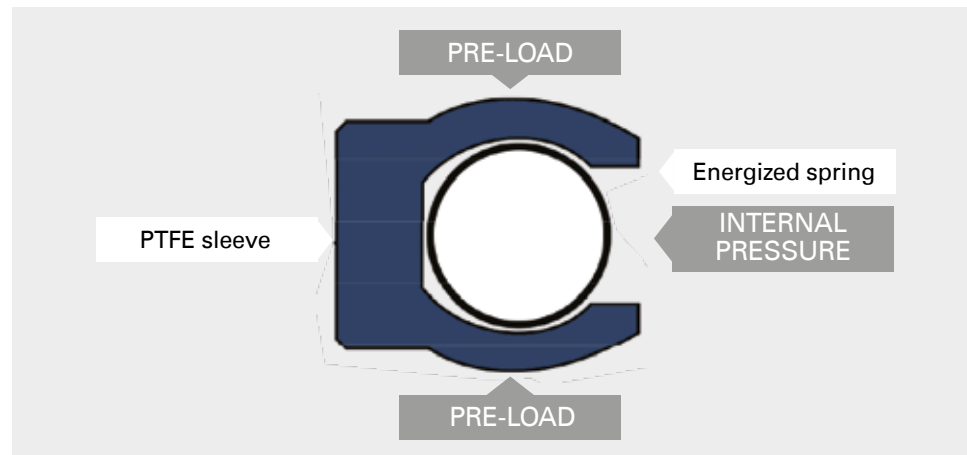
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01.0

The Energized Seal concept

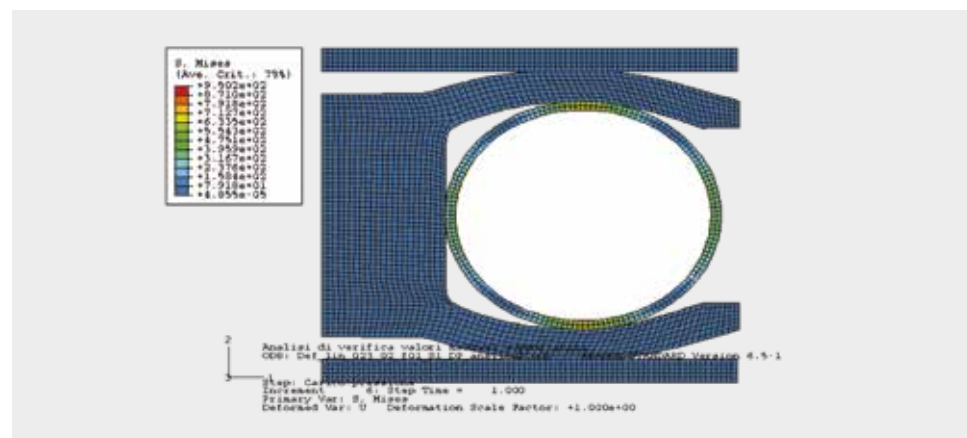
The way the seal functions is quite simple. There is an external component called sleeve, usually in fluorinated polymer, which corresponds to the seal, and an internal spring that makes the system elastic. Once the seal is mounted in its seat, the spring is compressed due to the interaction of the seal with the groove, thus exerting a force which, along with that generated by the system under pressure, ensures that the seal holds.

Figure 1
How the seal works



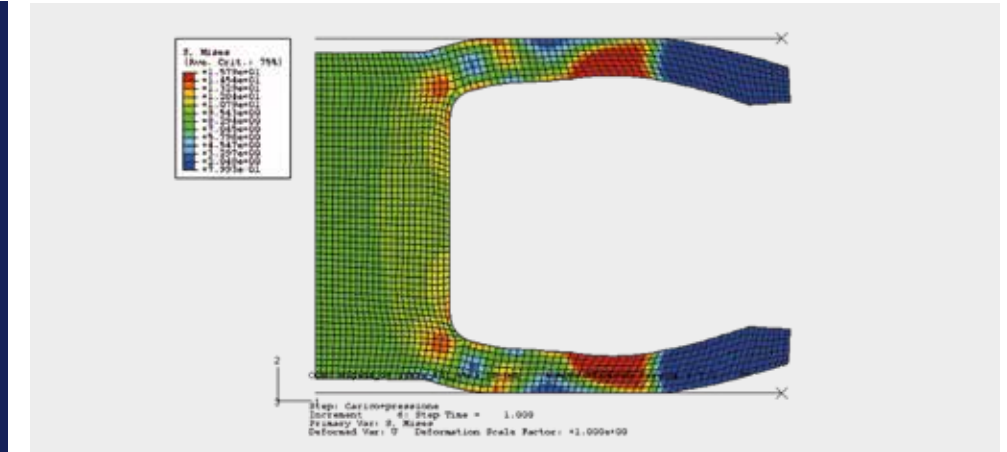
The analysis and study of the Finite Elements helps us better understand what the basic concepts of the seal hold are and what parts of the seal are more likely than others to yield under pressure. Below is an example of a seal fitted in a groove where the dynamics of the compression (in this case, minimal) of the spring can be clearly seen, and the virtual absence of sleeve deformation.

Figure 2
Initial deflection of the seal



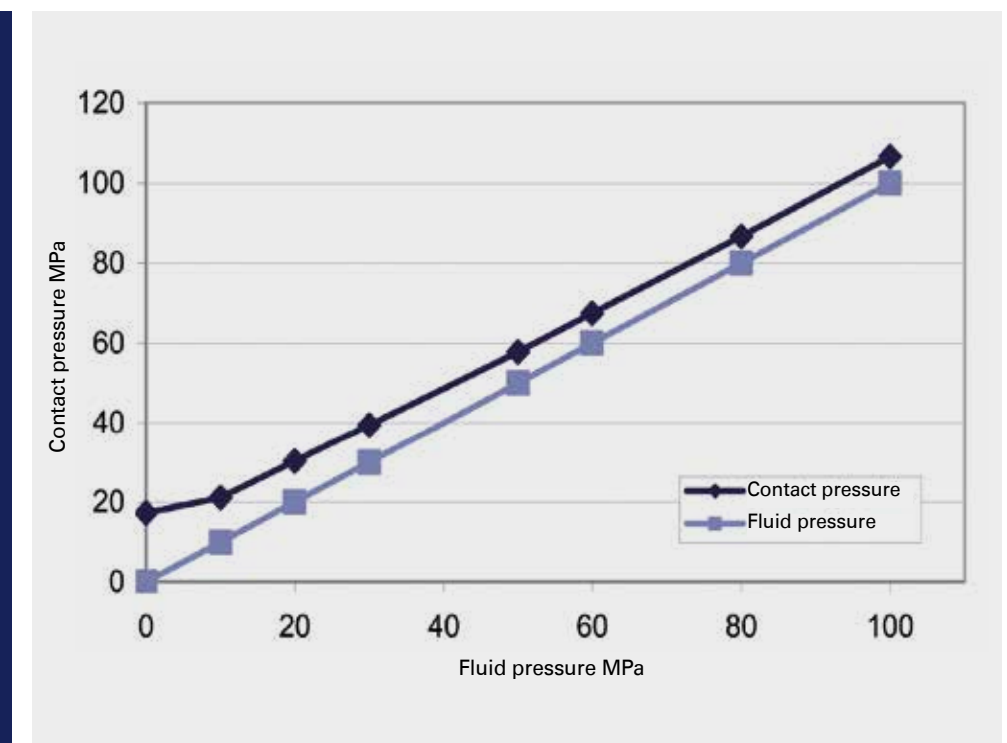
At this point the system subject to pressure exerts a force that deforms the seal, modifying the contact surface with the seat.

Figure 3
Modification of the contact areas under internal pressure



The relationship between internal pressure and the pressure exerted by the seal for the hold is shown in the diagram below

Figure 4
Evolution of contact pressures with the increase of internal pressure



02.0

Types

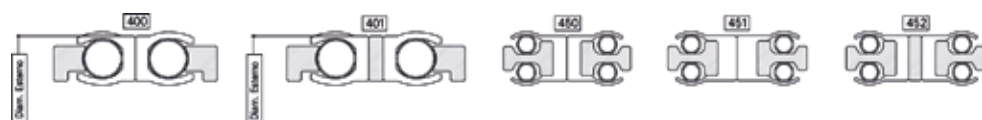
The energized seals fall into two main types: Radial and Axial, both Static and Dynamic. By ascertaining the operating conditions, the appropriate spring is chosen during the design stage - either "Toroidal", "Finger" or "V" (commonly called Raco®). All the springs differ in material and load, which is why careful designing is fundamental for the proper functioning of the energized seal. To overlook this important step leads to unsuitable products, which can have serious repercussions for the end client. For easy identification, we have divided the seals into "Series" each one representing different combinations of types, materials, springs and use and they encapsulate almost our entire range of products. Excluding the combinations shown below, we make other types and holds identified according to our specific designs.

02.1

Radial Seals

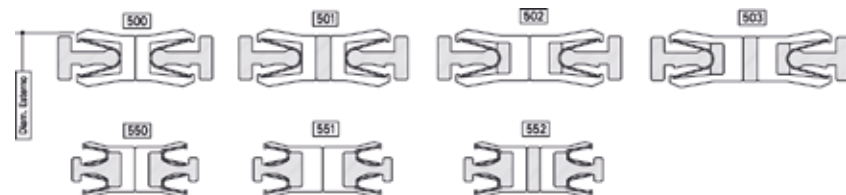
02.1.1

Series 400



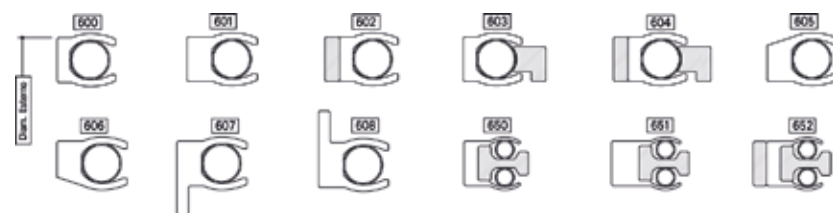
02.1.2

Series 500



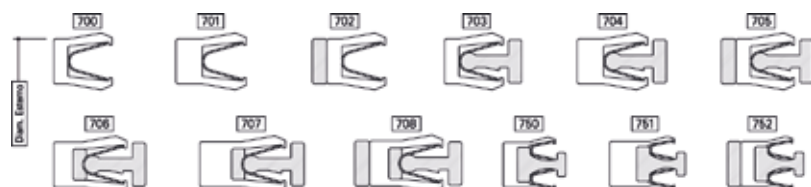
02.1.3

Series 600



02.1.4

Series 700



02.2

Axial Seals

02.2.1

Series 800 P. Internal

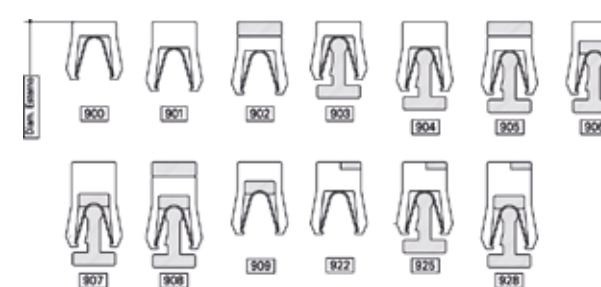


Series 800 P. External

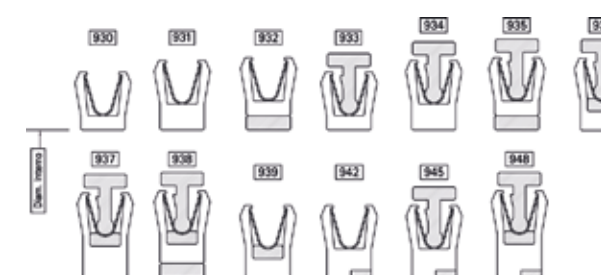


02.2.2

Series 900 P. Internal



Series 900 P. External



The series listed above represent our generic seals; once the seal has been identified (e.g. series 600, model 604) we will define all the component materials and the most suitable uses.

02.3

Special Seals

This category includes all seals designed expressly to address specific customer requests. Uses, materials and performances are reviewed each time to fully meet the requested requirements.



03.0

Uses and dimensions

In all situations where rubber O-rings cannot be used due to problems with temperature, pressure or chemical compatibility:

- Temperature ranging from -200° C to 315° C.
- Pressure ranging from 0 to 1500 Bar for ANSI 150 to 2500 and API 2000 to 15000.
- Diameters can vary from a minimum of 15 mm up to max of 2300 mm.

Nominal standard sections	Groove size
3/32"	from 2,25 to 2,32 mm
1/8"	from 3,05 to 3,15 mm
3/16"	from 4,70 to 4,75 mm
1/4"	from 6,05 to 6,15 mm
3/8"	from 9,30 to 9.50 mm
1/2"	from 12,40 to 12,60 mm

- Made-to-measure seals can be made for use in grooves that are of different size than those listed.
- All seals can be supplied according to ISO 15848-1 Low Fugitive Emissions, Shell MSE 77-312 and NORSK M-710 specifications.



04.0

Materials

The many different operating conditions possible require different materials both for the sleeves and the springs. The former are usually made of PTFE and/or PTFE modified according to the temperatures and pressures of the design, however, other polymers are also available such as Peek®, loaded Peek, Vespel®, Kel-F®, etc., for use in special situations. The springs can be made of Hastelloy® C276, Inconel® 718 and Elgiloy®. If these types are used or not depends on the type of seal - whether static or dynamic, if more or less friction is wanted to be created, the temperatures and the chemical compatibility with the contact fluid.

04.1 Sleeve Materials

Sleeve material	Chemical compatibility **	Max. Temp. °C
PTFE Virgin	Type 1,2,3 - G	-220/+300°C
PTFE+Graphite	Type 1,2,3 - G	-220/+300°C
PTFE+Carbon-graphite	Type 1,2,3 - G	-220/+300°C
PTFE+Glass	Type 1 and 2 - G, Type 3 - S	-220/+300°C
PTFE+Peek	Type 1,2,3 - G	-220/+300°C
TFM Virgin	Type 1,2,3 - G	-220/+300°C
TFM+Graphite	Type 1,2,3 - G	-220/+300°C
TFM+Carbon-graphite	Type 1,2,3 - G	-220/+300°C
TFM+Glass	Type 1 and 2 - G, Type 3 - S	-220/+300°C
Peek®	Type 1,2,3 - G	-50/+320°C
Peek+Graphite	Type 1,2,3 - G	-50/+320°C
Vespel®	Type 1,2,3 - G	-150/+400°C
Kel-F®	Type 1,2,3 - G	-240/+204°C

(Table continuously updated)

04.2 Back Up and Retainer Materials

Sleeve material	Chemical compatibility **	Max. Temp. °C
Nylon	Type 1 - G, Type 2 - S, Type 3 - B	-200/+150°C
Nylon 6XAU	Type 1 - G, Type 2 - S, Type 3 - B	-200/+180°C
Nylon+Glass	Type 1 - G, Type 2 - S, Type 3 - B	-200/+240°C
Peek®	Type 1,2,3 - G	-200/+315°C
Peek+Graphite	Type 1,2,3 - G	-200/+315°C
PTFE+Carbon-graphite	Type 1,2,3 - G	-200/+300°C
AISI 316	Type 1 and 2 - G, Type 3 - S	-250/+350°C
Duplex (F51)	Type 1 and 2 - G, Type 3 - S	-250/+350°C
Inconel® 625	Type 1,2,3 - G	-250/+400°C
Inconel® 718	Tipo 1,2,3 - G	-250/+400°C

04.3 Spring Materials

Spring material	Chemical compatibility **	Max. Temp. °C
AISI 301	Utilisation 1 - G, Utilisation 2 et 3 - B	-50/+150°C
AISI 304	Utilisation 1 - G, Utilisation 2 et 3 - B	-50/+150°C
AISI 316	Utilisation 1 et 2 - G, Utilisation 3 - S	-50/+200°C
17-7PH	Utilisation 1 et 2 - G, Utilisation 3 - S	-50/+200°C
Hastelloy® C276	Utilisation 1,2,3 - G	-200/+400°C
Inconel® 718	Utilisation 1,2,3 - G	-250/+400°C
Elgiloy® - UNS-R30003	Utilisation 1,2,3 - G	-250/+400°C

** Chemical compatibility refers to contact with gas and hydrocarbons as described:
Use 1 = Gas and refined hydrocarbons
Use 2 = Unrefined hydrocarbons
Use 3 = hydrocarbons with Hydrochloric and Sulphuric acid
G = Suitable S = Adequate B = Not recommended



05.0

Sizes and groove housings with guidelines for identifying energized seals appropriate for different uses

05.1

Seat

SPE Seat (Single acting) Section 3/32" - 2.25-2.3 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	700-600	4.5	701-601	5	702-602	6	702-602	6	X	X	X	X
-50/+200°C	700-600	4.5	701-601	5	702-602	6	702-602	6	X	X	X	X
-50/+300°C	702-602	6	702-602	6	702-602	6	702-602	6	X	X	X	X
-120/+120°C	700-600	4.5	701-601	5	702-602	6	702-602	6	X	X	X	X
-120/+200°C	700-600	4.5	701-601	5	702-602	6	702-602	6	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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SPE Seat (Single acting) Section 1/8" – 3.0-3.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	703	8	704	8	705	9.5	705	9.5	705	9.5	X	X
-50/+200°C	703	8	704	8	705	9.5	705	9.5	705	9.5	X	X
-50/+300°C	703	8	704-603	8	705	9.5	705	9.5	705	9.5	X	X
-120/+120°C	703-603	8	704-603	8	705-604	9.5	705-604	9.5	705-604	9.5	X	X
-120/+200°C	703-603	8	704-603	8	705-604	9.5	705-604	9.5	705-604	9.5	X	X
-196/+120°C	603	8	603	8	604	9	604	9	X	X	X	X
-196/+200°C	603	8	603	8	604	9	604	9	X	X	X	X
-196/+250°C	603	8	603	8	604	9	604	9	X	X	X	X

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SPE Seat (Single acting) Section 3/16" - 4.7-4.75 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	703	11	704	11	705	11	708	13	708	13	708	13.5
-50/+200°C	703	11	704	11	705	11	708	13	708	13	708	13.5
-50/+300°C	706-603	12	707-603	12	708-604	13	708-604	13	708-604	13	708-604	13.5
-120/+120°C	703-603	11	704-603	12	705-604	11.5	708-604	13	708-604	13	708-604	13.5
-120/+200°C	703-603	11	704-603	12	705-604	11.5	708-604	13	708-604	13	708-604	13.5
-196/+120°C	650-603	9.5	651-603	9.5	652-604	11.5	652-604	11.5	X	X	X	X
-196/+200°C	650-603	9.5	651-603	9.5	652-604	11.5	652-604	11.5	X	X	X	X
-196/+250°C	650-603	9.5	651-603	9.5	652-604	11.5	652-604	11.5	X	X	X	X

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SPE Seat (Single acting) Section 1/4" – 6.0-6.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	703	12.5	704	13.5	708	16	708	16	708	16	708	17
-50/+200°C	703	12.5	704	13.5	708	16	708	16	708	16	708	17
-50/+300°C	706-603	13	707-603	14.5	708-604	16	708-604	16	708-604	16	708-604	17
-120/+120°C	703-603	13	704-603	14.5	708-604	16	708-604	16	708-604	16	708-604	17
-120/+200°C	703-603	13	704-603	14.5	708-604	16	708-604	16	708-604	16	708-604	17
-196/+120°C	650-603	12	651-603	12	652-604	14	652-604	14	X	X	X	X
-196/+200°C	650-603	12	651-603	12	652-604	14	652-604	14	X	X	X	X
-196/+250°C	650-603	12	651-603	12	652-604	14	652-604	14	X	X	X	X

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SPE Seat (Single acting) Section 3/8" – 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	706	23.5	707	24.5	708	26.5	708	26.5	708	26.5	708	28
-50/+200°C	706	23.5	707	24.5	708	26.5	708	26.5	708	26.5	708	28
-50/+300°C	706-603	23.5	707-603	24.5	708-604	26.5	708-604	26.5	708-604	26.5	708-604	28
-120/+120°C	706-603	23.5	707-603	24.5	708-604	26.5	708-604	26.5	708-604	26.5	708-604	28
-120/+200°C	706-603	23.5	707-603	24.5	708-604	26.5	708-604	26.5	708-604	26.5	708-604	28
-196/+120°C	650-603	19.5	651-603	19.5	652-604	22.5	652-604	22.5	X	X	X	X
-196/+200°C	650-603	19.5	651-603	19.5	652-604	22.5	652-604	22.5	X	X	X	X
-196/+250°C	650-603	19.5	651-603	19.5	652-604	22.5	652-604	22.5	X	X	X	X

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SPE Seat (Single acting) Section 3/8" – 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	706	27	707	28	708	33	708	33	project	project	project	project
-50/+200°C	706	27	707	28	708	33	708	33	project	project	project	project
-50/+300°C	706-603	27	707-603	28	708-604	33	708-604	33	project	project	project	project
-120/+120°C	706-603	27	707-603	28	708-604	33	708-604	33	project	project	project	project
-120/+200°C	706-603	27	707-603	28	708-604	33	708-604	33	project	project	project	project
-196/+120°C	project	project	project	project	project	project	project	project	X	X	X	X
-196/+200°C	project	project	project	project	project	project	project	project	X	X	X	X
-196/+250°C	project	project	project	project	project	project	project	project	X	X	X	X

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Grease seat seal Section 1/8" – 3.0-3.1 mm

Special uses

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	605-606	5	605-606	5	605-606	5	605-606	5	X	X	X	X
-50/+200°C	605-606	5	605-606	5	605-606	5	605-606	5	X	X	X	X
-50/+300°C	605-606	5	605-606	5	605-606	5	605-606	5	X	X	X	X
-120/+120°C	605-606	5	605-606	5	605-606	5	605-606	5	X	X	X	X
-120/+200°C	605-606	5	605-606	5	605-606	5	605-606	5	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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Grease seat seal Section 3/16” - 4.7-4.75 mm Special uses

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	605-606	7.5	605-606	7.5	605-606	7.5	605-606	7.5	X	X	X	X
-50/+200°C	605-606	7.5	605-606	7.5	605-606	7.5	605-606	7.5	X	X	X	X
-50/+300°C	605-606	7.5	605-606	7.5	605-606	7.5	605-606	7.5	X	X	X	X
-120/+120°C	605-606	7.5	605-606	7.5	605-606	7.5	605-606	7.5	X	X	X	X
-120/+200°C	605-606	7.5	605-606	7.5	605-606	7.5	605-606	7.5	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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DPE Seat (Double piston effect) Section 3/32” - 2.25-2.3 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	X	X	X	X	X	X	X	X	X	X	X	X
-50/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-50/+300°C	X	X	X	X	X	X	X	X	X	X	X	X
-120/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-120/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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DPE Seat (Double piston effect) Section 1/8” - 3.0-3.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	400	15	400	15	400	15	401	16.5	X	X	X	X
-50/+200°C	400	15	400	15	400	15	401	16.5	X	X	X	X
-50/+300°C	400	15	400	15	400	15	401	16.5	X	X	X	X
-120/+120°C	400	15	400	15	400	15	401	16.5	X	X	X	X
-120/+200°C	400	15	400	15	400	15	401	16.5	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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DPE Seat (Double piston effect) Section 3/16” - 4.7-4.75 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	500	21	502	23	503	24.5	503	24.5	project	project	project	project
-50/+200°C	500	21	502	23	503	24.5	503	24.5	project	project	project	project
-50/+300°C	500	21	502	23	503	24.5	503	24.5	project	project	project	project
-120/+120°C	400	20	401	20.5	401	20.5	401	20.5	project	project	project	project
-120/+200°C	400	20	401	20.5	401	20.5	401	20.5	project	project	project	project
-196/+120°C	450	18	450	18	451	19	452	20	X	X	X	X
-196/+200°C	450	18	450	18	451	19	452	20	X	X	X	X
-196/+250°C	450	18	450	18	451	19	452	20	X	X	X	X

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DPE Seat (Double piston effect) Section 1/4” - 6.0-6.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	500	25	502	28	503	30	503	30	project	project	project	project
-50/+200°C	500	25	502	28	503	30	503	30	project	project	project	project
-50/+300°C	500	25	502	28	503	30	503	30	project	project	project	project
-120/+120°C	400	24	401	26.5	401	26.5	401	26.5	project	project	project	project
-120/+200°C	400	24	401	26.5	401	26.5	401	26.5	project	project	project	project
-196/+120°C	450	23	450	23	451	25	452	25	X	X	X	X
-196/+200°C	450	23	450	23	451	25	452	25	X	X	X	X
-196/+250°C	450	23	450	23	451	25	452	25	X	X	X	X

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DPE Seat (Double piston effect) Section 3/8” - 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	502	47	502	47	503	50	503	50	project	project	project	project
-50/+200°C	502	47	502	47	503	50	503	50	project	project	project	project
-50/+300°C	502	47	502	47	503	50	503	50	project	project	project	project
-120/+120°C	450-550	32	450-550	32	451-551	33	452-552	35	project	project	project	project
-120/+200°C	450-550	32	450-550	32	451-551	33	452-552	35	project	project	project	project
-196/+120°C	450	29	450	29	451	31	452	32	X	X	X	X
-196/+200°C	450	29	450	29	451	31	452	32	X	X	X	X
-196/+250°C	450	29	450	29	451	31	452	32	X	X	X	X

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DPE Seat (Double piston effect) Section 1/2” - 12.5-12.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	502	54	502	59	452-552	60	452-552	62	project	project	project	project
-50/+200°C	502	54	502	59	452-552	60	452-552	62	project	project	project	project
-50/+300°C	502	54	502	59	452-552	60	452-552	62	project	project	project	project
-120/+120°C	450-550	54	450-550	59	451-551	60	452-552	62	project	project	project	project
-120/+200°C	450-550	54	450-550	59	451-551	60	452-552	62	project	project	project	project
-196/+120°C	project	project	project	project	project	project	project	project	X	X	X	X
-196/+200°C	project	project	project	project	project	project	project	project	X	X	X	X
-196/+250°C	project	project	project	project	project	project	project	project	X	X	X	X

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05.2 Body/closing seal

Radial Body closing Section 3/32" - 2.25-2.3 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-50/+200°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-50/+300°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-120/+120°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-120/+200°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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Radial Body closing Section 1/8" - 3.0-3.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-50/+200°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-50/+300°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-120/+120°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-120/+200°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-196/+120°C	600	5.5	601	6	602	7	602	7	X	X	X	X
-196/+200°C	600	5.5	601	6	602	7	602	7	X	X	X	X
-196/+250°C	600	5.5	601	6	602	7	602	7	X	X	X	X

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Radial Body closing Section 3/16" - 4.7-4.75 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-50/+200°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-50/+300°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-120/+120°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-120/+200°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-196/+120°C	600	7.5	601	8.5	602	9	602-604	11.5	X	X	X	X
-196/+200°C	600	7.5	601	8.5	602	9	602-604	11.5	X	X	X	X
-196/+250°C	600	7.5	601	8.5	602	9	602-604	11.5	X	X	X	X

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Radial Body closing Section 1/4" - 6.0-6.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-50/+200°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-50/+300°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-120/+120°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-120/+200°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-196/+120°C	600	9	601	10	602	11	602-604	14	X	X	X	X
-196/+200°C	600	9	601	10	602	11	602-604	14	X	X	X	X
-196/+250°C	600	9	601	10	602	11	602-604	14	X	X	X	X

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Radial Body closing Section 3/8" - 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-50/+200°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-50/+300°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-120/+120°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-120/+200°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-196/+120°C	600	15	601	16	602	18	602-604	22.5	X	X	X	X
-196/+200°C	600	15	601	16	602	18	602-604	22.5	X	X	X	X
-196/+250°C	600	15	601	16	602	18	602-604	22.5	X	X	X	X

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Radial Body closing Section 1/2" - 12.5-12.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
- 50/+150°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-50/+200°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-50/+300°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-120/+120°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-120/+200°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-196/+120°C	600	21.5	601	22.5	602	27.5	602-604	32.5	X	X	X	X
-196/+200°C	600	21.5	601	22.5	602	27.5	602-604	32.5	X	X	X	X
-196/+250°C	600	21.5	601	22.5	602	27.5	602-604	32.5	X	X	X	X

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Axial Body closing Section 3/32" - 2.25-2.3 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-50/+200°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-50/+300°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-120/+120°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-120/+200°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-196/+120°C	800	4.5	801	5	802	5.5	802	5.5	X	X	X	X
-196/+200°C	800	4.5	801	5	802	5.5	802	5.5	X	X	X	X
-196/+250°C	800	4.5	801	5	802	5.5	802	5.5	X	X	X	X

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Axial Body closing Section 1/8" - 3.0-3.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-50/+200°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-50/+300°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-120/+120°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-120/+200°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-196/+120°C	800-900	5.5	801-901	6	802-902	7	802-804-902-905	7.5	X	X	X	X
-196/+200°C	800-900	5.5	801-901	6	802-902	7	802-804-902-905	7.5	X	X	X	X
-196/+250°C	800-900	5.5	801-901	6	802-902	7	802-804-902-905	7.5	X	X	X	X

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05.3 Gland-pin seal

Axial Body closing Section 3/16" - 4.7-4.75 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-50/+200°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-50/+300°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-120/+120°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-120/+200°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-196/+120°C	800-900	7.5	801-901	8	802-902	9.5	804-904	12.5	X	X	X	X
-196/+200°C	800-900	7.5	801-901	8	802-902	9.5	804-904	12.5	X	X	X	X
-196/+250°C	800-900	7.5	801-901	8	802-902	9.5	804-904	12.5	X	X	X	X

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Axial Body closing Section 1/4" - 6.0-6.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-50/+200°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-50/+300°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-120/+120°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-120/+200°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-196/+120°C	800-900	10	801-901	10.5	802-902	12.5	804-904	15.5	X	X	X	X
-196/+200°C	800-900	10	801-901	10.5	802-902	12.5	804-904	15.5	X	X	X	X
-196/+250°C	800-900	10	801-901	10.5	802-902	12.5	804-904	15.5	X	X	X	X

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Axial Body closing Section 3/8" - 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-50/+200°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-50/+300°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-120/+120°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-120/+200°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-196/+120°C	800-900	15	801-901	16	802-902	18	804-904	22.5	X	X	X	X
-196/+200°C	800-900	15	801-901	16	802-902	18	804-904	22.5	X	X	X	X
-196/+250°C	800-900	15	801-901	16	802-902	18	804-904	22.5	X	X	X	X

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Axial Body closing Section 1/2" - 12.5-12.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-50/+200°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
- 50/+300°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-120/+120°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-120/+200°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-196/+120°C	800-900	21.5	801-901	22.5	802-902	27.5	804-904	32.5	X	X	X	X
-196/+200°C	800-900	21.5	801-901	22.5	802-902	27.5	804-904	32.5	X	X	X	X
-196/+250°C	800-900	21.5	801-901	22.5	802-902	27.5	804-904	32.5	X	X	X	X

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Radial gland-pin seal Section 3/32" - 2.25-2.3 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-50/+200°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-50/+300°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-120/+120°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-120/+200°C	600	4	601	4.5	602	5	602	5	X	X	X	X
-196/+120°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+200°C	X	X	X	X	X	X	X	X	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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Radial gland-pin seal Section 1/8" - 3.0-3.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-50/+200°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-50/+300°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-120/+120°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-120/+200°C	600	5.5	601	6	602	7	602	7	602	8	602	8
-196/+120°C	600	5.5	601	6	602	7	602	7	X	X	X	X
-196/+200°C	600	5.5	601	6	602	7	602	7	X	X	X	X
-196/+250°C	600	5.5	601	6	602	7	602	7	X	X	X	X

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Radial gland-pin seal Section 3/16" - 4.7-4.75 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-50/+200°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-50/+300°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-120/+120°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-120/+200°C	600	7.5	601	8.5	602	9	602-604	11.5	602-604	12	602-604	13
-196/+120°C	600	7.5	601	8.5	602	9	602-604	11.5	X	X	X	X
-196/+200°C	600	7.5	601	8.5	602	9	602-604	11.5	X	X	X	X
-196/+250°C	600	7.5	601	8.5	602	9	602-604	11.5	X	X	X	X

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Radial gland-pin seal Section 1/4" - 6.0-6.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-50/+200°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-50/+300°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-120/+120°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-120/+200°C	600	9	601	10	602	11	602-604	14	602-604	15	602-604	15
-196/+120°C	600	9	601	10	602	11	602-604	14	X	X	X	X
-196/+200°C	600	9	601	10	602	11	602-604	14	X	X	X	X
-196/+250°C	600	9	601	10	602	11	602-604	14	X	X	X	X

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Radial gland-pin seal Section 3/8” - 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-50/+200°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-50/+300°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-120/+120°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-120/+200°C	600	15	601	16	602	18	602-604	22.5	602-604	23.5	602-604	24
-196/+120°C	600	15	601	16	602	18	602-604	22.5	X	X	X	X
-196/+200°C	600	15	601	16	602	18	602-604	22.5	X	X	X	X
-196/+250°C	600	15	601	16	602	18	602-604	22.5	X	X	X	X

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Radial gland-pin seal Section 1/2” - 12.5-12.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-50/+200°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-50/+300°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-120/+120°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-120/+200°C	600	21.5	601	22.5	602	27.5	602-604	32.5	project	project	project	project
-196/+120°C	600	21.5	601	22.5	602	27.5	602-604	32.5	X	X	X	X
-196/+200°C	600	21.5	601	22.5	602	27.5	602-604	32.5	X	X	X	X
-196/+250°C	600	21.5	601	22.5	602	27.5	602-604	32.5	X	X	X	X

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Radial gland-pin seal Section 3/32” - 2.25-2.3 mm Groove height

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-50/+200°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-50/+300°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-120/+120°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-120/+200°C	800	4.5	801	5	802	5.5	802	5.5	802	6	802	6
-196/+120°C	800	4.5	801	5	802	5.5	802	5.5	X	X	X	X
-196/+200°C	800	4.5	801	5	802	5.5	802	5.5	X	X	X	X
-196/+250°C	800	4.5	801	5	802	5.5	802	5.5	X	X	X	X

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Radial gland-pin seal Section 1/8” - 3.0-3.1 mm Groove Height

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-50/+200°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-50/+300°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-120/+120°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-120/+200°C	800	5.5	801	6	802	7	802-804	7.5	802-804	8.5	802-804	9
-196/+120°C	800-900	5.5	801-901	6	802-902	7	802-804-902-905	7.5	X	X	X	X
-196/+200°C	800-900	5.5	801-901	6	802-902	7	802-804-902-905	7.5	X	X	X	X
-196/+250°C	800-900	5.5	801-901	6	802-902	7	802-804-902-905	7.5	X	X	X	X

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Axial gland-pin seal Section 3/16” - 4.7-4.75 mm Groove height

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-50/+200°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-50/+300°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-120/+120°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-120/+200°C	800	7.5	801	8	802	9.5	802-804-822-824	12.5	802-804-822-824	13	802-804-822-824	14
-196/+120°C	800-900	7.5	801-901	8	802-902	9.5	804-904	12.5	X	X	X	X
-196/+200°C	800-900	7.5	801-901	8	802-902	9.5	804-904	12.5	X	X	X	X
-196/+250°C	800-900	7.5	801-901	8	802-902	9.5	804-904	12.5	X	X	X	X

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Axial gland-pin seal Section 1/4” - 6.0-6.1 mm Groove height

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-50/+200°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-50/+300°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-120/+120°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-120/+200°C	800	10	801	10.5	802	12.5	802-804-822-824	15.5	802-804-822-824	16	802-804-822-824	17
-196/+120°C	800-900	10	801-901	10.5	802-902	12.5	804-904	15.5	X	X	X	X
-196/+200°C	800-900	10	801-901	10.5	802-902	12.5	804-904	15.5	X	X	X	X
-196/+250°C	800-900	10	801-901	10.5	802-902	12.5	804-904	15.5	X	X	X	X

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Axial gland-pin seal Section 3/8” - 9.5-9.7 mm Groove height

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-50/+200°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-50/+300°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-120/+120°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-120/+200°C	800	15	801	16	802	18	802-804-822-824	22.5	802-804-822-824	23	802-804-822-824	24
-196/+120°C	800-900	15	801-901	16	802-902	18	804-904	22.5	X	X	X	X
-196/+200°C	800-900	15	801-901	16	802-902	18	804-904	22.5	X	X	X	X
-196/+250°C	800-900	15	801-901	16	802-902	18	804-904	22.5	X	X	X	X

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Axial gland-pin seal Section 1/2” - 12.5-12.7 mm Groove height

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-50/+200°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-50/+300°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-120/+120°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-120/+200°C	800	21.5	801	22.5	802	27.5	802-804-822-824	32.5	802-804-822-824	33	802-804-822-824	34
-196/+120°C	800-900	21.5	801-901	22.5	802-902	27.5	804-904	32.5	X	X	X	X
-196/+200°C	800-900	21.5	801-901	22.5	802-902	27.5	804-904	32.5	X	X	X	X
-196/+250°C	800-900	21.5	801-901	22.5	802-902	27.5	804-904	32.5	X	X	X	X

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05.4 Rod seals

Rod Section 3/32" - 2.25-2.3 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600-700	4.5	601-701	5	602-702	6	602-702	6	X	X	X	X
-50/+200°C	600-700	4.5	601-701	5	602-702	6	602-702	6	X	X	X	X
-50/+300°C	600-700	4.5	601-701	5	602-702	6	602-702	6	X	X	X	X
-120/+120°C	600-700	4.5	601-701	5	602-702	6	602-702	6	X	X	X	X
-120/+200°C	600-700	4.5	601-701	5	602-702	6	602-702	6	X	X	X	X
-196/+120°C	600	4.5	601	5	602	6	602	6	X	X	X	X
-196/+200°C	600	4.5	601	5	602	6	602	6	X	X	X	X
-196/+250°C	X	X	X	X	X	X	X	X	X	X	X	X

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Rod Section 1/8" - 3.0-3.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600-603-700-703	8	601-604-701-704	9	602-705	9.5	602-705	9.5	602-604	10	602-604	10
-50/+200°C	600-603-700-703	8	601-604-701-704	9	602-705	9.5	602-705	9.5	602-604	10	602-604	10
-50/+300°C	600-603-700-703	8	601-604-701-704	9	602-705	9.5	602-705	9.5	602-604	10	602-604	10
-120/+120°C	600-603-700-703	8	601-604-701-704	9	602-604-702-705	9.5	602-604-702-705	9.5	602-604	10	602-604	10
-120/+200°C	600-603-700-703	8	601-604-701-704	9	602-604-702-705	9.5	602-604-702-705	9.5	602-604	10	602-604	10
-196/+120°C	600-603	7.5	601-604	9	602-604	9	602-604	9	X	X	X	X
-196/+200°C	600-603	7.5	601-604	9	602-604	9	602-604	9	X	X	X	X
-196/+250°C	600-603	7.5	601-604	9	602-604	9	602-604	9	X	X	X	X

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Rod Section 3/16" - 4.7-4.75 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600-603-700-703	11	601-603-701-704	11	602-604-705	11	602-604-708	13	602-604	13	602-604	14
-50/+200°C	600-603-700-703	11	601-603-701-704	11	602-604-705	11	602-604-708	13	602-604	13	602-604	14
-50/+300°C	600-603-700-703	11	601-603-701-704	11	602-604-705	11	602-604-708	13	602-604	13	602-604	14
-120/+120°C	600-603-700-703	11	601-603-701-704	11	602-604-702-705	11	602-604-702-708	13	602-604	13	602-604	14
-120/+200°C	600-603-700-703	11	601-603-701-704	11	602-604-702-705	11	602-604-702-708	13	602-604	13	602-604	14
-196/+120°C	600-603-650	11	601-603-651	11	604-652	11.5	604-652	11.5	X	X	X	X
-196/+200°C	600-603-650	11	601-603-651	11	604-652	11.5	604-652	11.5	X	X	X	X
-196/+250°C	600-603-650	11	601-603-651	11	604-652	11.5	604-652	11.5	X	X	X	X

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Rod Section 1/4" - 6.0-6.1 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600-603-700-703	12.5	601-603-701-704	13.5	602-604-705	14.5	602-604-708	16	602-604	15	602-604	16
-50/+200°C	600-603-700-703	12.5	601-603-701-704	13.5	602-604-705	14.5	602-604-708	16	602-604	15	602-604	16
-50/+300°C	600-603-700-703	12.5	601-603-701-704	13.5	602-604-705	14.5	602-604-708	16	602-604	15	602-604	16
-120/+120°C	600-603-700-703	12.5	601-603-701-704	13.5	602-604-702-705	14.5	602-604-702-708	16	602-604	15	602-604	16
-120/+200°C	600-603-700-703	12.5	601-603-701-704	13.5	602-604-702-705	14.5	602-604-702-708	16	602-604	15	602-604	16
-196/+120°C	600-603-650	12	601-603-651	12	604-652	14	604-652	14	X	X	X	X
-196/+200°C	600-603-650	12	601-603-651	12	604-652	14	604-652	14	X	X	X	X
-196/+250°C	600-603-650	12	601-603-651	12	604-652	14	604-652	14	X	X	X	X

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Rod Section 3/8" - 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600-603-700-706	23.5	601-603-701-707	24.5	602-604-708	26.5	602-604-708	26.5	602-604-708	27	602-604-708	28
-50/+200°C	600-603-700-706	23.5	601-603-701-707	24.5	602-604-708	26.5	602-604-708	26.5	602-604-708	27	602-604-708	28
-50/+300°C	600-603-700-706	23.5	601-603-701-707	24.5	602-604-708	26.5	602-604-708	26.5	602-604-708	27	602-604-708	28
-120/+120°C	600-603-700-706	23.5	601-603-701-707	24.5	602-604-708	26.5	602-604-708	26.5	602-604-708	27	602-604-708	28
-120/+200°C	600-603-700-706	23.5	601-603-701-707	24.5	602-604-708	26.5	602-604-708	26.5	602-604-708	27	602-604-708	28
-196/+120°C	600-603-650	20	601-604-651	22.5	602-604-652	22.5	602-604-652	22.5	X	X	X	X
-196/+200°C	600-603-650	20	601-604-651	22.5	602-604-652	22.5	602-604-652	22.5	X	X	X	X
-196/+250°C	600-603-650	20	601-604-651	22.5	602-604-652	22.5	602-604-652	22.5	X	X	X	X

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Rod Section 3/8" - 9.5-9.7 mm

Temperature Range	Pressure											
	Class 150-600	Groove Height	Class 900	Groove Height	Class 1500	Groove Height	Class 2500	Groove Height	Class API 10000	Groove Height	Class API 15000	Groove Height
-50/+150°C	600-603-700-706	27	601-603-701-707	28	602-604-708	33	602-604-708	33	602-604-708	34	602-604-708	35
-50/+200°C	600-603-700-706	27	601-603-701-707	28	602-604-708	33	602-604-708	33	602-604-708	34	602-604-708	35
-50/+300°C	600-603-700-706	27	601-603-701-707	28	602-604-708	33	602-604-708	33	602-604-708	34	602-604-708	35
-120/+120°C	600-603-700-706	27	601-603-701-707	28	602-604-708	33	602-604-708	33	602-604-708	34	602-604-708	35
-120/+200°C	600-603-700-706	27	601-603-701-707	28	602-604-708	33	602-604-708	33	602-604-708	34	602-604-708	35
-196/+120°C	600-603-650	27	601-604-651	32.5	602-604-652	32.5	602-604-652	32.5	X	X	X	X
-196/+200°C	600-603-650	27	601-604-651	32.5	602-604-652	32.5	602-604-652	32.5	X	X	X	X
-196/+250°C	600-603-650	27	601-604-651	32.5	602-604-652	32.5	602-604-652	32.5	X	X	X	X

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06.0

Mechanical requirements

The quality of the seal alone is not enough to guarantee a satisfactory hold. Many conditions play their part, among them the roughness of the seats, their concentricity and the coupling clearance. It is vital, therefore, to verify that at least these three components match the requirements as listed below, prior to installation.

06.1

Roughness

06.1.1 Static hold roughness

Temperature	Surface finish
+200°C/ 0°C	0.6 Ra
-1°C/ -46°C	0.4 Ra
-47°C/ -100°C	0.3 Ra
-101°C/ -196°C	0.2 Ra

For tests carried out with helium gas, it is always preferable to have a surface roughness of not more than 0.3 Ra for temperatures up to -46 ° C and 0.2 Ra for lower temperatures.

06.1.2 Dynamic hold roughness

Temperature	Surface finish
+200°C/ 0°C	0.4 Ra
-1°C/ -46°C	0.3 Ra
-47°C/ -100°C	0.3 Ra
-101°C/ -196°C	0.2 Ra

For tests carried out with helium gas, it is always preferable to have a surface roughness of not more than 0.2 Ra for temperatures up to -46 ° C and 0.1 Ra for lower temperatures.

06.2

Concentricity

The diameter concentricity for Radial grooves should match those in the table. For Axial grooves, the same height tolerance applies.

Temperature	
+200°C/ 0°C	+/- 0.05 mm
-1°C/ -46°C	+/- 0.03 mm
-46°C/ -196°C	+/- 0.01 mm

06.3

Seal mounting entrances

06.3.1 Grooves from 3/32" Drawing detail "Annex 1"

06.3.2 Grooves from 1/8" Drawing detail "Annex 2"

06.3.3 Grooves from 3/16" Drawing detail "Annex 3"

06.3.4 Grooves from 1/4" Drawing detail "Annex 4"

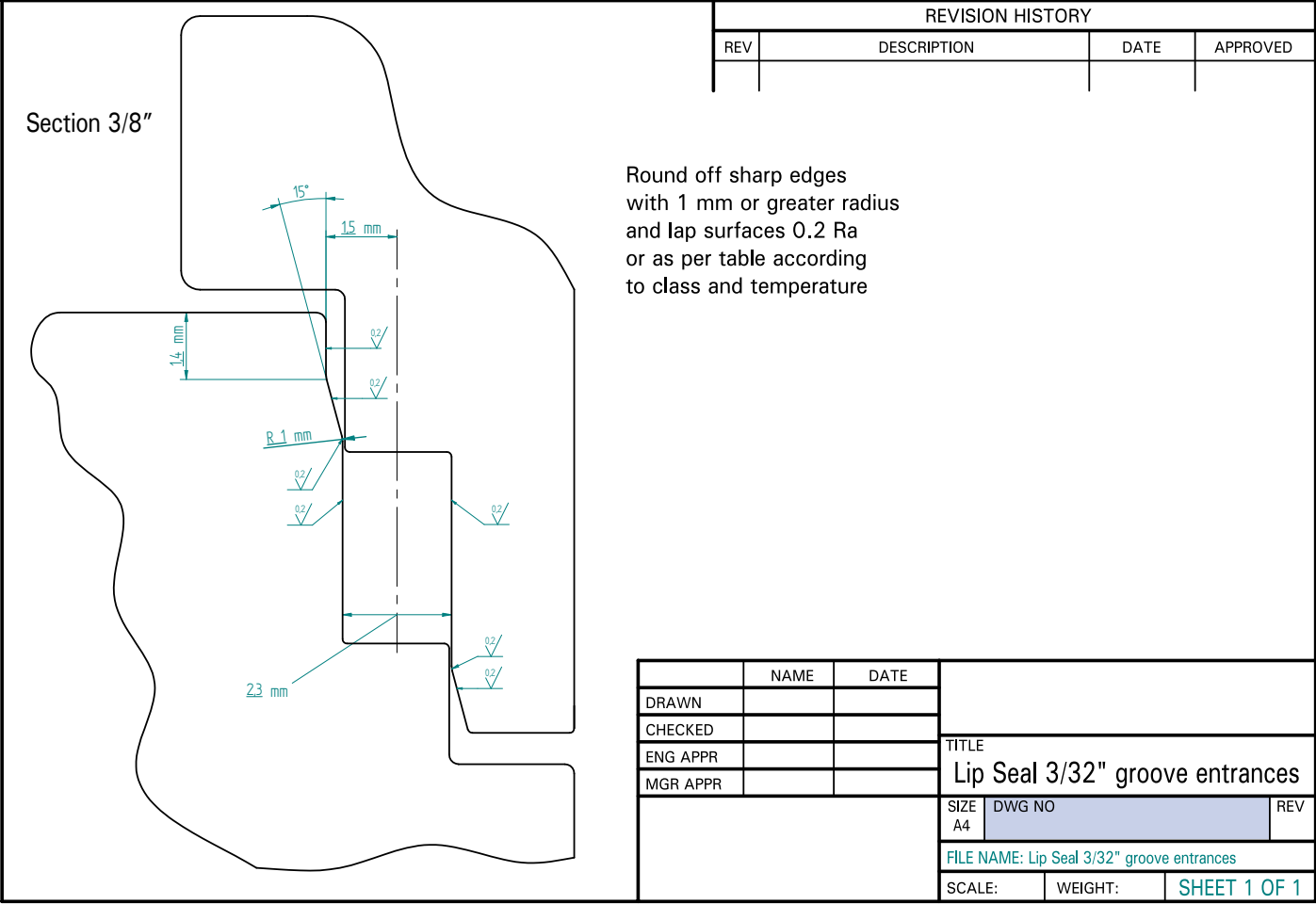
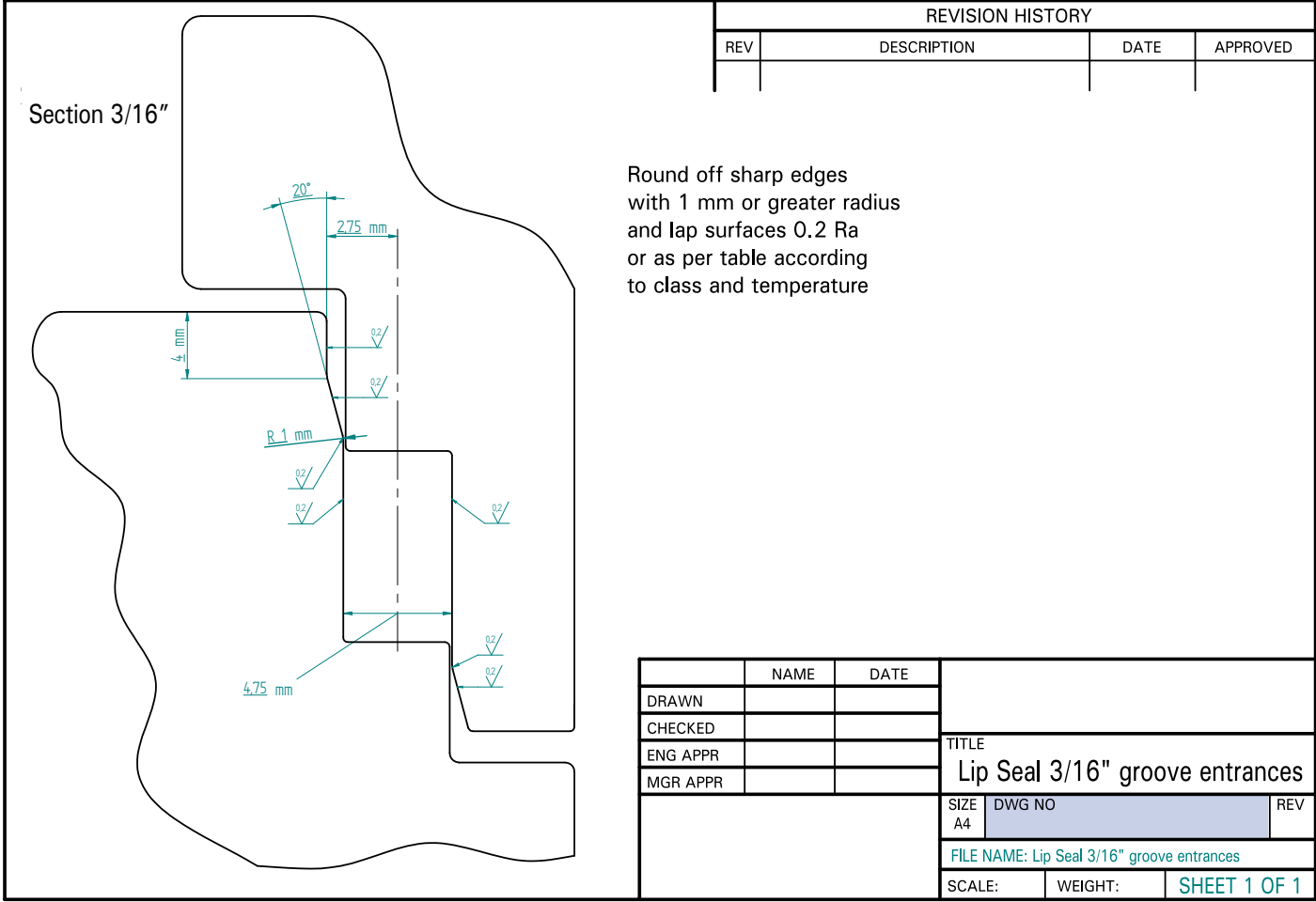
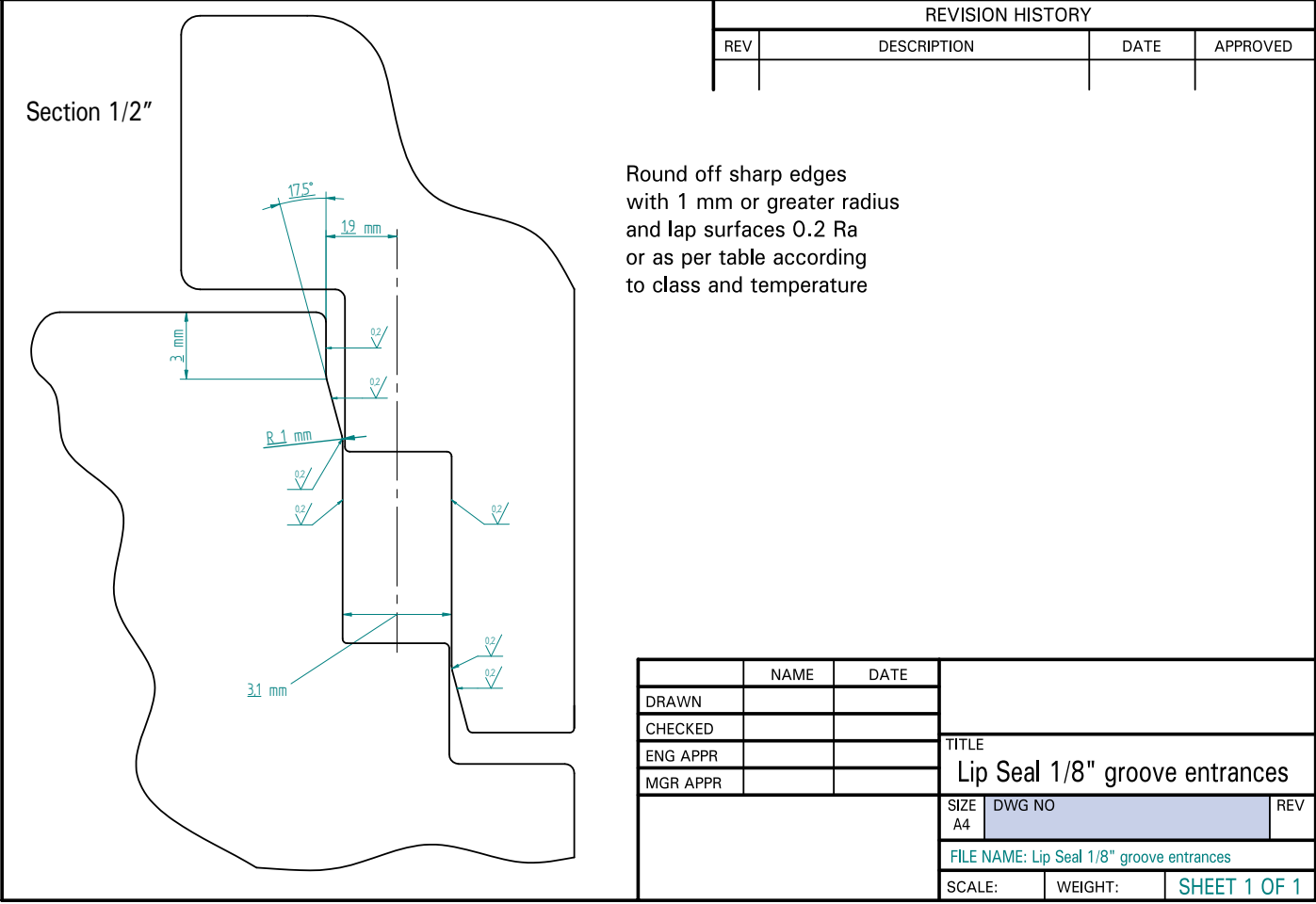
06.3.5 Grooves from 3/8" Drawing detail "Annex 5"

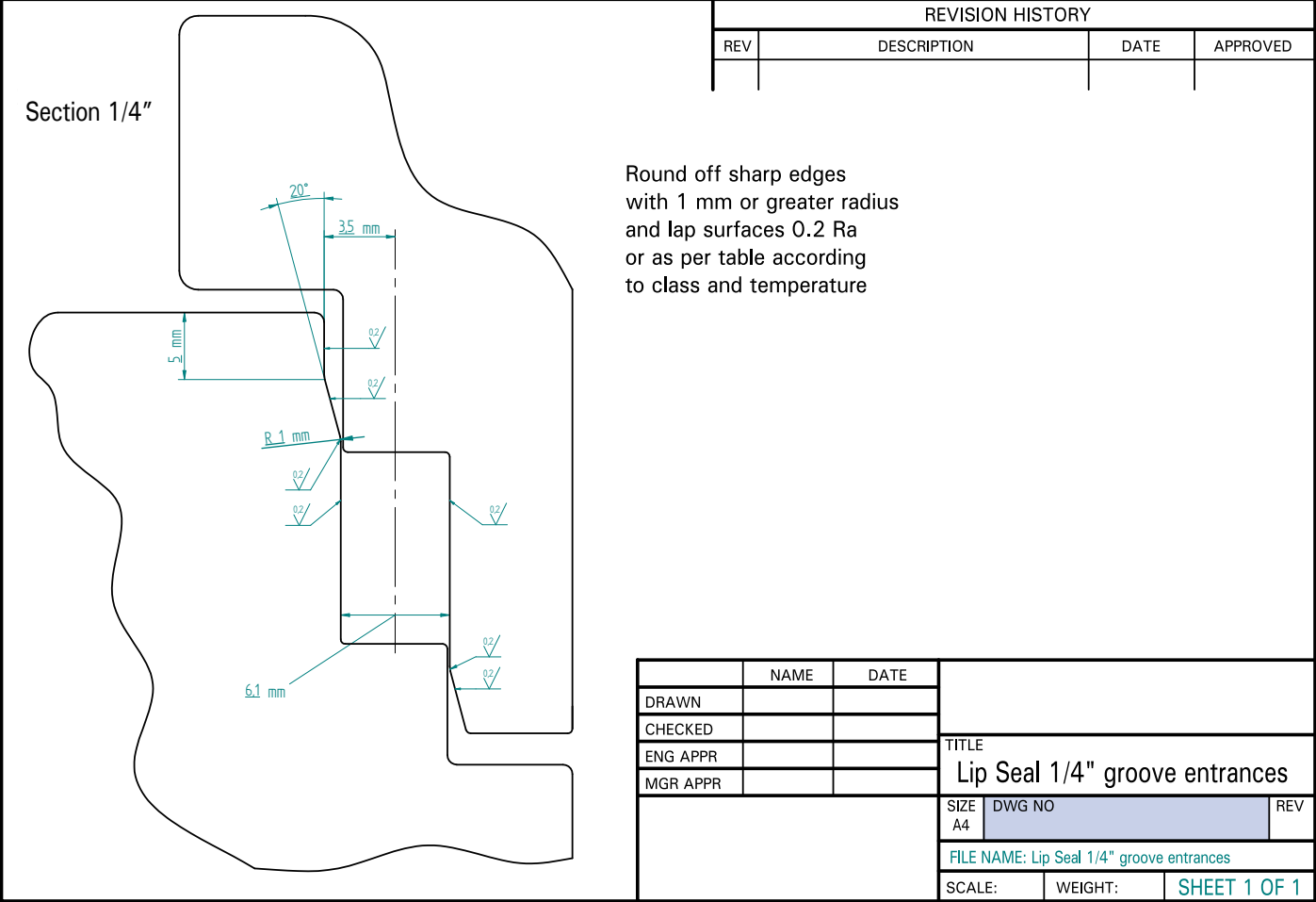
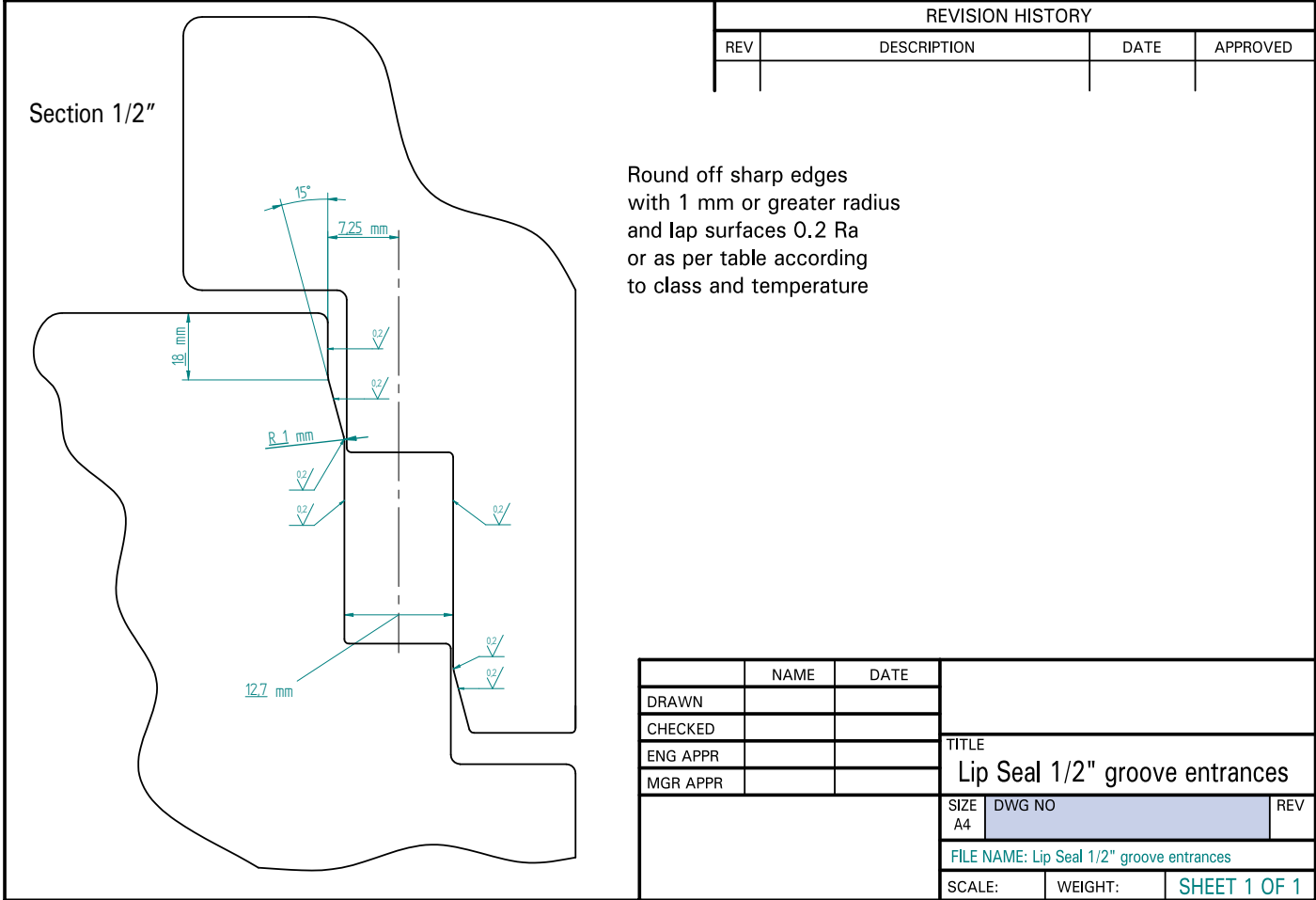
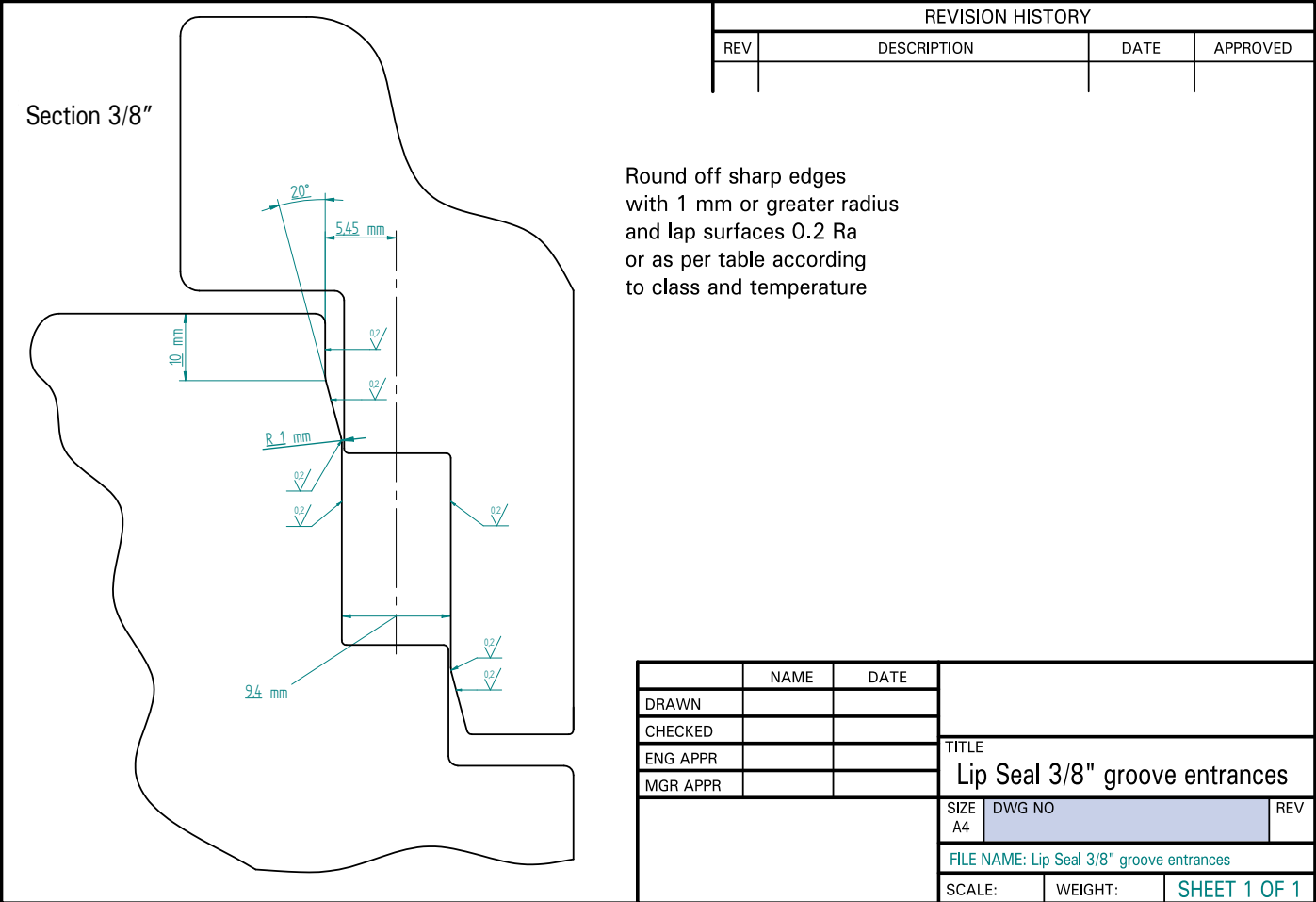
06.3.6 Grooves from 1/2" Drawing detail "Annex 6"

06.4

Coupling clearance

To avoid sealing problems in the planning stage it is good practice to aim for reduced coupling clearance, and for high pressures situations it is essential to reduce them to allow space for the placement of a Back-Up: e.g. 0.20 mm (diameter) for seals without Back-Up and 0.30 mm (diameter) for those with Back-Up is considered sufficient in almost all cases. For pressures above 600 bar and temperatures over 180° C, we recommend contacting our technical department.





MAIN PROCESSES:
FLOW AND
PARAMETERS

1. Purpose
2. Scope
3. Operations responsibility
4. Content and finality of the flows
5. Parameters identification
6. Attachments

1. Purpose

The procedure shows the flow charts (attached) of the main operational processes, to make that which is described in the Manual sections and related Procedures more readily available.

It also defines the criteria for identifying significant parameters (indicators) for the leading processes, monitor the results and, where necessary, implement the necessary actions for on-going improvement.

2. Scope

This procedure applies to the definition of the indicators of the effectiveness of processes and quality goals related to the Policy outlined in Section 5.1 of the Manual.

The numerical value of the effectiveness parameters shown below is assigned on the basis of the data logging.

The most significant flows are taken into account with particular attention given to the leading processes.

3. Operations Responsibility

The QM Manager together with the personnel involved is responsible for identifying the more relevant and significant parameters for each operational process.

4. Content And Aim Of The Flows

Given the non-repetitive nature of order contracts, technical features and management of order contracts and the needed simplification (for the sake of simplicity and clarity), the flow charts are only indicative.

They do, however, identify the leading processes, establishing the correlation and the sequences between them.

The flows are for:

- Overall corporate management to identify the correlations and the sequences between the leading processes (see sect. 4.1 QM)
- Operation processes management
- Quotation-offer-contract (sales) process
- Supply process
- Executive processes
- Process for handling non-compliances and Corrective and Preventive Actions

5. Parameters Identification

Quality Policy	Parameter
Customer Satisfaction	Average index of satisfaction that emerged from questionnaires monitoring Customers Prevention of complaints and penalties
Compliance with current law provisions	Effectiveness of accident prevention Prevention of non-compliances due to not abiding to the provisions of applicable current laws
Problems prevention	Level of implementation of the system
Process Improvement	Effectiveness of the operation processes (indicators listed in the relevant charts)

The parameters listed above are turned into suitable indicators chosen by the Management.

The numerical values of the identified parameters are reported, along with the objectives for the following period, in the appropriate registration card.

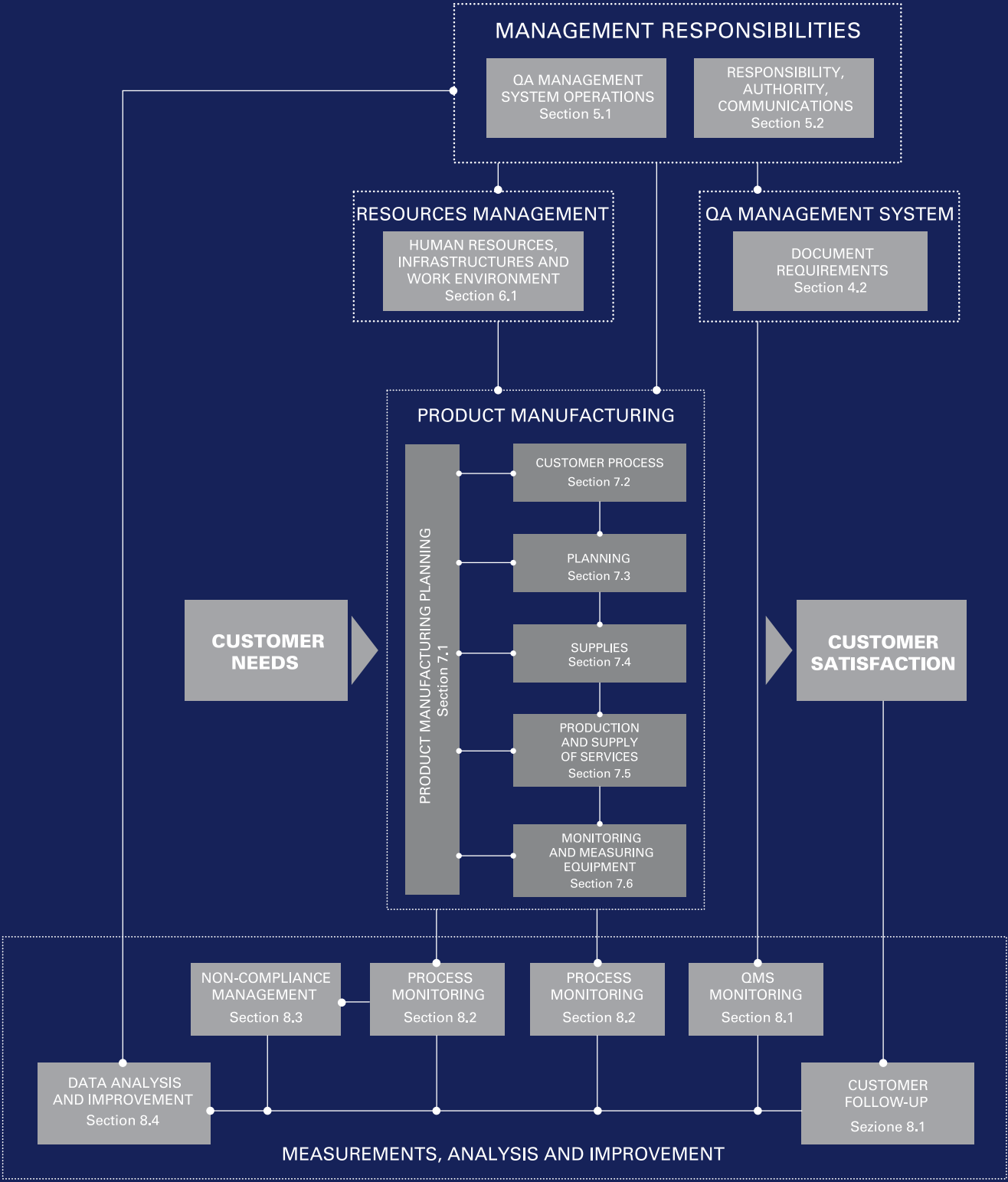
As far as possible, the indicators are calculated for each year from data relating to previous years that is available within the Company.

During the periodic system reviews by the Management, the achieved results are verified.

6. Annexes

Annexes 0: General flow of corporate processes (see sect. 4.1 QM)

General flow of company processes



Key: macro processes support processes leading processes Sequences and interactions



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