PS/ML/Note Tech. 82-12
27.9.1982

A NEW U.H.V. FLANGE CONNECTION USING APPROVED TECHNIQUES

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Generalities

In U.H.V. systems it is often desirable to place two tanks as close as possible to one another with a dismountable and rotatable flange connection which can also be baked-out at 350 ^{o}C.

CERN-developed Quick-Connect-Couplings, the PS- and SPS-type, may be used for a vacuum down to 10^{-9} Torr and are bakeable up to 120 ^{o}C only.

The chain-type couplings on the market (as offered e.g. by EVAC, Helioflex or SIN) seem to be applicable for a vacuum of 10^{-12} Torr and a bake-out of 350 ^{o}C, but were never really accepted and relied upon at CERN. Instead, we use most commonly the Conflat-type flanges up to 375 mm outside diametre, and the Wheeler-type ones from 12" (300 mm) O/D upwards.

Description of flange connections

This note compares various fixations for flanges of 295 mm O/D, smaller and larger ones can be made as required.

1. Drawing E.43.1228.3 shows a typical Conflat-flange arrangement, needing at least 128 mm clearance between the tanks. If compared with the following connections, a supplementary bake-out jacket is needed. A rotatable flange assembly is optional.

2. Drawing E.43.1129.3 demonstrated the normal technique of gaining axial space by cutting out the bolt holes of the flanges and introducing the bolts laterally. Disadvantage : a flange can be rotated with respect to the other one only by the fixed angle at which the bolt holes are placed.

3. With a combination of these two arrangements (not shown) an axial distance of one flange thickness with respect to 1. is gained (for the size chosen 23.5 mm). This is done by mounting on one side a fixed flange with slotted bolt holes, and to the other side a rotatable one.

4. Now, if we look at the advantages of both Conflat and Wheeler-type flanges and combine them, a solution as shown on drawing E.43.1230.3 is found. The space between the tanks becomes relatively small, and one flange can rotate freely with respect to the other one. Both of them are identical.

   The clamps, similar to the ones offered by Varian, have been cut from specially turned rings in order to adapt themselves to small diametre flanges. - The smaller the space, the more difficult it becomes to work with two hands. In this case the flanges can be tightened using one spanner only.

5. A further improvement could be made when forged clamps were applied. The built-in space of the flange connection could be made even smaller by turning down the outer part of the flange thickness. This was only possible because the force lines created by the pressure surfaces of the clamps pass directly and vertically through the joint, whilst in all other cases the pressure surfaces are not lined-up with the sealing surface (drawing E.43.1231.3).

Test results

A test rig was built containing two "Helioflex" connections of DN 160, and each two of the flange pairs as described in 4. and 5. with 232 DN (or 295 O/D). The system was thermally cycled between ambient temperature and 350 ^{o}C as well as being maintained at 350 ^{o}C during 24 h.

The tests*) showed that a leak-free connection could be made after the flange was clamped for the first time, while the Helioflex couplings presented some problems before a tight joint could finally be obtained.

Costs

To establish prices correctly, the number of pieces manufactured must be taken into account. The following estimation is based on three complete and assembled connections, however without a central bore hole or tube welded onto the flanges.

Using the same numbering as in the description, the price per assembly is approximatively:

		SFrs
1.	Standard type	800
2.	With cut-out bolt holes	900
3.	One rotatable-flange and one with cut-out bolt holes	950
4.	With machined clamps	2350
5.	With forged clamps	1350

Conclusion

It is too early to make a final judgement because of the relatively few tests made until now. Other factors, such as bolt tightening torques, flange deformation, long-term tests, etc., will give a more complete picture.

However, the results so far obtained are very encouraging and would suggest that a reliable and fully bakeable U.H.V. connection could be available at a reasonable price.

Acknowledgements

Mr. P.L. Riboni made it possible to have the different assemblies manufactured and tested, whilst the mounting and testing itself was done by M. Girardini.

Distribution : open

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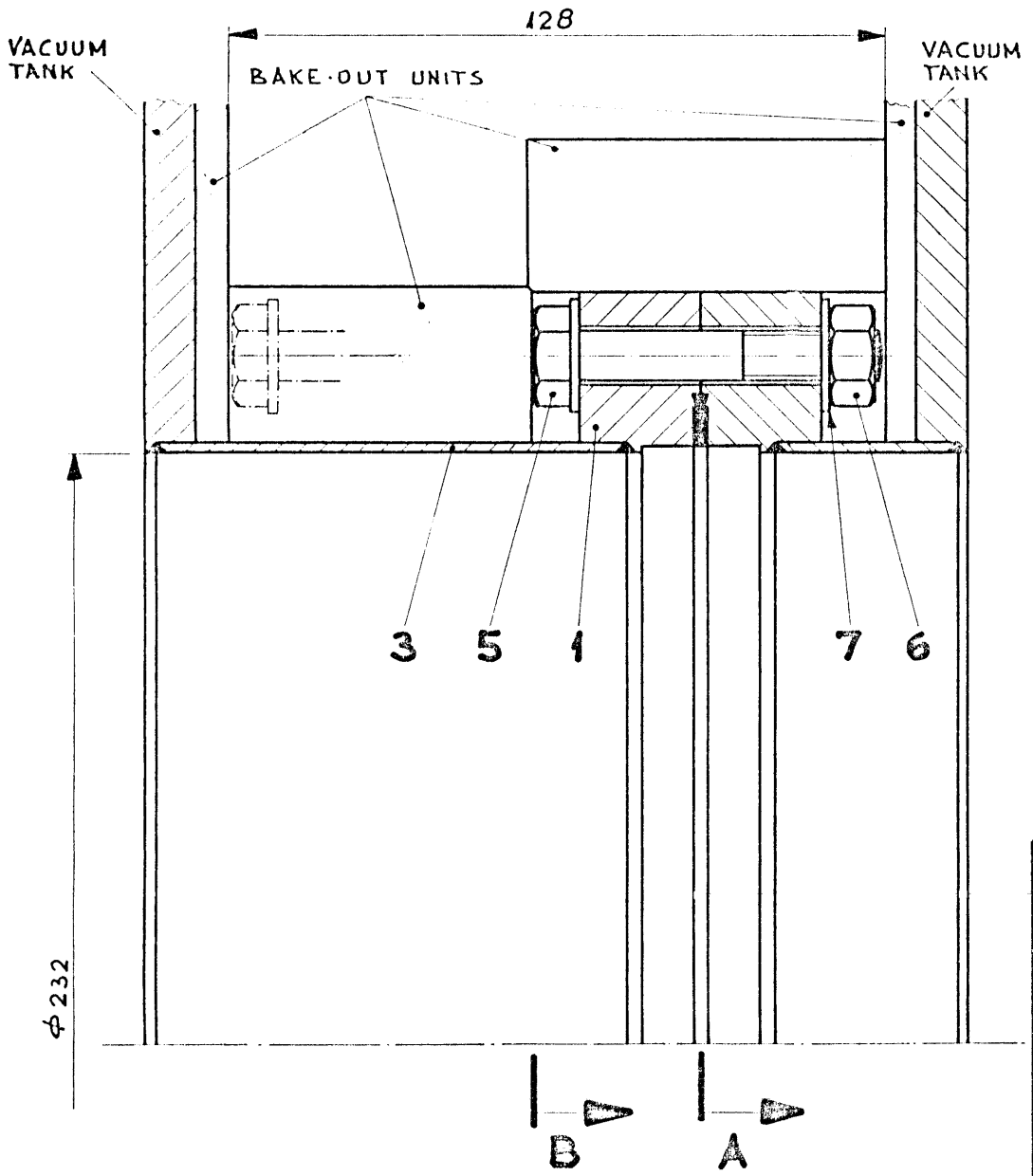
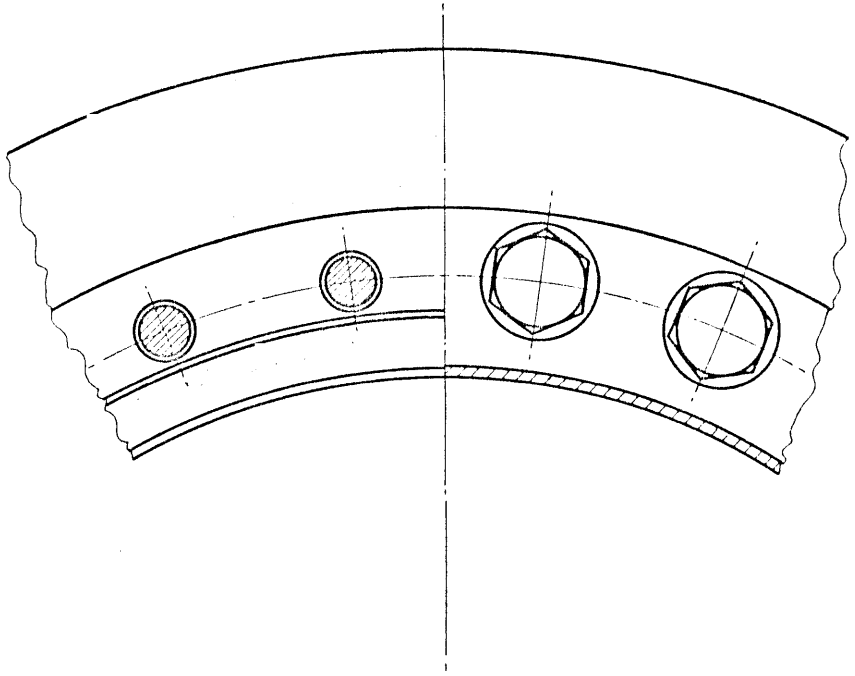
*) Jonctions métalliques étuvables pour le vide, PS/ML/VAC/MG/ar, 19.8.81.



SECTION 'A'

SECTION 'B'



		8			
48	FLAT WASHER, M 10	7	ST.ST.		47.78.15.122.7
24	HEX. SCREW, M 10	6	ST.ST., A4		47.43.78.110.0
24	HEX. BOLT, M 10 × 60	5	ST.ST., A4		47.62.83.224.8
		4			
2	TUBE, Φ236 × Φ232	3	ST.ST.		
		2			
2	CF-FLANGE, 295 O/D	1			ISR.261.126.1
NOMBRE PAR UNITE	DESCRIPTION	POS	MATIÈRE	COTES BRUTES	FOURNISSEURS NO SCEM
	ENSEMBLE		S. ENSEMBLE		

	NOM	DATE
DESSINÉ	Zanoli	20.9.82
CONTRÔLÉ		

VACUUM FLANGE CONNECT. 295 O/D STANDARD TYPE

ÉCHELLE SCALE 1:1

REMPLACE
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ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
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E.43.1228.3

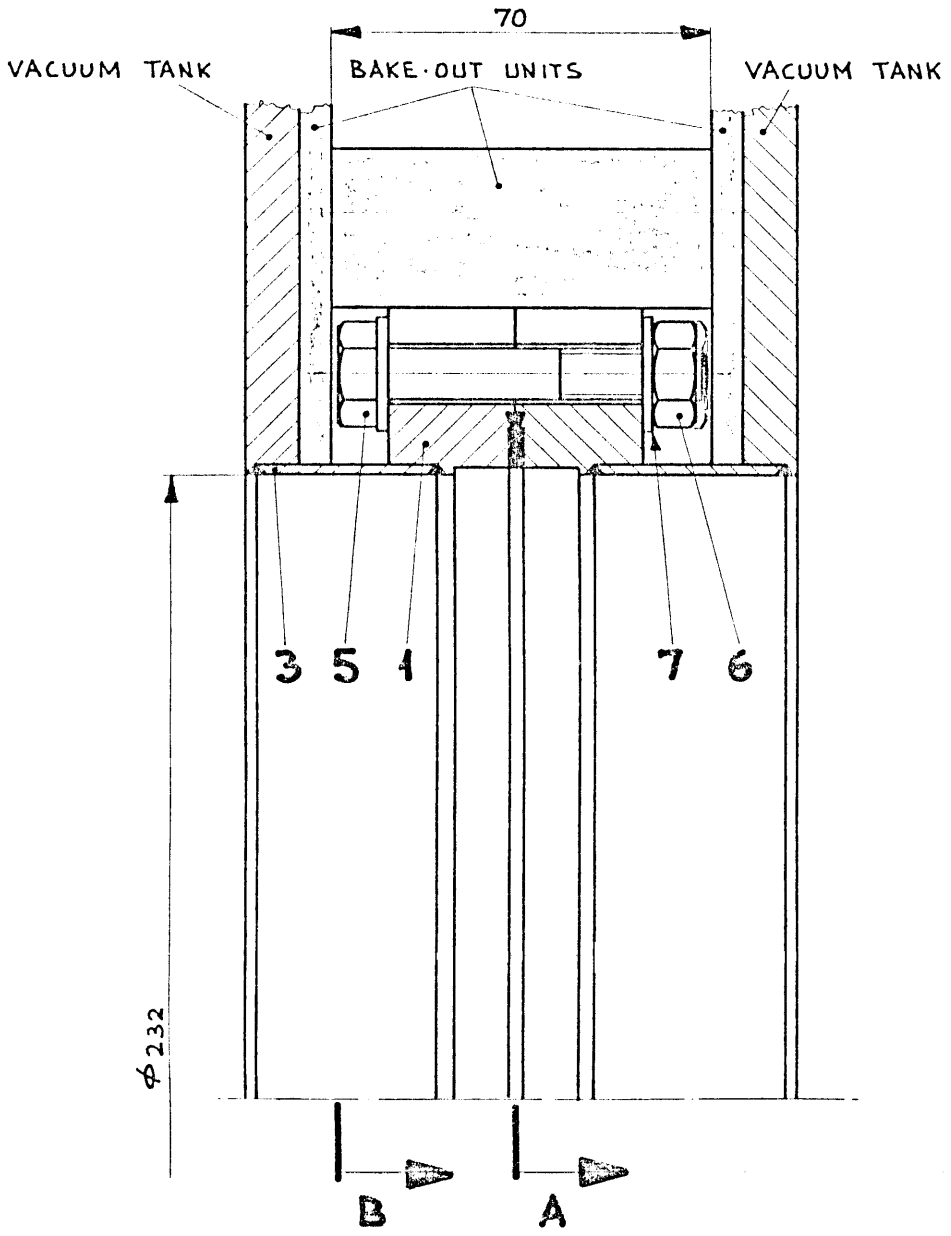
INDICE	DATE	NOM	ZONE	MODIFICATION

TOLÉRANCES GÉNÉRALES

USINAGE	±0.2	±0.3	±0.5	±0.8	±1	±2	±3	±4
MÉCANO-SOUDURE	±0.5	±0.8	±1	±1.5	±2	±3	±4	±5

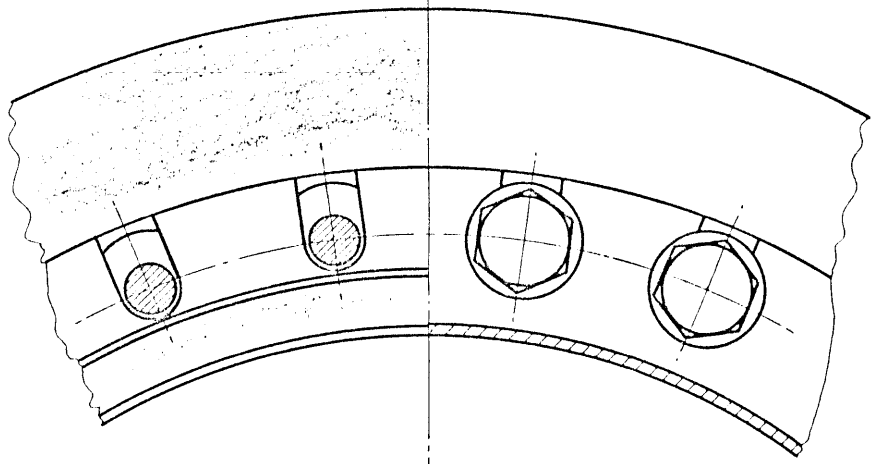
DESSIN, RUGOSITÉ, TOLÉRANCES SELON NORMES ISO

First angle projection



SECTION 'A'

SECTION 'B'



		8			
48	FLAT WASHER, M 10	7	ST. ST.		47.78.15.122.7
24	HEX. SCREW, M 10	6	ST. ST., A 4		47.43.78.110.0
24	HEX. BOLT, M 10 × 60	5	ST. ST., A 4		47.62.83.224.8
		4			
2	TUBE, Φ236 × Φ232	3	ST. ST.		
		2			
2	CF-FLANGE, 295 O/D	1	CUT OUT BOLT HOLES		ISR.261.126.1

NOMBRE PAR UNITÉ	DESCRIPTION	POS	MATIÈRE	COTES BRUTES	FOURNISSEURS No SCEM
	ENSEMBLE		S. ENSEMBLE		

	NOM	DATE
DESSINÉ	Zanoli	20.9.82
CONTRÔLÉ		

ÉCHELLE SCALE: 1:1

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VACUUM FLANGE CONNECT. 295 O/D WITH CUT-OUT BOLT HOLES

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TELEX GENÈVE 2 3 9 8

E.43.1229.3

INDICE

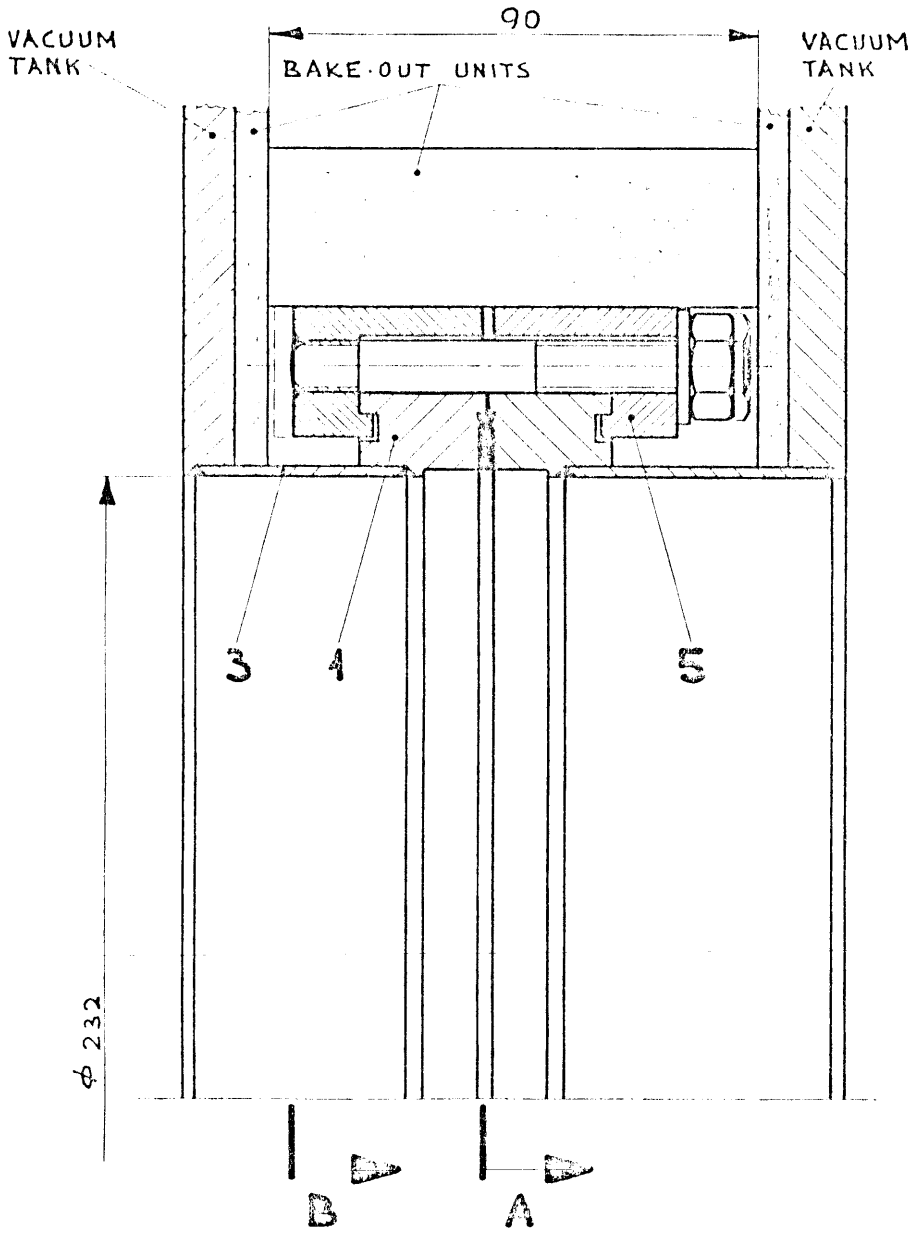
INDICE	DATE	NOM	ZONE	MODIFICATION

USINAGE	±0.2	±0.3	±0.5	±1	±2	±3	±4
MÉCANO-SOUDURE	±0.5	±0.8	±1				

TOLÉRANCES GÉNÉRALES

DESSIN RUGOSITÉ, TOLÉRANCES SELON NORMES ISO

Projection du 3e dièdre
First angle projection



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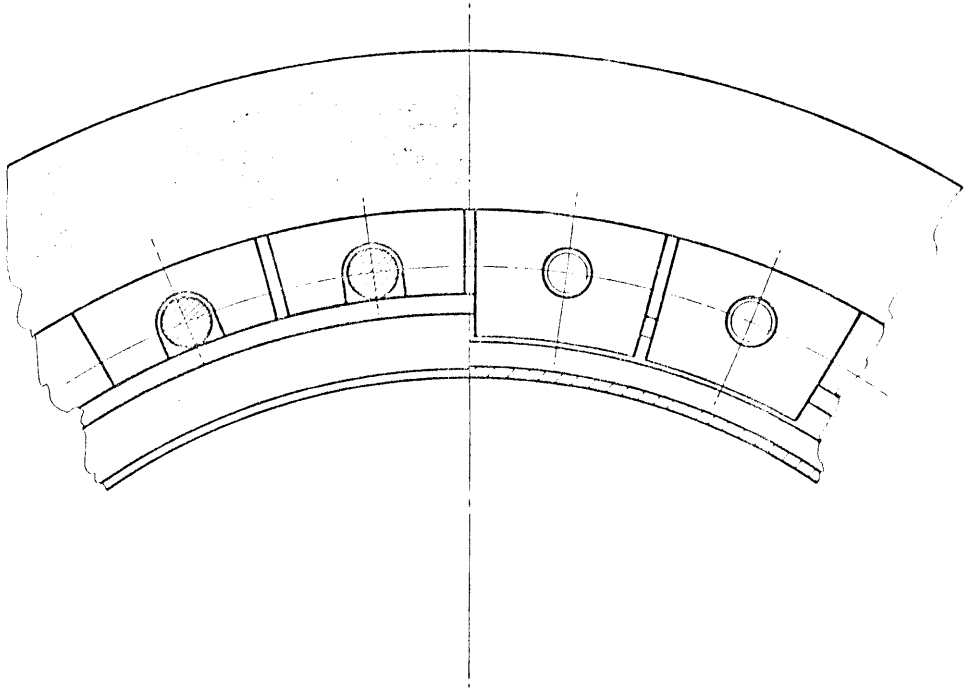
SECTION 'B'



		8			
		7			
		6			
24	CLAMP SUB-ASSY.	5	ST. ST.	ϕ295 NOM.	E.43.1059.3
		4			
2	TUBE, ϕ236 × ϕ232	3	ST. ST.		
2	FLANGE, ϕ295 NOM.				E.43.1057.3
NOMBRE PAR UNITÉ	DESCRIPTION	POS	MATIÈRE	COTES BRUTES	FOURNISSEURS No. OEM
	ENSEMBLE		S. ENSEMBLE		NOM DATE

DESSINÉ Zanoli 20.9.82
CONTRÔLÉ

VACUUM FLANGE CONNECT. 295 NOM. O/D WITH MACHINED CLAMPS

FORMAT E
ÉCHELLE 1:1
REMPLACÉ
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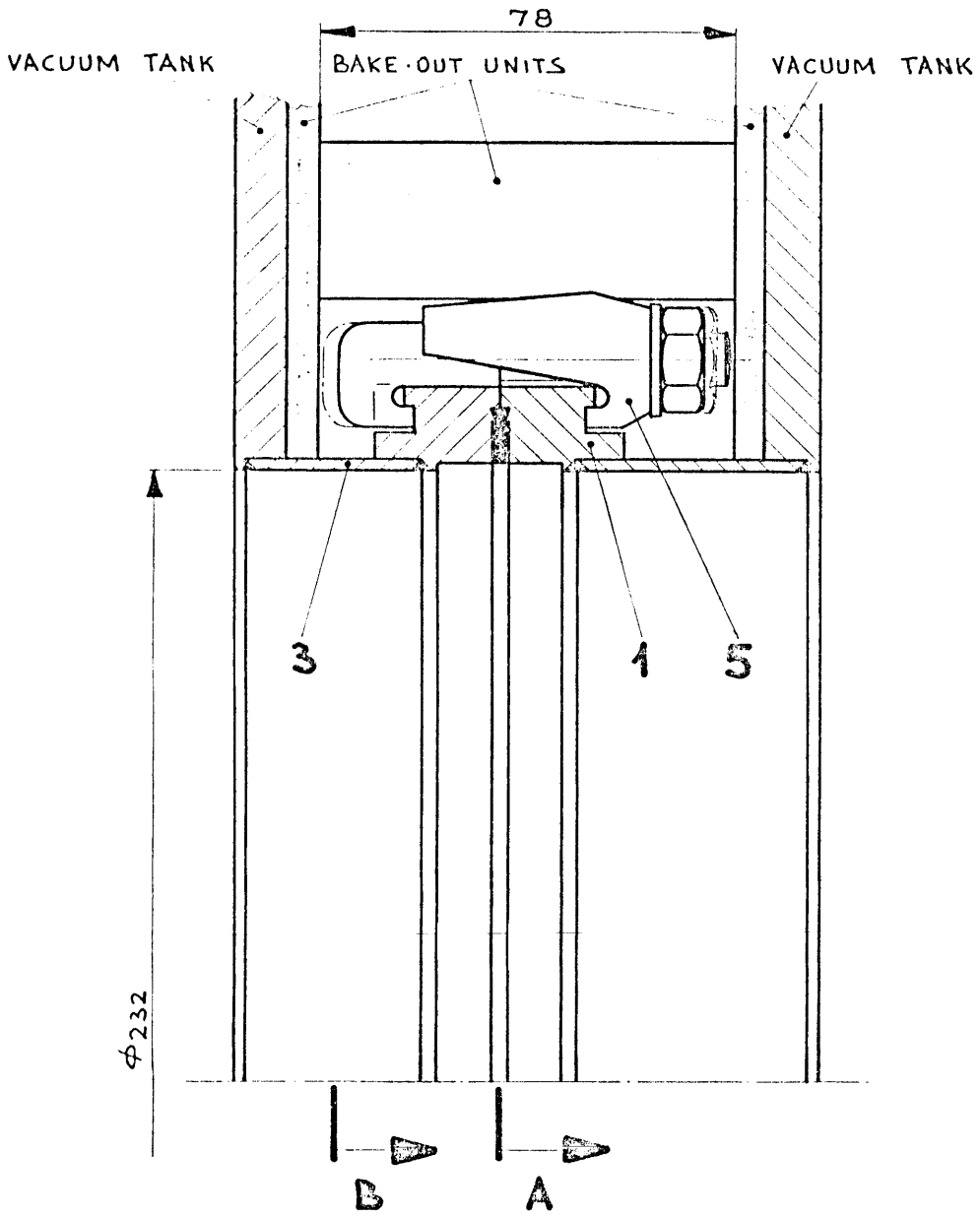
E.43.4230.3

INDICE DATE NOM ZONE MODIFICATION

DESSIN RUBOSITÉ ET CHANFREINS SELON NORMES ISO



SECTION 'A'

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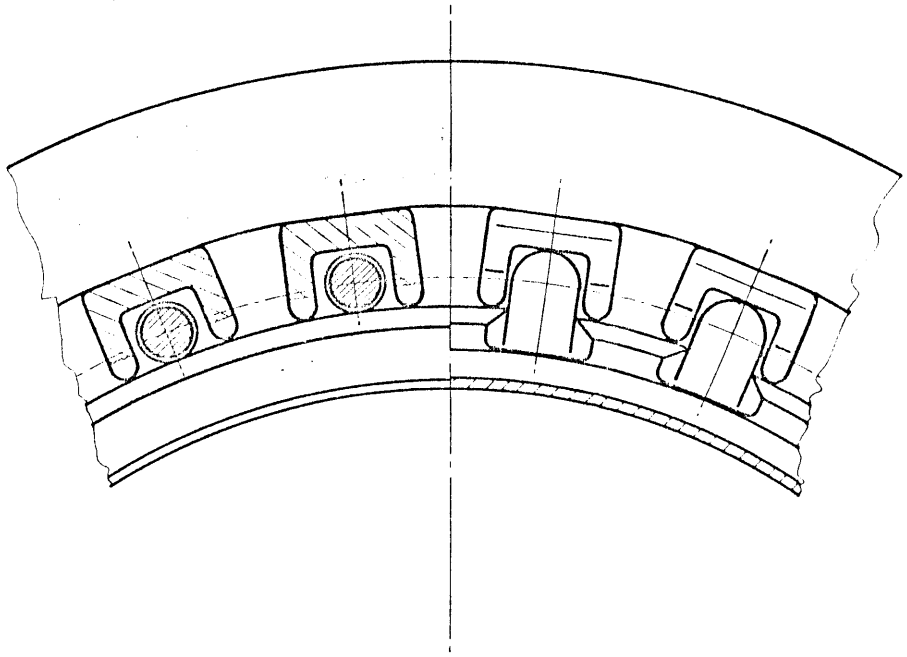

		8			
		7			
		6			
24	CLAMP	5	ST. ST., A4		RATHMANN M10-L
		4			
2	TUBE, Φ236 × Φ232	3	ST. ST.		
		2			
2	FLANGE, Φ295 NOM.	1			E.43.1072.4

NOMBRE PAR UNITE	DESCRIPTION	POS	MATIÈRE	COTES BRUTES	FOURNISSEURS N. S/EM.
	ENSEMBLE		S. ENSEMBLE		

NOM: Zanoli DATE: 20.9.82

DESSINE

CONTRÔLÉ

REMPLACE

REMPLACÉ PAR

RÉDUCTION

ÉCHELLE SCALE: 1:1

VACUUM FLANGE CONNECT. 295 NOM. O/D WITH FORGED CLAMPS

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
CERN Lab PS

E.43.1231.3

DESSIN, RUGOSITE TOLERANCES SELON NORMES ISO

TOLÉRANCES GÉNÉRALES

USINAGE	±0.2	±0.3	±0.5	±1	±2	±3	±4
MÉCANO-SOUDURE	±0.5	±0.5	±1	±2	±3	±4	

INDICE	DATE	NOM	ZONE	MODIFICATION