

Unipetrol RPA, s.r.o. Technical Services	<b>Regulation for maintenance and inspection of flange joints with metallic ring joint gasket</b>	N 11 020

The standard is binding for all departments of the company and external organizations which perform maintenance, assembly and inspection of flange joints with metallic ring joint gasket in ORLEN UNIPETROL RPA, s.r.o. Does not apply to the Litvínov and Kralupy refinery unit.

The departments are obliged to present the standard to all external organizations the standard is also binding for.

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1. General provisions

1.1 Scope of validity

The standard applies to maintenance, assembly and inspection of flange joints with metallic ring joint gasket in UNIPETROL RPA, s.r.o.

1.2 Scope of application

One of the types of flange joints widely used around the world for oil and petrochemical industry is a flange joint with oval groove and metallic gasket ring. This type of flange joints is used for equipment and pipelines with presence of harmful and hazardous operating medium (inflammable, explosive, toxic or corrosive) where extraordinary tightness and long-term reliability of joints is required.

1.2.1 This type is used in UNIPETROL RPA, s.r.o. for production equipment of Plant 01 for operation parameters stated in table 1.

1.2.2 Construction and material execution of these joint in UNIPETROL RPA, s.r.o. is not unified, as different standards ( company standards PNC and American standards ANSI) were used for their production and delivery.

1.3 Purpose of this standard is to determine correct procedure and principles for its differentiation, designation, assembly, disassembly and inspection and thus to ensure reliable operation and maintenance of flange joints with metallic ring joint gaskets.

1.4 Flange joints with metallic ring joint gasket and their components have to be accompanied with certificate, inspection and testing documentation. When manufactured, the standards N 11 040, N 11 157 and N 11 158 apply.

1.5 All components of the joint must be embossed with designation pursuant to art. 4 herein, the designation must be permanently maintained in legible state.

1.6 Standards N 11 020 and N 11 986 have to be used together.

<b>It replaces:</b>  N 11 020 from 15.1. 2000	<b>Administrator:</b>  Reliability and documentation department	<b>Valid from:</b>  10. 4. 2013
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## 2. Terms and definitions

**Maintainer** – a determined employee, who is responsible for technical status of individual tangible asset groups including maintenance and repairs.

**Inspection technician** - an employee of VTZ and VPZ (technical supervision department) authorized to perform inspections and tests of pressure equipment having certificate and professional competence for these activities.

## 3. Types of joints

3.1 The following type of flange joints with metallic gaskets is used in UNIPETROL RPA, s.r.o.

- **ANSI inch joints** pursuant to ANSI B16.5 with original imported parts.

3.1.1 Scope of application of these joints is given by the table No.1. Table No. 2 gives orientation comparison of pressure designation as per ANSI and ČSN.

3.2 Flanges – welding neck flanges are used as well as blind flanges with modification of sealing surface for inch joints as per ANSI B16.20.

3.2.1 For ANSI inch joints a groove with flat bottom is used, as per ANSI B 16.20.

3.2.2 The groove must not interfere with the thickness of flange plate “a”. The height of sealing strip of the flange equals to the depth of groove.

3.2.3 Schematic representation of sealing surface modification of the inch flanges ANSI as per figure No. 2.

3.3 Joint gasket rings – inch R gasket rings of oval or octagonal cross section – as per ANSI B 16.20

3.3.1 Dimensions and materials, including cover marks of materials, are elaborated in detail in Standard N 13 035.

3.4 Bolts and nuts – as per table No. 1 or as per suitability to consider usage of bolts and nuts as per ČSN 13 1500.

## 4. Designation of components and principles for joint completion

4.1 In order to avoid exchanging joint elements and materials when completing the machines, it is necessary to adhere to the following principles:

- Clear embossing of the following designation that must be permanently maintained on components of the flange joint,
- Height of letters must not be less than 4 mm,
- Bolts are designated only with cover mark of material or shape marking of the end.

### 4.1.1 Flanges

Flange	DN	PN	Number	Material
As per ANSI	10"	1500 LB	R 53 (groove)	A 182 Gr. F11

### 4.1.2 Joint gasket ring

Ring	DN	PN	Number	Material
As per ANSI	-	-	R 54 (ring)	F5

4.2 Selection of ring size is carried out as per table No.3 based upon nominal inside diameter DN and nominal pressure PN, or as per designation of R groove number on the flange (ring of the same number).

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4.3 Selection of ring type – in case of any doubt ( ) designation of the flange is illegible) it is necessary to execute disassembly and determine the type as per existing rings, or as per groove shape.

4.4 Selection of material – the issued work permit shall contain number of pipe group (number of pipe branch including the pipe class).

4.4.1 Generally the following principle applies: hardness of the gasket ring must be lower than hardness of flanges to prevent permanent deformation of grooves when tightening the joints.

4.4.2 Assignment of flange and ring materials is as follows:

Flange material	Ring material (cover mark)	Max HB of ring
(11 416.1)	soft iron D	Max 90
A182 Gr. F11	F5	Max 130
A 182 Gr. F321H	S 316, S 304	Max 160

## 5. Disassembly, assembly and repair

### 5.1 Disassembly

5.1.1 After slackening and disassembly of flange joint bolts, to take out and thoroughly clean the ring and grooves of flanges.

5.1.2 To check flange and ring designation as per art. 4 herein and if need be renew the designation.

5.1.3 To properly measure and mark unidentifiable rings and flanges, or to eliminate them.

5.1.4 To check thoroughly status of the ring and flange grooves.

5.1.5 When damage is ascertained at some of the sealing surfaces of the ring or groove, to carry out manual equalizing using fine emery cloth.

5.1.6 Cleaned and equalized sealing surfaces are lubricated and properly marked rings are wired to the flanges.

5.1.7 Rings need to be secured so that the sealing surfaces cannot be mechanically damaged during the disassembly and so that their assembly to original place can be guaranteed.

### 5.2 Assembly

5.2.1 to remove conservation material of the ring and groove and both wipe them dry.

5.2.2 To check designation of rings and flanges, if need be renew the designation.

5.2.3 To check sealing surface of the ring and grooves thoroughly, to ensure their maximum cleanness.

5.2.4 To settle the ring into grooves of the flange and evenly tighten the bolts crosswise under concurrent check using the feeler gauge whether no deviations of flanges occur.

5.2.5 Blinding of flange joints with metallic ring joint gaskets may be performed only using the blinding glands installed to the pipeline. These glands have to have the same type of grooves and have to be designated as per art. 4 as the flanges.

5.2.6 It is not allowed to assemble even little mechanically damaged ring.

5.2.7 Not to assemble joint with damaged grooves of the flanges. Slight crushing of groove in place of sealing circle from the sealing ring does not obstruct the

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reassembly. Acceptable degree of crushing of the groove is assessed by the foreman (or his deputy) of the executing department.

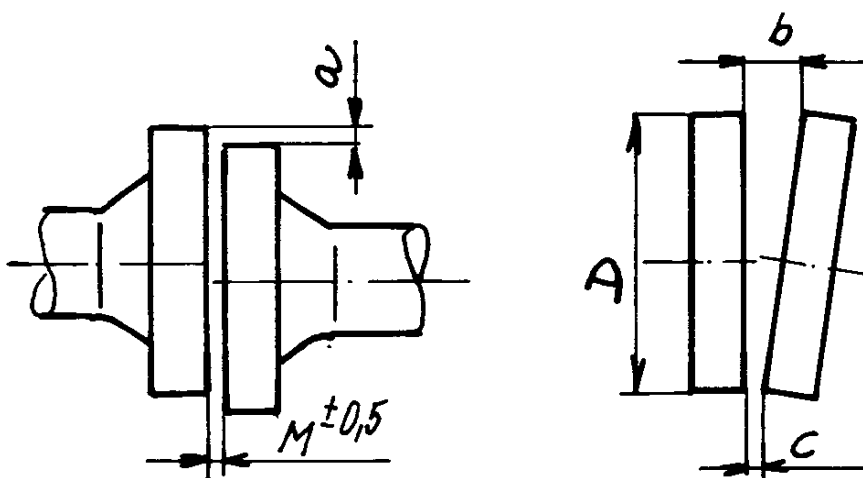
- 5.2.8 To adhere consistently to a principle of mutual sequencing of sealing ring materials and flanges as per table in art. 4.4.2.
- 5.2.9 Usage of type and materials of bolts and nuts for the flange joint is determined as per specification of pipe groups (pipe branches, pipe classes)
- 5.2.10 Sealing rings must not touch down the bottom of the groove during assembly.
- 5.3 Tightening the joints under pressure
  - 5.3.1 Under pressure N<sub>2</sub> (leak test) – the foreman (or his deputy) of the executing department carries out assessment whether it is spot leak or partially circumferential leak. In both cases it is possible to execute tightening under pressure.
  - 5.3.2 Under operating conditions - the operating procedure is the same as the one under nitrogen pressure, while all safety regulations including Directive S 456 are observed. The way of execution is in competence of the foreman (or his deputy) of the executing department in cooperation with the inspection technician.
- 5.4 Equalizing of rings and grooves
  - 5.4.1 When the ring is damaged obstructing its reassembly without prior mechanical equalizing, it is necessary to perform inspection of ring damage degree. The ring may be equalized only to minimum dimensions determined by the calculation. This calculation guarantees adherence to allowance between flanges during assembly.
  - 5.4.2 Equalizing of the groove may be performed only provided that the flange face is reduced in order to maintain the shape (depth) of the groove. The flange plate is herewith attenuated and this may be carried out only to the minimum dimension determined by a calculation.
  - 5.4.3 Allowed dimensions for equalizing the flange grooves and gasket rings are given by calculation V 5627.
- 6. Manufacture and assembly inspection
  - 6.1 When manufacturing flange joints components with metallic ring joint gasket the inspection is carried out in compliance with N 11040, completeness of documentation, designation, and tests including dimensions as per fabrication drawings.
  - 6.2 Flange joints with metallic ring joint gasket are subject to assembly inspection, where the following is checked:
    - a) Correctness of bolt tightening
    - b) Inspection of alignment and inclination of flanges
    - c) Overlap of min. two threads of the bolt from the nut.

a=0,01D  
max. 1mm

b-c=0,01D  
max. 1mm

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#### 7. Inspections, revisions and tests

7.1 to ensure safe and reliable operation of the joints with metallic ring joint gasket it is necessary to regularly ensure performance of inspections, revisions and tests of pipeline.

7.2 In case the joints with metallic ring joint gasket are part of gas pipeline, the inspection, revisions and tests are carried out pursuant to N 11 004.

7.3 Types of inspection, revision and tests including their cycles are determined by Standard N 11 986.

7.3.1 The maintainer of the respective pipeline may determine shorter cycles for performance of internal and external inspections, pressure tests, pipe and component wall thickness measurement than is determined in N 11 986.

7.3.2 There are reports on all performed inspections, tests or repairs that are included in the pipeline passport pursuant to N 11 986.

#### Amendments, compared to the original issue:

References to the issue related to NRL and PSP equipment were left out from the standards as these are production plants of Česká rafinérská, a.s.

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8. List of quoted and related standards

Quoted:

ANSI/ASME B16.5-2009 -Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

ANSI/ASME B16.20-2007 Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed

ČSN 13 0010 r.90 Pipes and fitting. Nominal pressures and working overpressure

ČSN 13 1500 Pipes. Bolts and nuts for flanged pipeline joints. Application

N 11 004 Standard. Operating rules of gas equipment

N 11 040 Providing the machinery products and materials with testing and inspection documentation.

N 11 157 Precision bolts and nuts. Technical delivery terms

N 11 158 HP pipeline components. Technical delivery terms

N 11 986 Pipeline. Documentation, inspections and acceptance

N 13 035 Metallic ring joint gaskets as per ANSI. Dimensions

Directive 465 Work permitting

related:

N 11 200 Standard for acceptance of equipment from operation to repair and back to operation

N 12 010 Review of cover marks for material designation

invalid: As these PNC standards became invalid it is necessary to consider all PNC standards listed in this standard as informative only. With respect to construction and material execution of these joints in UNIPETROL RPA, s.r.o. these PNC standards in existing production and tech, equipment are listed in this standard.

PNC 13 8522 r.81 Pipeline for crude oil processing. Modification of flange sealing surfaces

PNC 13 8522 r.83 Pipeline for crude oil processing. Modification of flange sealing surfaces

PNC 13 8525 r.81 Pipeline for crude oil processing. Flanges. Technical delivery terms

PNC 13 8525 r.87 Pipeline for crude oil processing. Flanges. Technical delivery terms

PNC 13 8609 r.81 Pipeline. Metallic ring joint gaskets. Technical delivery terms

PNC 13 8609 r.87 Pipeline. Metallic ring joint gaskets. Technical delivery terms

PNC 13 8611 r.81 Pipeline for crude oil processing. Metallic ring joint gaskets of octagonal cross section.

PNC 13 8611 r.88 Pipeline for crude oil processing. Metallic ring joint gaskets of octagonal cross section.

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Table No.1 – Scope of application of joints in UNIPETROL RPA, s.r.o.

Data	Plant 01
Max. operating overpressure	6,85 MPa
Max operating temperature	650 °C
Piping class 15*	D2D, E2D
Piping class 17*	F2M, F3M
Nominal pressure of flanges PN	ANSI 600 up to 1500 LB
Nominal inner diameter of flanges DN	4" up to 12"
Modification of flange grooves as per standard	ANSI B 16.20
Ring joint gaskets	Oval or octagonal ANSI B 16.20
Bolts and nuts	"W" thread ANSI B 16,5

\*- operating overpressure and temperature of individual classes are given in specification of the pipe classes.

Table No. 2 Orientation comparison of nominal pressure designation

ČSN 13 0010*	ANSI 16.5	ANSI 16.5
PN	PN	Class -Series
16	-	-
(20)	20	150LB
40	-	-
(50)	50	300LB
63	68	400 LB
100	100	600 LB
1600	150	900 LB
250	250	1500 LB
400	420	2500 LB

\*- selection of PN is given for temperature above 0 °C  
PN in brackets are used for new pipelines only exceptionally

Table No. 3 – Assignment of ring joint gasket

Nominal inner diameter DN	Nominal Pressure				
	150 LB	300 – 600 LB	900 LB	1500 LB	2500 LB
1/2"	-	R11	R12	R12	R13
3/4"	-	R13	R14	R14	R16
1"	R15	R16	R16	R16	R18
1 1/4"	R17	R18	R18	R18	R21
1 1/2"	R19	R20	R20	R20	R23
2"	R22	R23	R24	R24	R26
2 1/2"	R25	R26	R27	R27	R28
3"	R29	R31	R31	R35	R32

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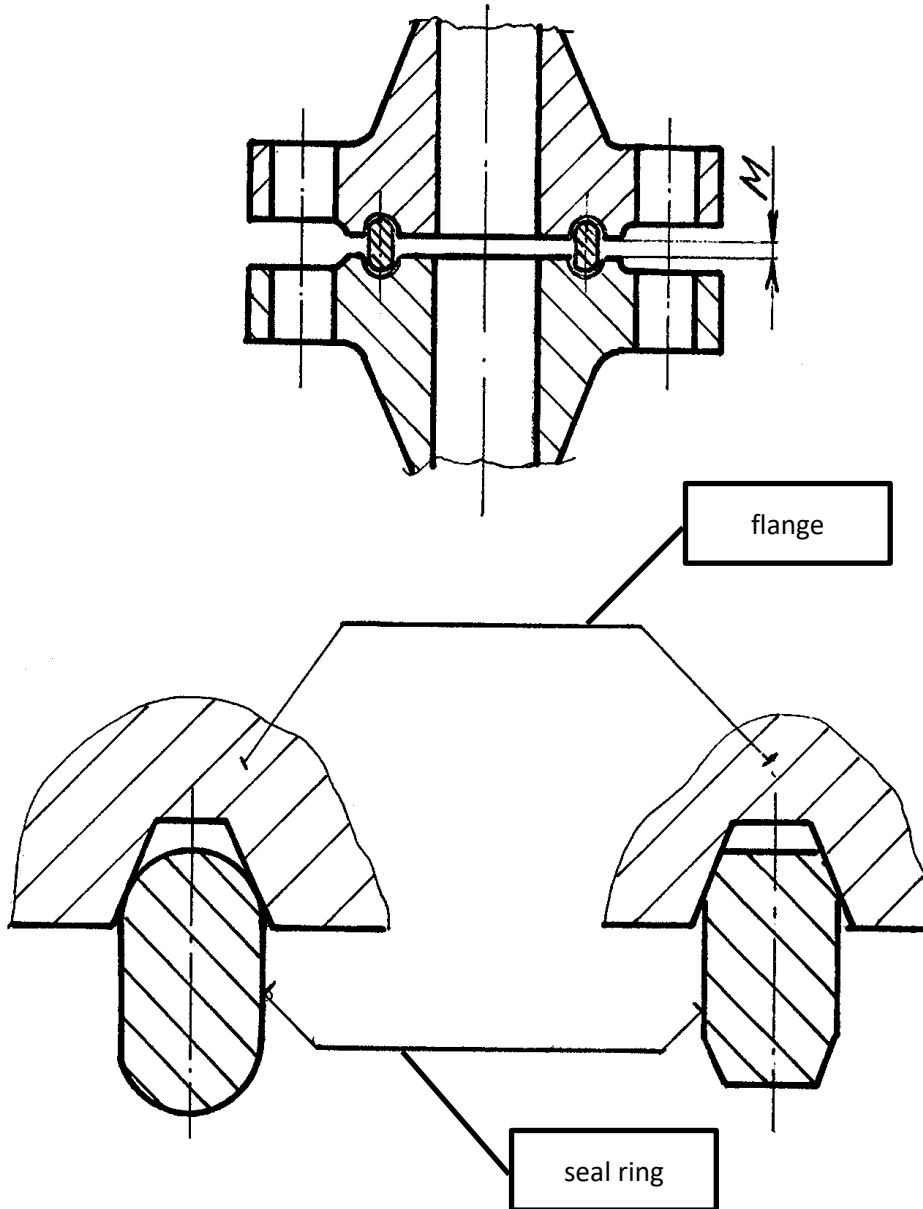
4"	R36	R37	R37	R39	R38
5"	R40	R41	R41	R44	R42
6"	R43	R45	R45	R46	R47
8"	R48	R49	R49	R50	R51
10"	R52	R53	R53	R54	R55
12"	R56	R57	R57	R58	R60
14"	R59	R61	R62	R63	-
16"	R64	R65	R66	R67	-
18"	R68	R69	R70	R71	-
20"	R72	R73	R74	R75	-
24"	R76	R77	R78	R79	-

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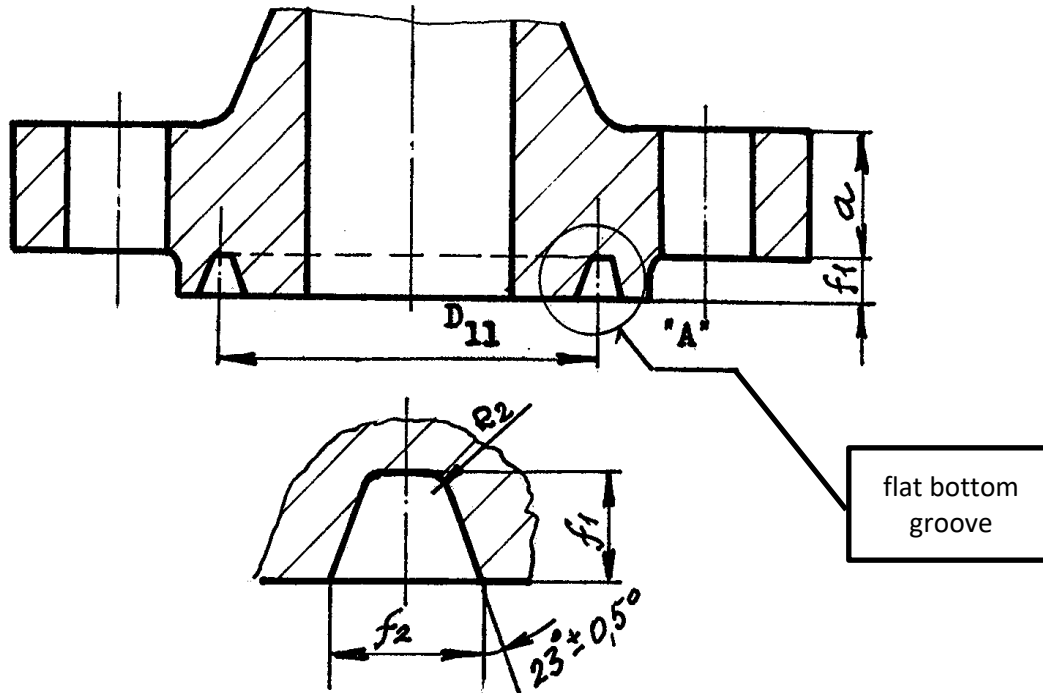
Pict. No. 1 Flange connection with metal ring



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Pict. No. 2 Modifications of tight surfaces of ANSI inch flanges



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