

RE-4 (RPC) gas tubes in the CMS YE-3 endcap peripheries

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1 Technical specification

1.1 Design scope

The scope of this design is the routing of gas tubes from the gas rack to patchpanels placed in the peripheries of the CMS YE-3 endcap. The routing is carried out as a 3D CAD model as well as 2D production drawings (PDF format). The 3D model can be found at:

<https://edms.cern.ch/document/1259329/1>

2D drawings are the attachments of this design.

The gas rack (WxDxH – 600x600x1800mm) will be installed in the far side tower (-X) of the endcap at X2 level. The design and installation of the gas rack is out of the scope of this design. Below the footprint of the rack in the edncap's -X tower is shown.



1.2 System description

There will be 72 individual tubes routed from the gas rack to patchpanels.

The tubes will be made of copper of outer/inner diameter 8/6mm. Changes of direction of each of the tubes' paths will be done by bending. The method used for bending must ensure that the tubes will not be flattened. If possible each tube should be continuous without any fittings joining different pieces of tube. The tubes will be attached to the metallic structure of the endcap by means of custom made copper clamps. The rough drafts of the clamps are shown in the drawing CMSYEP3RE4_002. However each clamp has to be adjusted on-site due to the fact that the tubes will be routed among existing services and, in some spots, attached to existing tubing. The tubes have to be clean without dust, metallic chips, grease etc. Before the tubes are connected to tube fittings on top of the gas rack and patchpanel fittings they should be closed with a tube cap or flattened with a hammer at both ends.

Each tube should be labelled at both ends (by the gas rack and by a patchpanel). The text of the labels is shown in table 1.

A patchpanel consists of an aluminium holding plate and 2 gas distributors with tube fittings screwed in. The holding plates and 3 different patchpanel assemblies are shown in the drawing CMSYEP3RE4_001. The aluminium gas distributors according to separate design. The patchpanels will be fixed to the metallic structure with two M6 stainless steel screws – tapped holes have to be made in the structure.

After the installation pressure and leak tests should be performed.

Position of the patchpanels, bundle clamps and tubes routing are shown in the drawings CMSYEN3RE4_001, CMSYEN3RE4_002, CMSYEN3RE4_003 and CMSYEN3RE4_004. 3D views of the tubes routing is shown in the drawing CMSYEN3RE4_005.

2 Assignment of the gas rack channels to the patchpanels

Table 1.

RE-4

Tube/ Distributor No.	Gas rack		Tube label	Patch- panel No.	Super- modules
	Channel No.	Supply/ Return			
1A	17	RET	Gas RE-4/17/RET/1A	1AB	1 & 2
1B	17	SUP	Gas RE-4/17/SUP/1B		
1C	5	RET	Gas RE-4/5/RET/1C	1CD	
1D	5	SUP	Gas RE-4/5/SUP/1D		
2A	3	RET	Gas RE-4/3/RET/2A	2AB	3 & 4
2B	3	SUP	Gas RE-4/3/SUP/2B		
2C	18	RET	Gas RE-4/18/RET/2C	2CD	
2D	18	SUP	Gas RE-4/18/SUP/2D		
3A	6	RET	Gas RE-4/6/RET/3A	3AB	5 & 6
3B	6	SUP	Gas RE-4/6/SUP/3B		
3C	4	RET	Gas RE-4/4/RET/3C	3CD	
3D	4	SUP	Gas RE-4/4/SUP/3D		
4A	19	RET	Gas RE-4/19/RET/4A	4AB	7 & 8
4B	19	SUP	Gas RE-4/19/SUP/4B		
4C	7	RET	Gas RE-4/7/RET/4C	4CD	
4D	7	SUP	Gas RE-4/7/SUP/4D		
5A	11	RET	Gas RE-4/11/RET/5A	5AB	9 & 10
5B	11	SUP	Gas RE-4/11/SUP/5B		
5C	20	RET	Gas RE-4/20/RET/5C	5CD	
5D	20	SUP	Gas RE-4/20/SUP/5D		
6A	8	RET	Gas RE-4/8/RET/6A	6AB	11 & 12
6B	8	SUP	Gas RE-4/8/SUP/6B		
6C	12	RET	Gas RE-4/12/RET/6C	6CD	
6D	12	SUP	Gas RE-4/12/SUP/6D		
7A	21	RET	Gas RE-4/21/RET/7A	7AB	13 & 14
7B	21	SUP	Gas RE-4/21/SUP/7B		
7C	9	RET	Gas RE-4/9/RET/7C	7CD	
7D	9	SUP	Gas RE-4/9/SUP/7D		
8A	23	RET	Gas RE-4/23/RET/8A	8AB	15 & 16
8B	23	SUP	Gas RE-4/23/SUP/8B		
8C	22	RET	Gas RE-4/22/RET/8C	8CD	
8D	22	SUP	Gas RE-4/22/SUP/8D		
9A	10	RET	Gas RE-4/10/RET/9A	9AB	17 & 18
9B	10	SUP	Gas RE-4/10/SUP/9B		
9C	24	RET	Gas RE-4/24/RET/9C	9CD	
9D	24	SUP	Gas RE-4/24/SUP/9D		

Tube/ Distributor No.	Gas rack		Tube label	Patch- panel No.	Super- modules	
	Channel No.	Supply/ Return				
10A	1	RET	Gas RE-4/1/RET/10A	10AB	19 & 20	
10B	1	SUP	Gas RE-4/1/SUP/10B			
10C	2	RET	Gas RE-4/2/RET/10C	10CD		
10D	2	SUP	Gas RE-4/2/SUP/10D			
11A	13	RET	Gas RE-4/13/RET/11A	11AB	21 & 22	
11B	13	SUP	Gas RE-4/13/SUP/11B			
11C	14	RET	Gas RE-4/14/RET/11C	11CD		
11D	14	SUP	Gas RE-4/14/SUP/11D			
"BOTTOM MANIFOLD"	12A	25	RET	Gas RE-4/25/RET/12A	12AB	23 & 24
	12B	25	SUP	Gas RE-4/25/SUP/12B		
	12C	30	RET	Gas RE-4/30/RET/12C	12CD	
	12D	30	SUP	Gas RE-4/30/SUP/12D		
	13A	28	RET	Gas RE-4/28/RET/13A	13AB	25 & 26
	13B	28	SUP	Gas RE-4/28/SUP/13B		
	13C	26	RET	Gas RE-4/26/RET/13C	13CD	
	13D	26	SUP	Gas RE-4/26/SUP/13D		
	14A	27	RET	Gas RE-4/27/RET/14A	14AB	27 & 28
	14B	27	SUP	Gas RE-4/27/SUP/14B		
	14C	31	RET	Gas RE-4/31/RET/14C	14CD	
	14D	31	SUP	Gas RE-4/31/SUP/14D		
	15A	32	RET	Gas RE-4/32/RET/15A	15AB	29 & 30
	15B	32	SUP	Gas RE-4/32/SUP/15B		
	15C	33	RET	Gas RE-4/33/RET/15C	15CD	
	15D	33	SUP	Gas RE-4/33/SUP/15D		
	16A	34	RET	Gas RE-4/34/RET/16A	16AB	31 & 32
	16B	34	SUP	Gas RE-4/34/SUP/16B		
	16C	35	RET	Gas RE-4/35/RET/16C	16CD	
	16D	35	SUP	Gas RE-4/35/SUP/16D		
	17A	36	RET	Gas RE-4/36/RET/17A	17AB	33 & 34
	17B	36	SUP	Gas RE-4/36/SUP/17B		
	17C	29	RET	Gas RE-4/29/RET/17C	17CD	
	17D	29	SUP	Gas RE-4/29/SUP/17D		
	18A	16	RET	Gas RE-4/16/RET/18A	18AB	35 & 36
	18B	16	SUP	Gas RE-4/16/SUP/18B		
	18C	15	RET	Gas RE-4/15/RET/18C	18CD	
	18D	15	SUP	Gas RE-4/15/SUP/18D		
	SPARE	37	RET			
	SPARE	37	SUP			

Tube/ Distributor No.	Gas Rack		Tube label	Patch- panel No.	Super- modules
	Channel No.	Supply/ Return			
SPARE	38	RET			
SPARE	38	SUP			
SPARE	39	RET			
SPARE	39	SUP			

“Bottom manifold” in the above table refers to a manifold inside the gas rack to which gas channels from 25 to 36 are connected. Those channels are assigned to patchpanels from 12 to 17 located at the bottom part of the endcap.

3 Bill of material

Table 2.

No.	Standard/SCEM code	Name	Material	Quantity	Remarks
1		PANEL #1, 81x52x6mm	Aluminium	33	see drawing CMSYEP3RE4_001
2		PANEL #2, 89x61x6mm	Aluminium	3	see drawing CMSYEP3RE4_001
3	DIN 912; ISO 4762	HEXAGON SOCKET HEAD CAP SCREWS, M6, L=16mm	Stainless steel	161	
4	ISO 3506; ISO 7089	PLAIN WASHER, M6	Stainless steel	207	
5	DIN 7991	HEXAGON SOCKET COUNTERSUNK HEAD FLAT SCREW, M6, L=12mm, head diameter 12mm	Stainless steel	144	
6		GAS DISTRIBUTOR	Aluminium	72	according to separate design
7		TUBE FITTING B-8M0-1-4, SWAGELOK	Brass	72	
8		FITTING		144	to be defined
10		PANEL #4, 120x112x3mm	Stainless steel	1	see drawing CMSYEP3RE4_002
11		PANEL #5, 124x102x3mm	Stainless steel	2	see drawing CMSYEP3RE4_002
13		PANEL #7, 85x30x3mm	Stainless steel	1	see drawing CMSYEP3RE4_002
14		CLAMP #1	Copper	1	see drawing CMSYEP3RE4_002
15		CLAMP #2	Copper	1	see drawing CMSYEP3RE4_002
16		CLAMP #3	Copper	4	see drawing CMSYEP3RE4_002
17		CLAMP #4	Copper	2	see drawing CMSYEP3RE4_002
20		CLAMP #7	Copper	1	see drawing CMSYEP3RE4_002
21		CLAMP #8	Copper	1	see drawing CMSYEP3RE4_002
22		CLAMP #9	Copper	1	see drawing CMSYEP3RE4_002
23		CLAMP #10	Copper	2	see drawing CMSYEP3RE4_002
24		CLAMP #11	Copper	1	see drawing CMSYEP3RE4_002
25		CLAMP #12	Copper	3	see drawing CMSYEP3RE4_002
26		CLAMP #13	Copper	2	see drawing CMSYEP3RE4_002
27		CLAMP #14	Copper	2	see drawing CMSYEP3RE4_002

3D maker – Wojciech Szczęsny

No.	Standard/SCEM code	Name	Material	Quantity	Remarks
29		CLAMP #16	Copper	1	see drawing CMSYEP3RE4_002
30		CLAMP #17	Copper	8	see drawing CMSYEP3RE4_002
31		CLAMP #18	Copper	6	see drawing CMSYEP3RE4_002
32		CLAMP #19	Copper	5	see drawing CMSYEP3RE4_002
33		CLAMP #20	Copper	4	see drawing CMSYEP3RE4_002
34		CLAMP #21	Copper	7	see drawing CMSYEP3RE4_002
35		CLAMP #22	Copper	3	see drawing CMSYEP3RE4_002
36		CLAMP #23	Copper	5	see drawing CMSYEP3RE4_002
37		CLAMP #24	Copper	4	see drawing CMSYEP3RE4_002
38		TUBE 8/6mm OD/ID (72 INDIVIDUAL TUBES)	Copper	~1000m	longest tube - 27 m
39	41.90.30.636.8	U-BOLT DN65 (D=78mm), M10	Stainless steel	7	
40	ISO 3506; ISO 7089	PLAIN WASHER, M10	Stainless steel	16	
41	ISO 3506, ISO 4032	HEXAGON NUT, M100	Stainless steel	16	
42	ISO 3506, ISO 4032	HEXAGON NUT, M6	Stainless steel	24	
43	ISO 4014/4017 DIN 933/931	HEXAGON SCREW, M6, L=25mm	Stainless steel	8	
44	ISO 4014/4017 DIN 933/931	HEXAGON SCREW, M6, L=20mm	Stainless steel	14	
47	DIN 6334	HEXAGONAL COUPLING NUT, M10	Stainless steel	2	
49		THREADED ROD M10, L=530mm	Stainless steel	2	

4 Drawing list

Table 3.

Drawing No.	Title	Size
CMSYEN3RE4_001	YE-3 ENDCAP RPC RE-4 gas pipes on the periphery of the endcap - patchpanels	A0
CMSYEN3RE4_002	YE-3 ENDCAP RPC RE-4 gas pipes on the periphery of the endcap - cross sections	A1+
CMSYEN3RE4_003	YE-3 ENDCAP RPC RE-4 gas pipes on the periphery of the endcap - details - 1	A1
CMSYEN3RE4_004	YE-3 ENDCAP RPC RE-4 gas pipes on the periphery of the endcap - details -2	A1
CMSYEN3RE4_005	YE-3 ENDCAP RPC RE-4 gas pipes on the periphery of the endcap - 3D views	A1