

YE3

Cooling Upgrade

New YE3 schematic

Estimate for rack dissipation

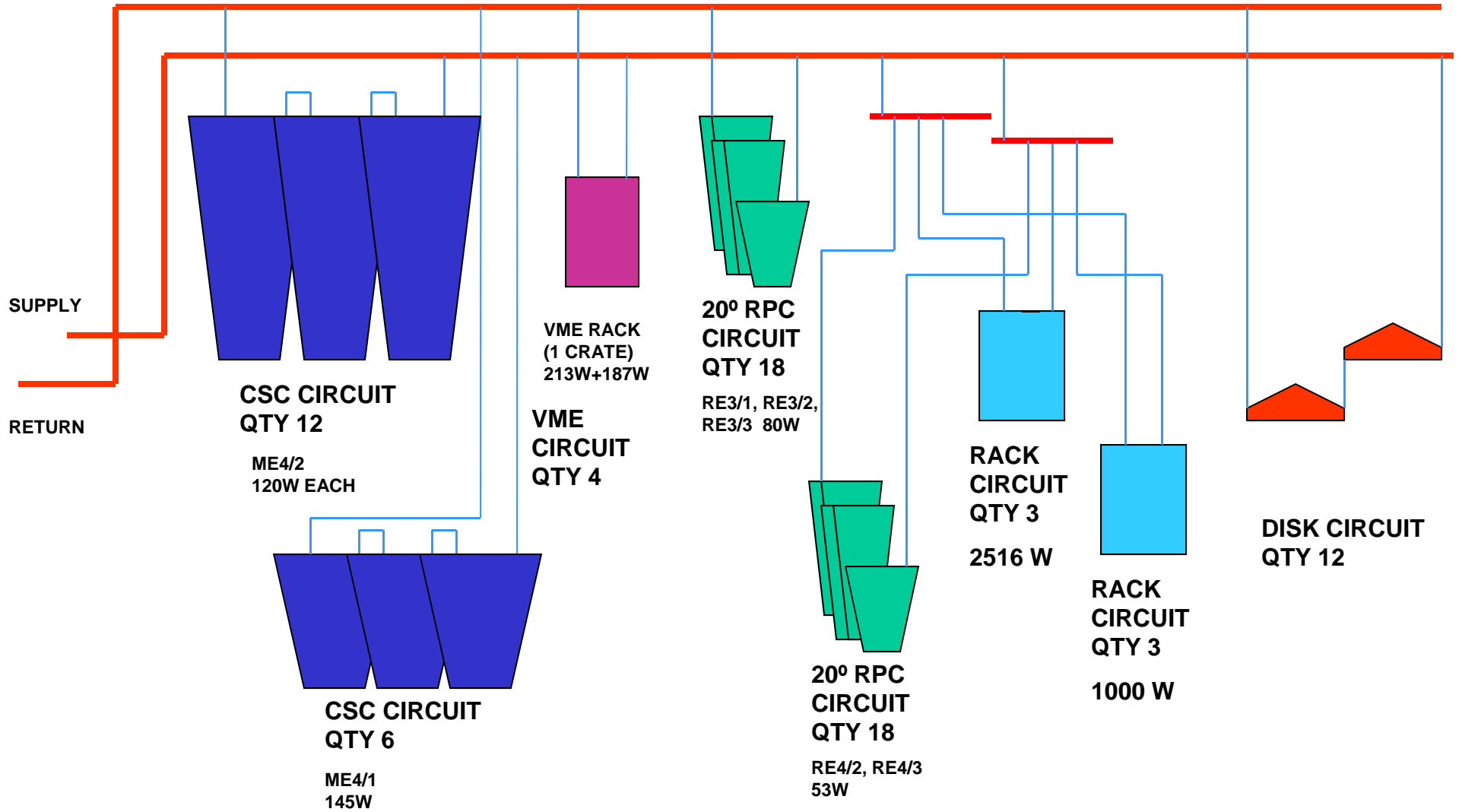
YE3 cooling parameters

Endcap cooling summary

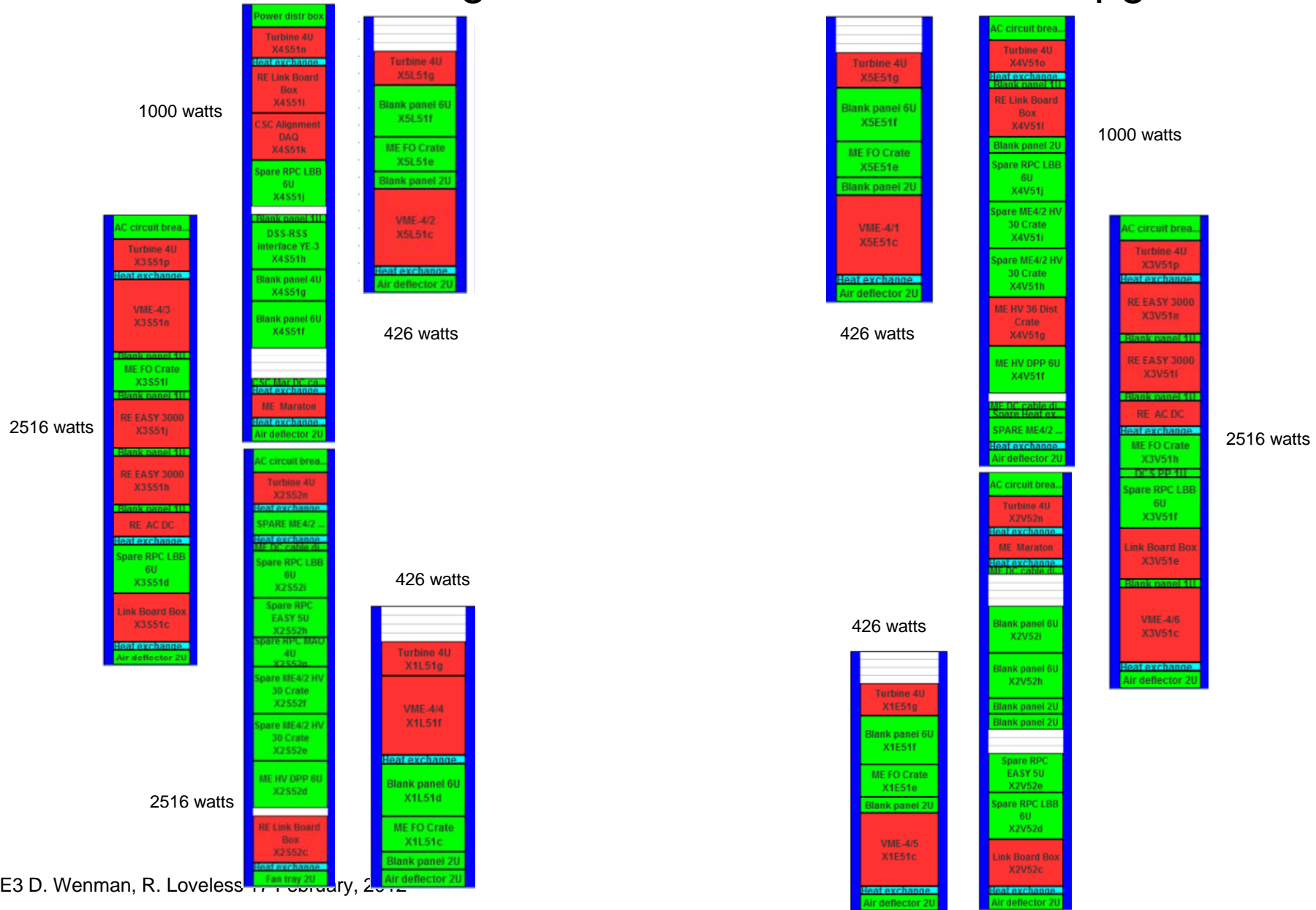
ME4/2

New RE4/Rack manifold

YE3 cooling schematic



Estimate of cooling needed for YE3 racks after upgrade



YE3 cooling parameters

	Units	YE3 periphery manifold	CSC cooling circuit ME4/2	CSC cooling circuit ME4/1	RPC cooling circuit RE3	RPC cooling circuit RE4	Disk circuit	VME/CRB circuit (minirack)	Rack cooling circuit (low flow)	Rack cooling circuit (high flow)
Tube/pipe OD	mm	48.3	9.5	9.5	8.0	8.0	12.7	12.7	12.7	12.7
Tube/pipe wall	mm	1.7	0.8	0.8	1.0	1.0	1.2	1.2	1.2	1.2
Tube/pipe ID	mm	45.0	7.9	7.9	6.0	6.0	10.2	10.2	10.2	10.2
Tube/pipe Area	mm ²	1587	49	49	28	28	82	82	82	82
Flow rate	liter/min	199	2.3	2.3	2	2	2	4.7	4.7	9.5
Flow velocity	m/sec	2.1	0.8	0.8	1.2	1.2	0.4	1.0	1.0	1.9
Reynolds	unitless	90704	5973	5973	6838	6838	4014	9434	9434	19068
Heat removal/circuit	W	21180	360	369	80	53	400	426	1000	2516
Temperature rise	C	1.5	2.2	2.3	0.6	0.4	2.9	1.3	3.1	3.8
Number of circuits	ea	1	12	6	18	18	12	4	3	3
Total flow	liter/min	199	27.6	13.8	36	36	24	18.8	14.1	28.5
Heat removed	W	21180	4320	2214	1440	954		1704	3000	7548
Heat removal capacity	W						4800			
Pressure drop (measured)	bar									

	liter/min	
Total flow	n	199
Total Heat removed	W	21180
Total temperature rise	C	1.5

Flow comparison

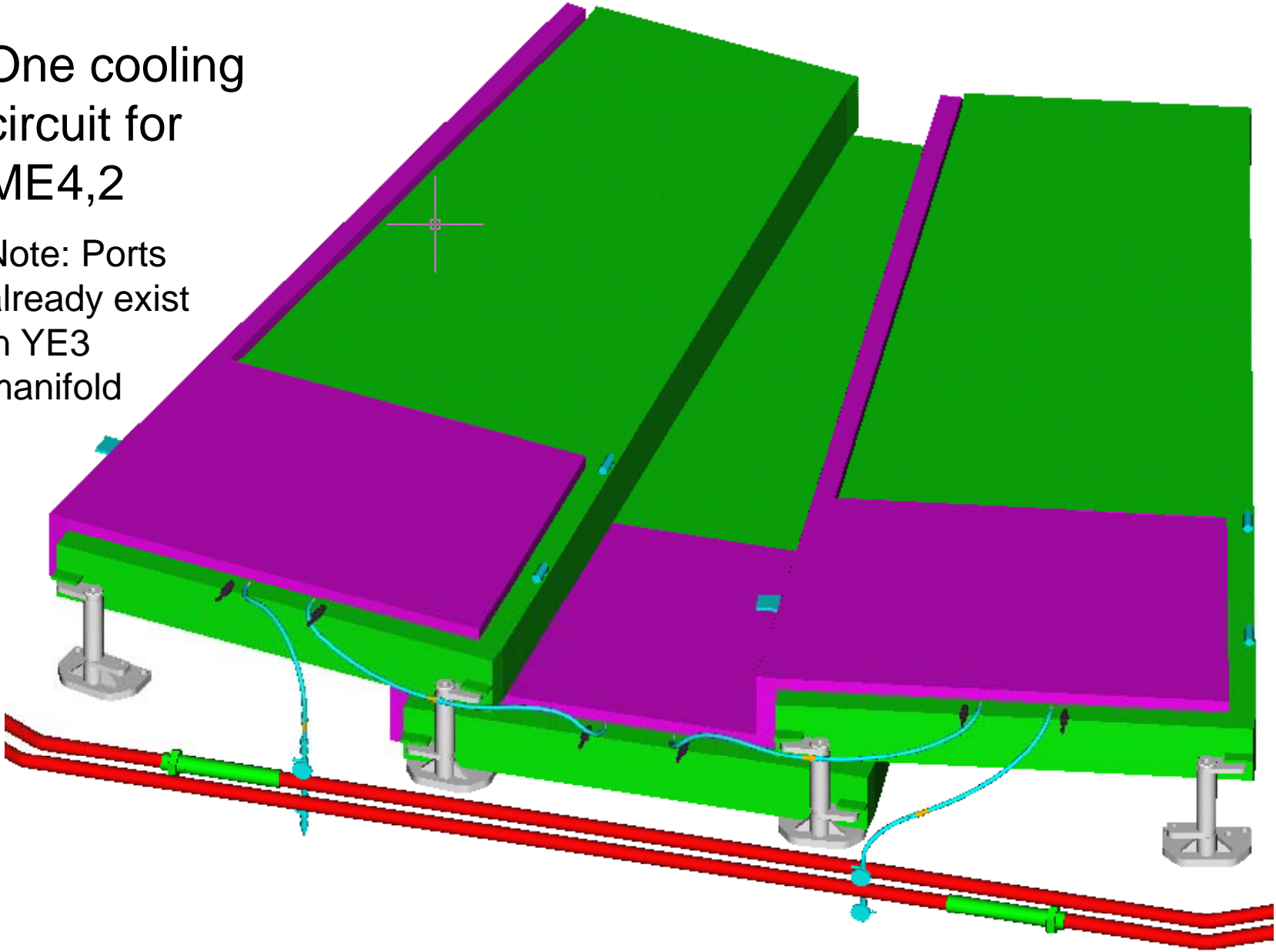
Periphery manifolds	Units	Upgrade	Original	Percent
Total Flow YE3 manifold	liter/min	199	161	23.5
Total Heat removed YE3 Manifold	W	21180	15482	36.8
Total temp rise YE3 Manifold	C	1.5	1.4	
Total flow per endcap	liter/min	708	671	5.6
Total Heat removed per endcap	W	76832	71134	8.0
Total temperature rise	C	1.6	1.5	

YE1 Tower manifolds	Units			
Total flow per endcap	liter/min	182	182	0
Total Heat removed per endcap	W	28200	28200	0
Total temperature rise	C	2.2	2.2	0

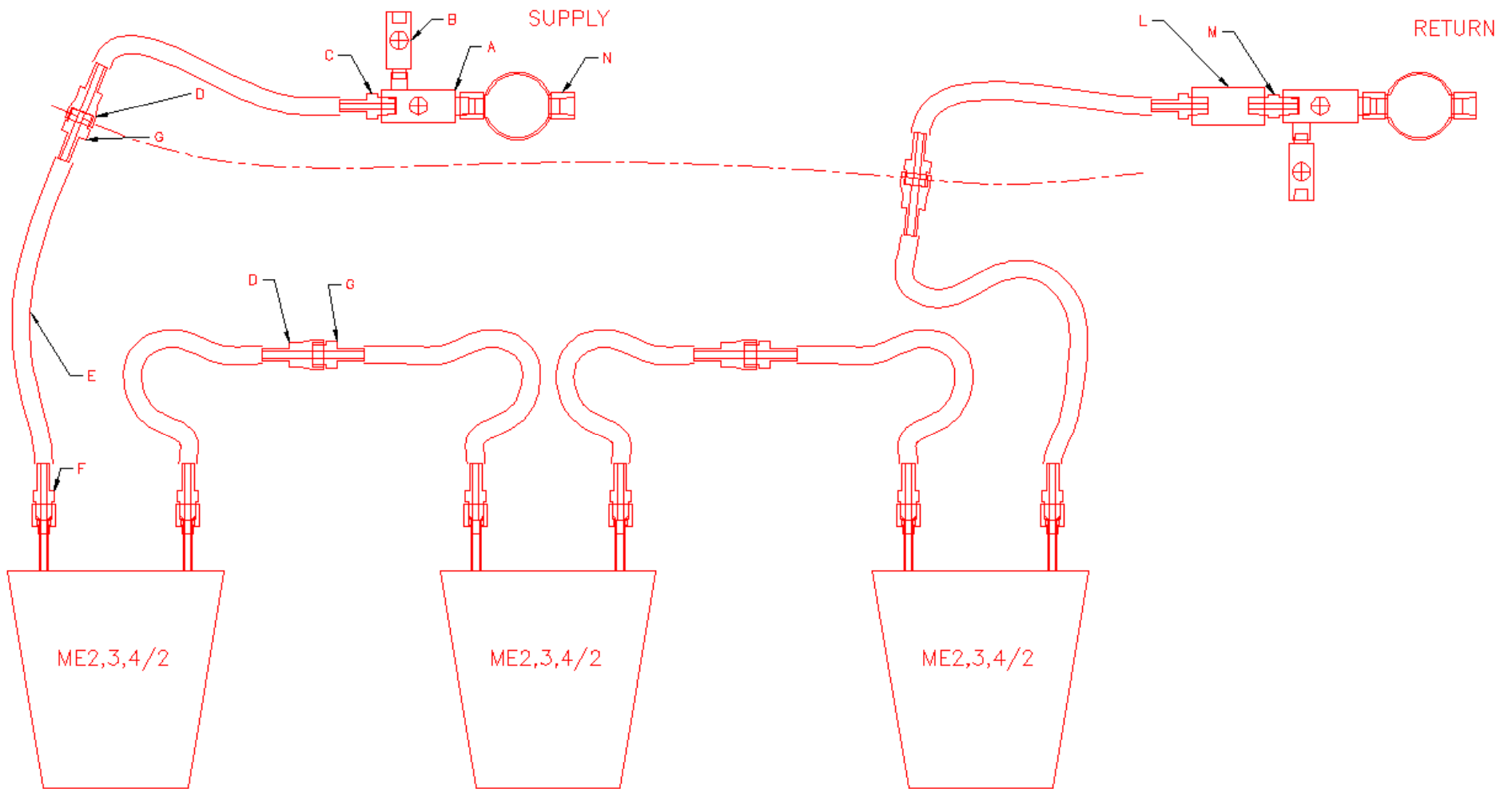
Totals for one endcap	Units			
Total flow per endcap	liter/min	891	853	4.4
Total Heat removed per endcap	W	105032	99334	5.7
Total temperature rise	C	1.7	1.7	

One cooling circuit for ME4,2

Note: Ports already exist in YE3 manifold



CSC cooling circuit for ME4/2



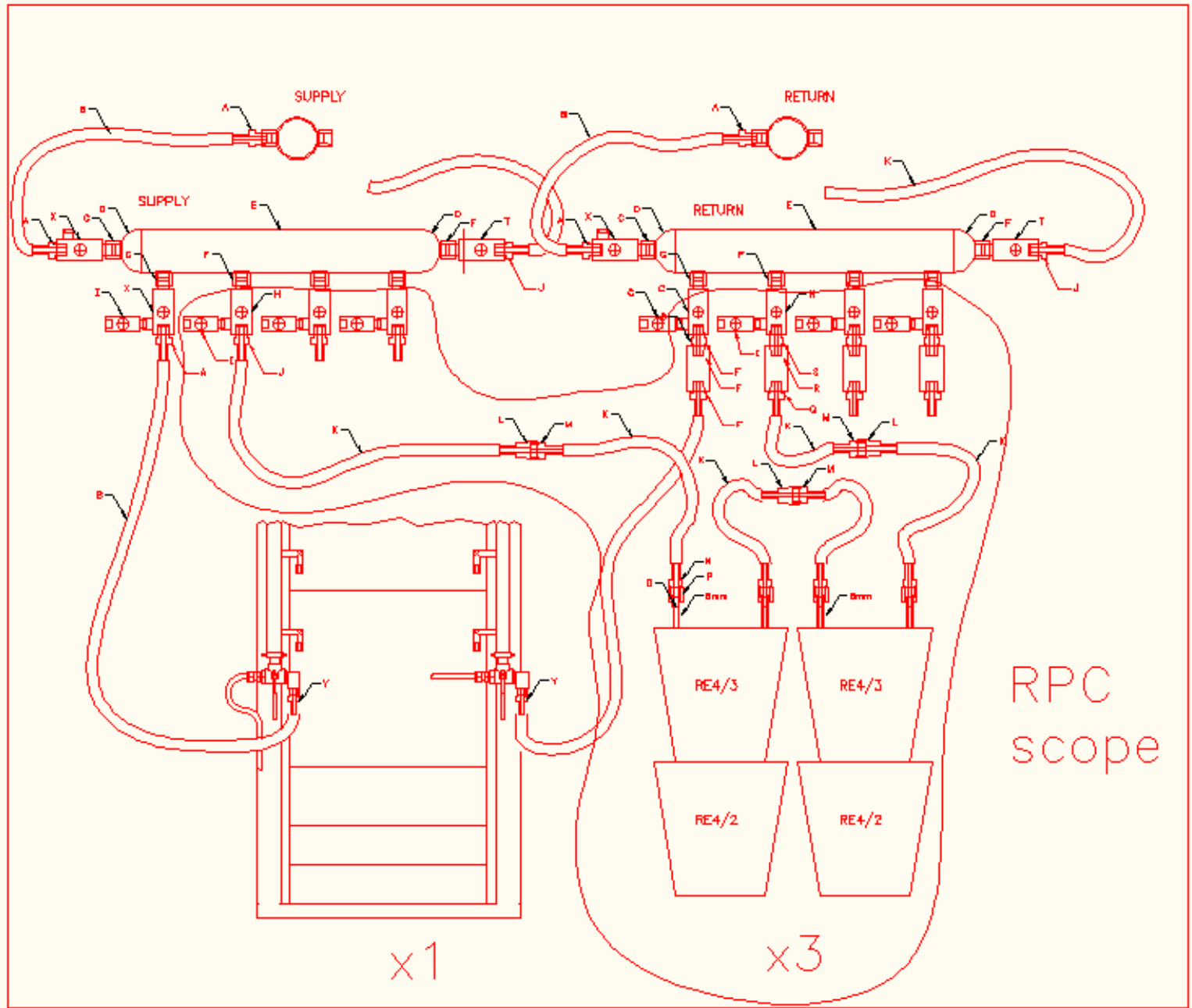
Items in a ME4/2 cooling circuit

KEY	Description	Material
	1.5" sch 5 SS supply manifold	304 SS
N	Ladish # 32915 half coupling 1/4" pipe thread (welded to manifold)	316 SS
A	Apollo # 7B-841-01 1/4" Ball valve w/ SS ball & stem & side port	Bronze
B	B&G # RP-250B Bell & Gossett Readout Valve	Brass
C	Parker # 30182-4-6B 1/4" MPT to 3/8" hose barb	Brass
E	Parker # 821-6 3/8" Push lok hose	MSHA approved
D	Parker # 3JC82-6-6B (barb to female O-ring)	Brass
G	Parker # 3J082-6-6B (Barb to male O-ring)	Brass
E		
F	Parker # 30382-6-6B 3/8" male 37 deg to barb	Brass
F	Parker # 6 BTX B Nut	
F	Parker # 6 TX B Sleeve	Brass
	Chamber (3/8" OD X .032 wall copper tube)	Brass
	F,E,D,G,E,F	
	Chamber (3/8" OD X .032 wall copper tube)	Copper
	F,E,D,G,E,F	
	Chamber (3/8" OD X .032 wall copper tube)	Copper
	F,E,D,G,E,C	
L	Hayes Mesurflo # 2305-0061- 1/4" IPS flow regulator (0.6 GPM)	Bronze
M	Parker # 216P-4 1/4" hex nipple	Brass
B	B&G # RP-250B Bell & Gossett Readout Valve	Brass
A	Apollo # 7B-841-01 1/4" Ball valve w/ SS ball & stem & side port	Bronze
N	Ladish # 32915 half coupling 1/4" pipe thread (welded to manifold)	316 SS

YE3

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New Manifold cooling circuit



Items in the RE4 manifold circuit

Manifold hardware

	item	Part number
A	1/2" to 1/2" barb	Parker #30182-8-8B 1/2" MPT to 1/2" hose barb
B	1/2" hose	Parker #831-8 1/2" Push-Lok hose (blue preferred) PSL# 5599Axxx Mod half coupling 1/2" IPS 316SS Ladish 150#
C	1/2" half cplg w/pilot	half coupling #32915-1/2" 316SS
D	1-1/2" cap	304/304L SS sch 10 Cap
E	1-1/2" pipe	304/304LSS Sch 5 pipe x xxxmm LG PSL#5599A358 Mod Half Coupling 1/4" IPS 316SS Ladish
F	1/4" half couplings	150# half coupling #32915-1/4" 316SS
	1/2" half cplg	PSL# 5599A693 Mod half coupling 1/2" IPS 316SS Ladish
G	w/fishmouth	150# half coupling #32915-1/2" 316SS
T	valves	Apollo 7x-xxx-xx 1/4" Ball valve w/SS ball & stem
J	1/4" to barb	Parker #30182-4-4B 1/4" MPT to 1/4" hose barb
K	1/4" hose	Parker #831-4 1/4" Push-Lok hose (green preferred)
X	1/2" valve	Apollo 7B-843-01 1/2" Ball valve w/SS ball & stem & port

Items in the RE4 distribution circuit

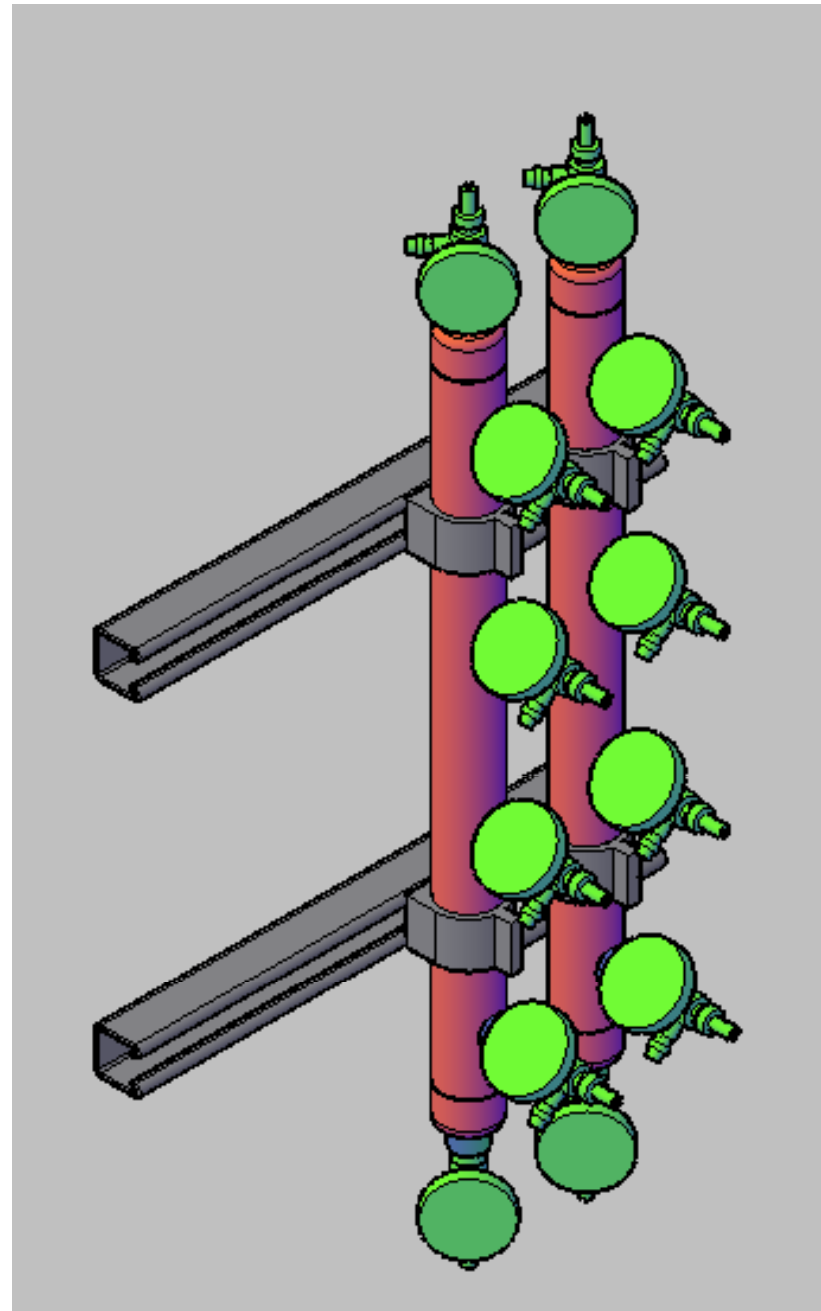
RPC w/ optional orings fittings total

	item	Part number
H	1/4" valve w/side port	Apollo 7B-841-01 1/4" Ball valve w/SS ball & stem & port
I	readout valve	B&G #RV-125A Bell & Gossett Readout Valve
J	1/4" to barb	Parker #30182-4-4B 1/4" MPT to 1/4" hose barb
K	1/4" hose	Parker #831-4 1/4" Push-Lok hose (green preferred)
L	1/4" female O-ring	Parker # 3JC82-4-4B 1/4" barb to female o-ring
M	1/4" male O-ring	Parker # 3J082-4-4B 1/4" barb to male o-ring
N	flare fittings	Parker #30382-4-5B+ 5/16" male 37 degree to 1/4" barb
O	sleeve	5/16" Tube Sleeve, Brass #5-TX-B
P	nut	5/16" Tube Nut, Brass #5-BTX-B
Q	3/8" to barb	Parker #30182-6-4B 3/8" MPT to 1/4" hose barb
R	flow restrictor	Hayes Mesurflo #2305-1021 1/4" flow regulator (0.5 GPM)
S	1/4" coupler	Parker #216-4 1/4" Hex Nipple

Items in the Rack Circuit

	item	Part number
A	1/2" to 1/2" barb	Parker #30182-8-8B 1/2" MPT to 1/2" hose barb
B	1/2" hose	Parker #831-8 1/2" Push-Lok hose (blue preferred)
I	readout valve	B&G #RV-125A Bell & Gossett Readout Valve
X	1/2" valve	Apollo 7B-843-01 1/2" Ball valve w/SS ball & stem & port
Y	Valvetech Swivel	#31382-8-8B-6 Barb W/ Swivel
Za	flow restrictor	Hayes Mesurflo #2305-1051 1/2" flow regulator (1.25 GPM)
Zb	flow restrictor	Hayes Mesurflo #2305-1091 1/2" flow regulator (2.5 GPM)
AA	1/2" coupler	Parker #216-8 1/2" Hex Nipple

Iso View of the manifold

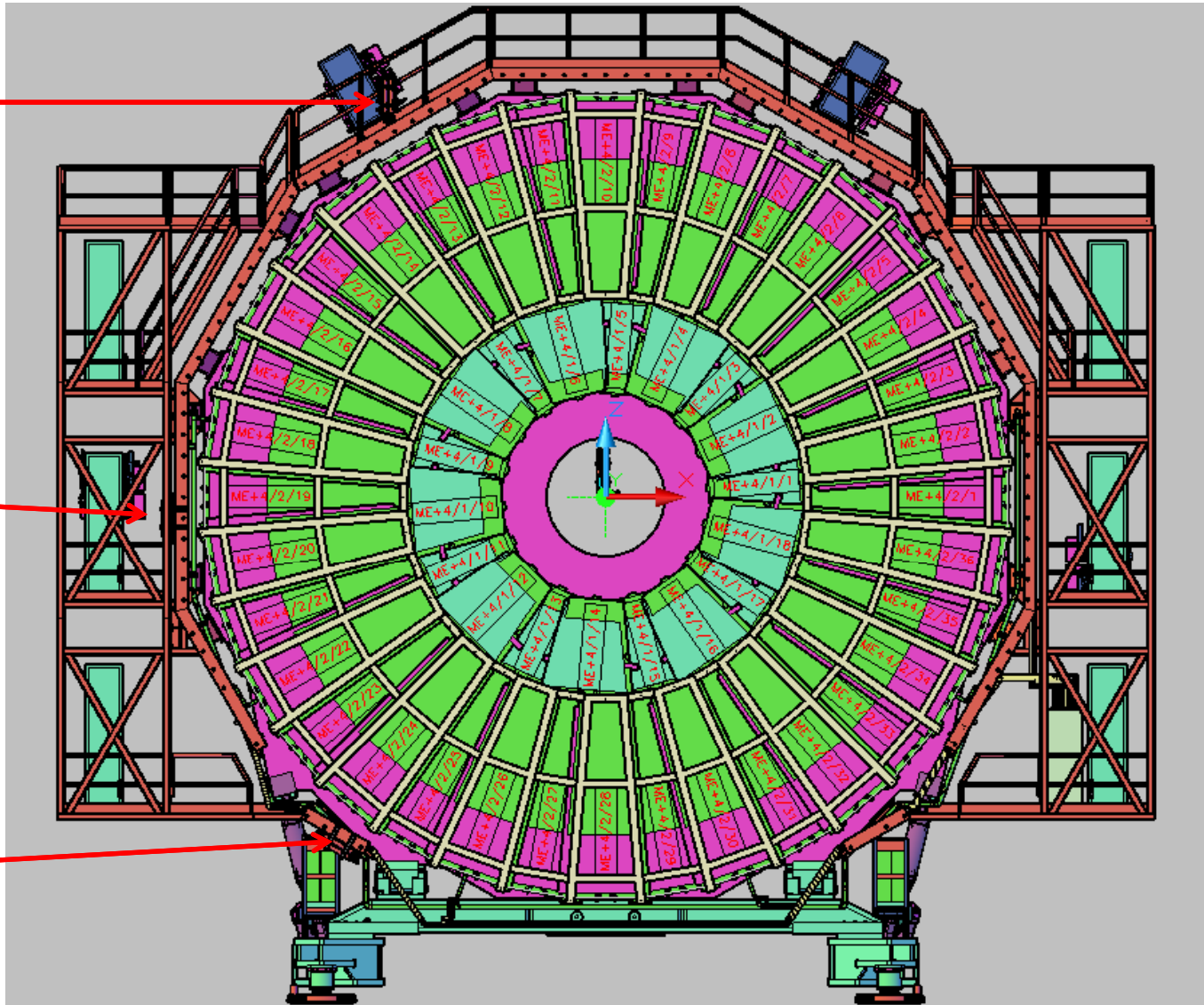


External view of RE4 manifold positions

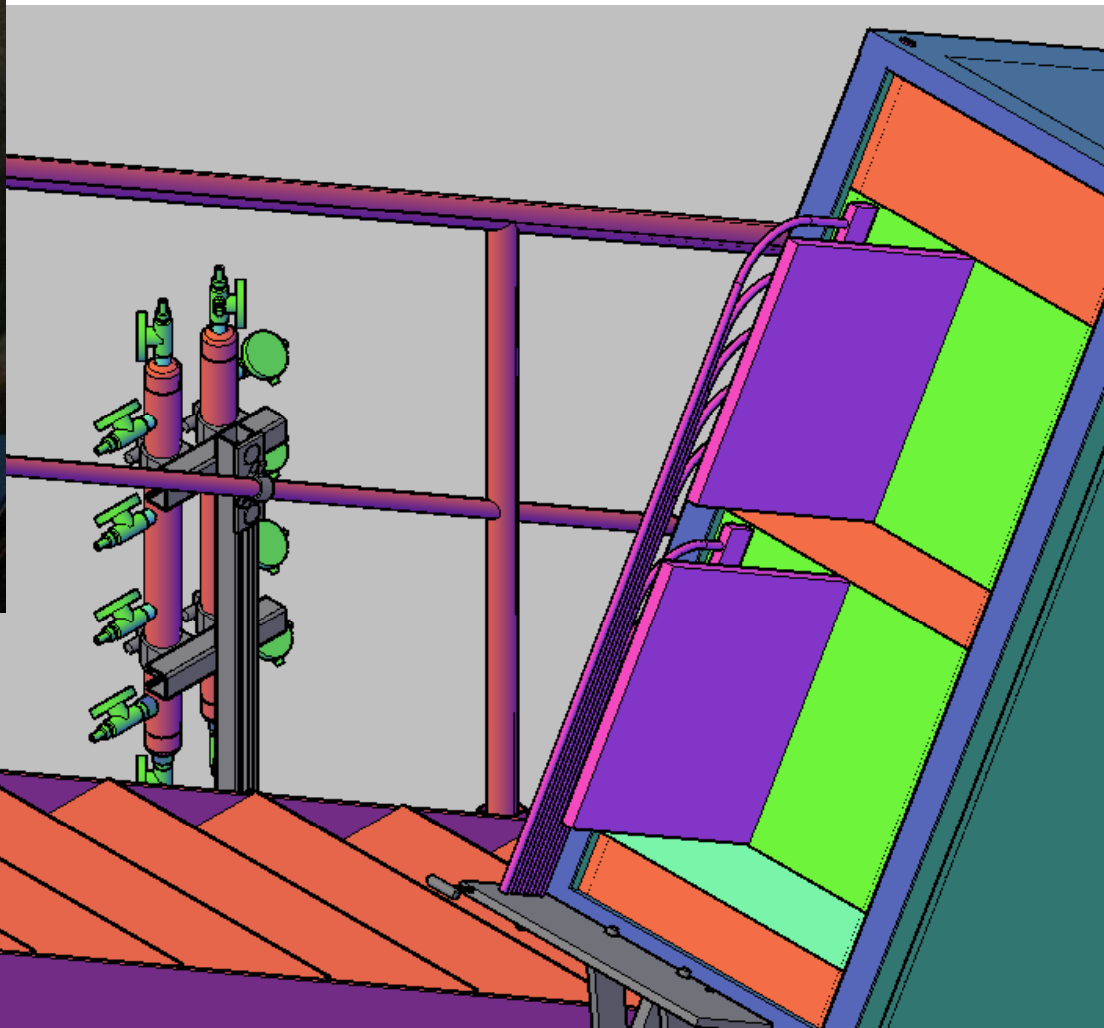
Position #1

Position #2

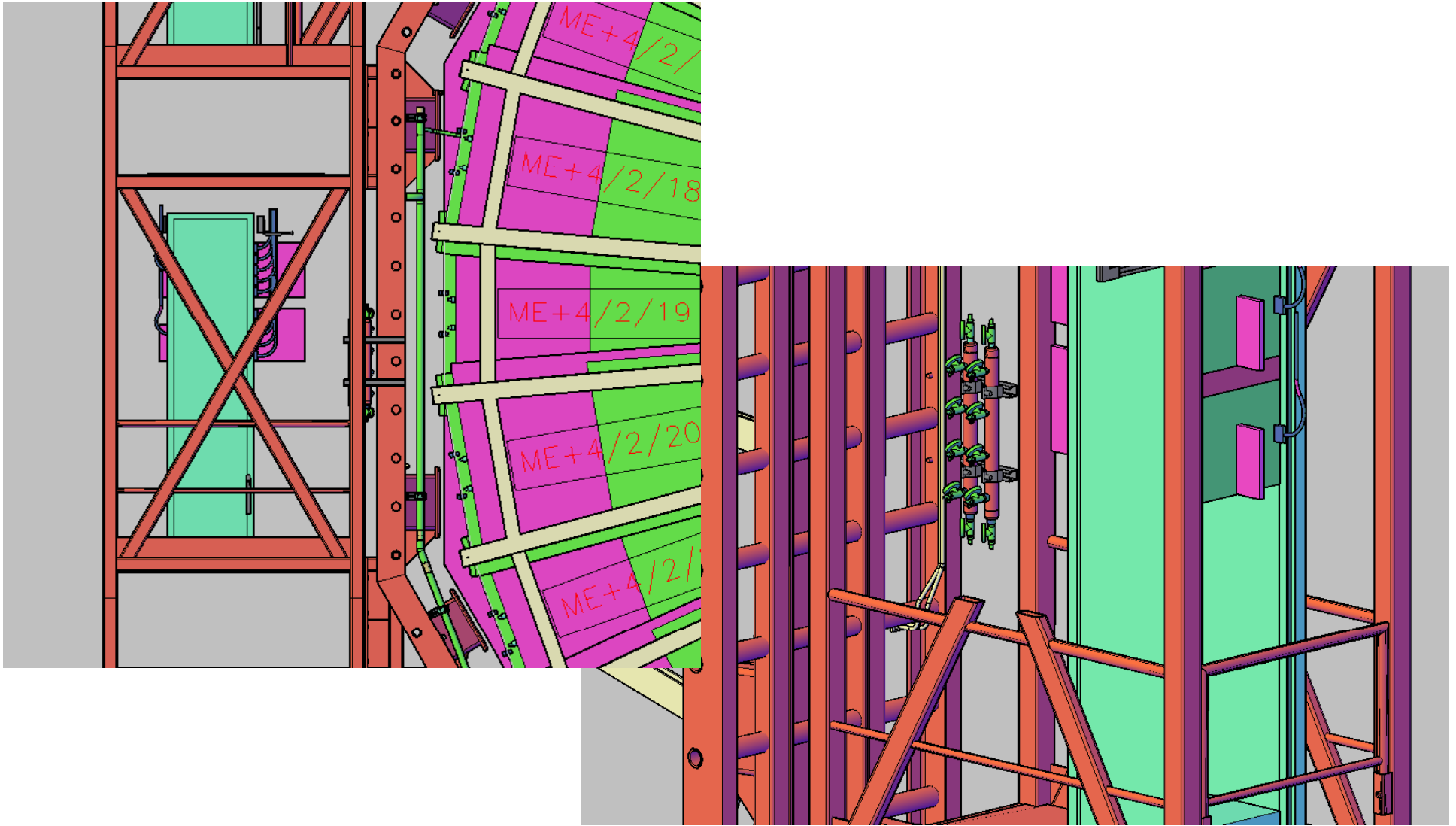
Position #3



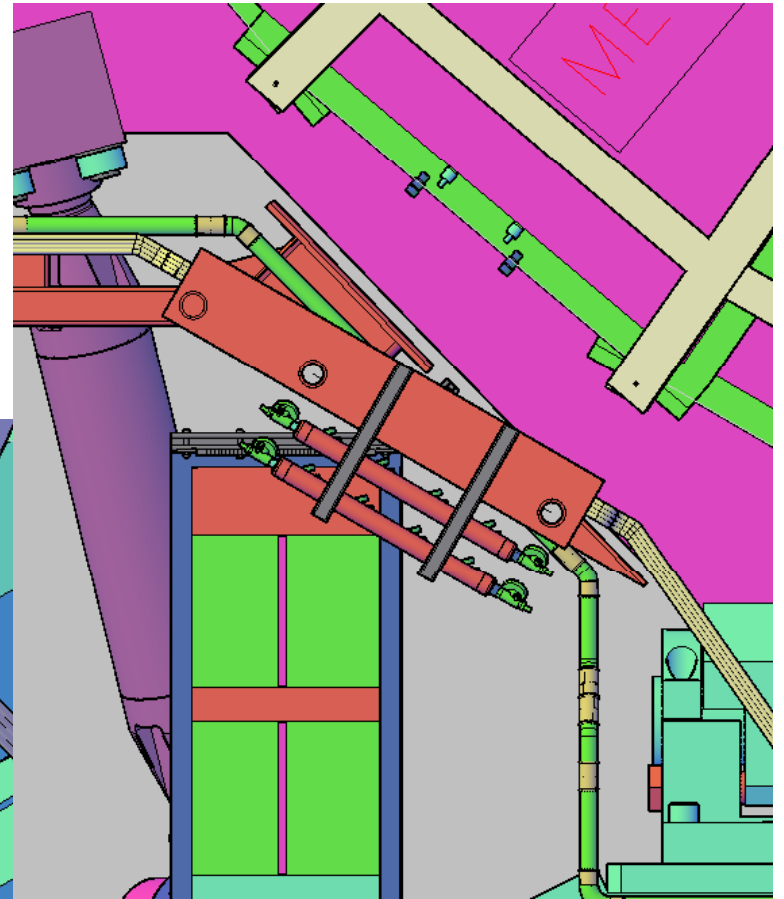
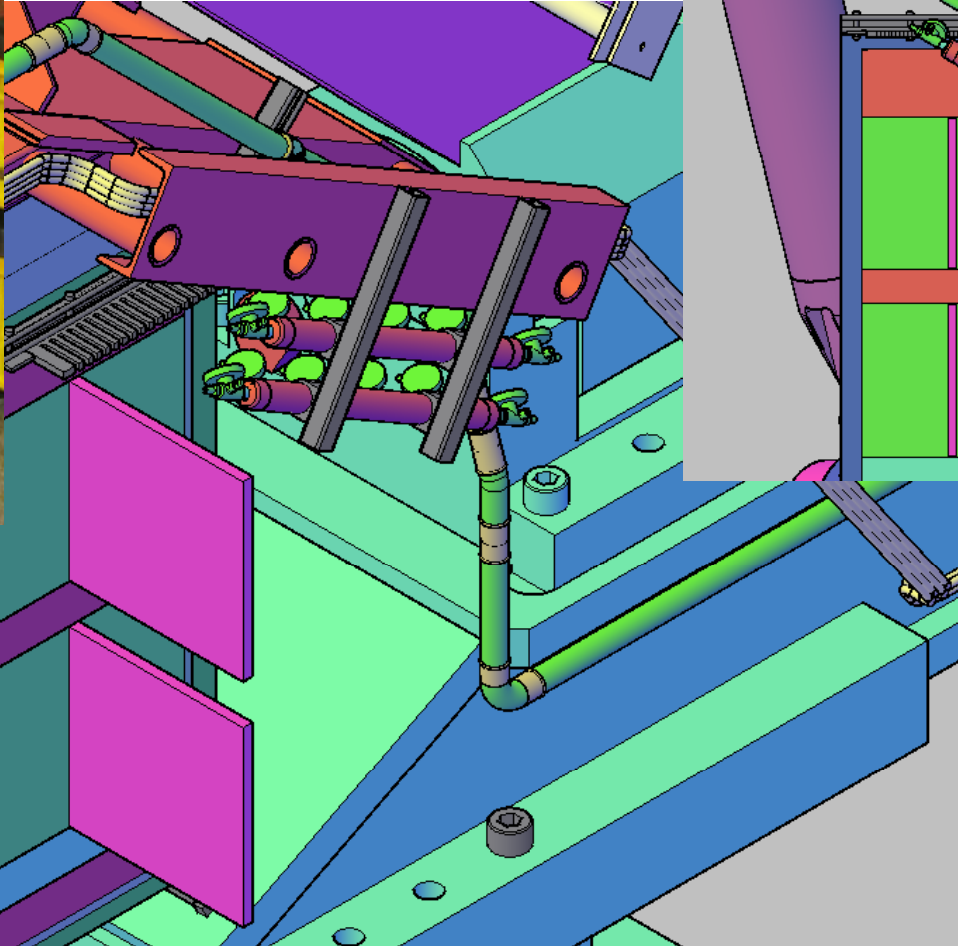
Position #1



Position #2



Position #3



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