

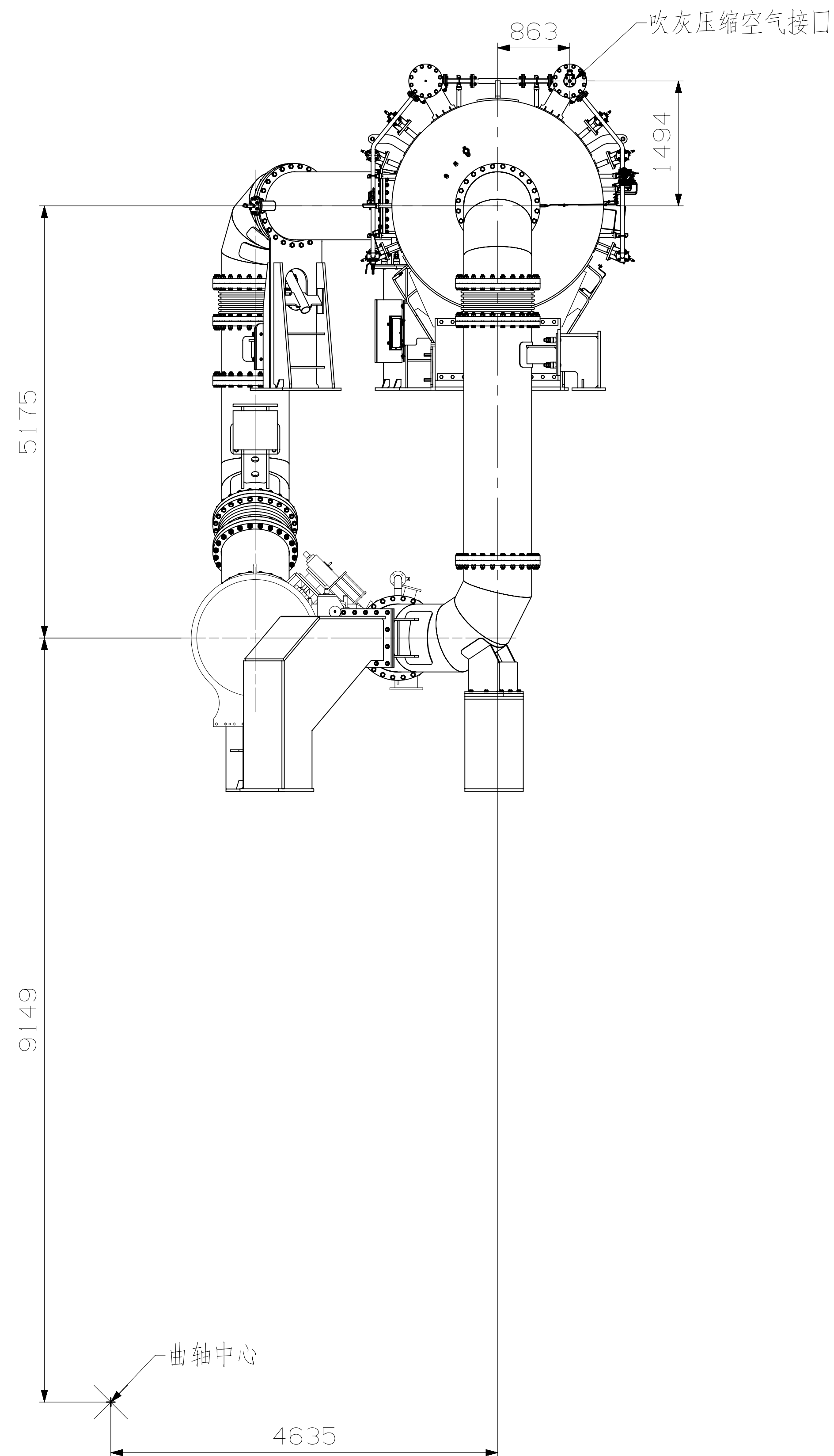
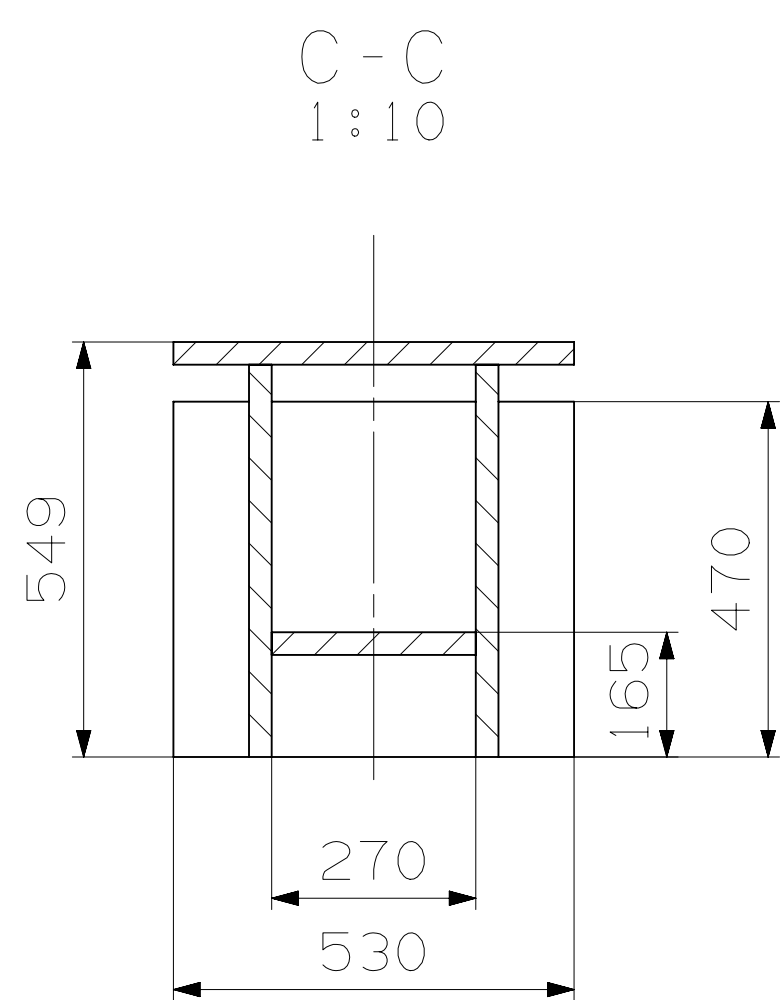
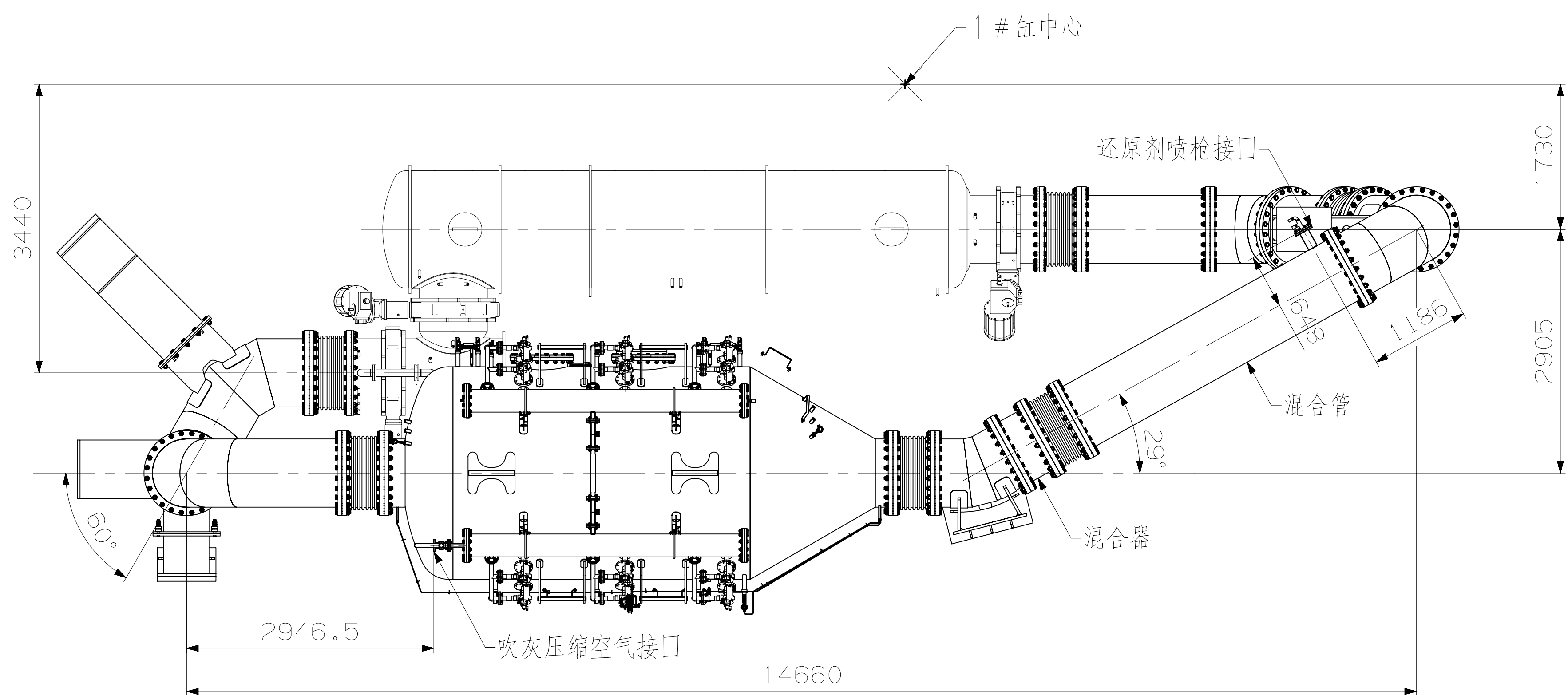
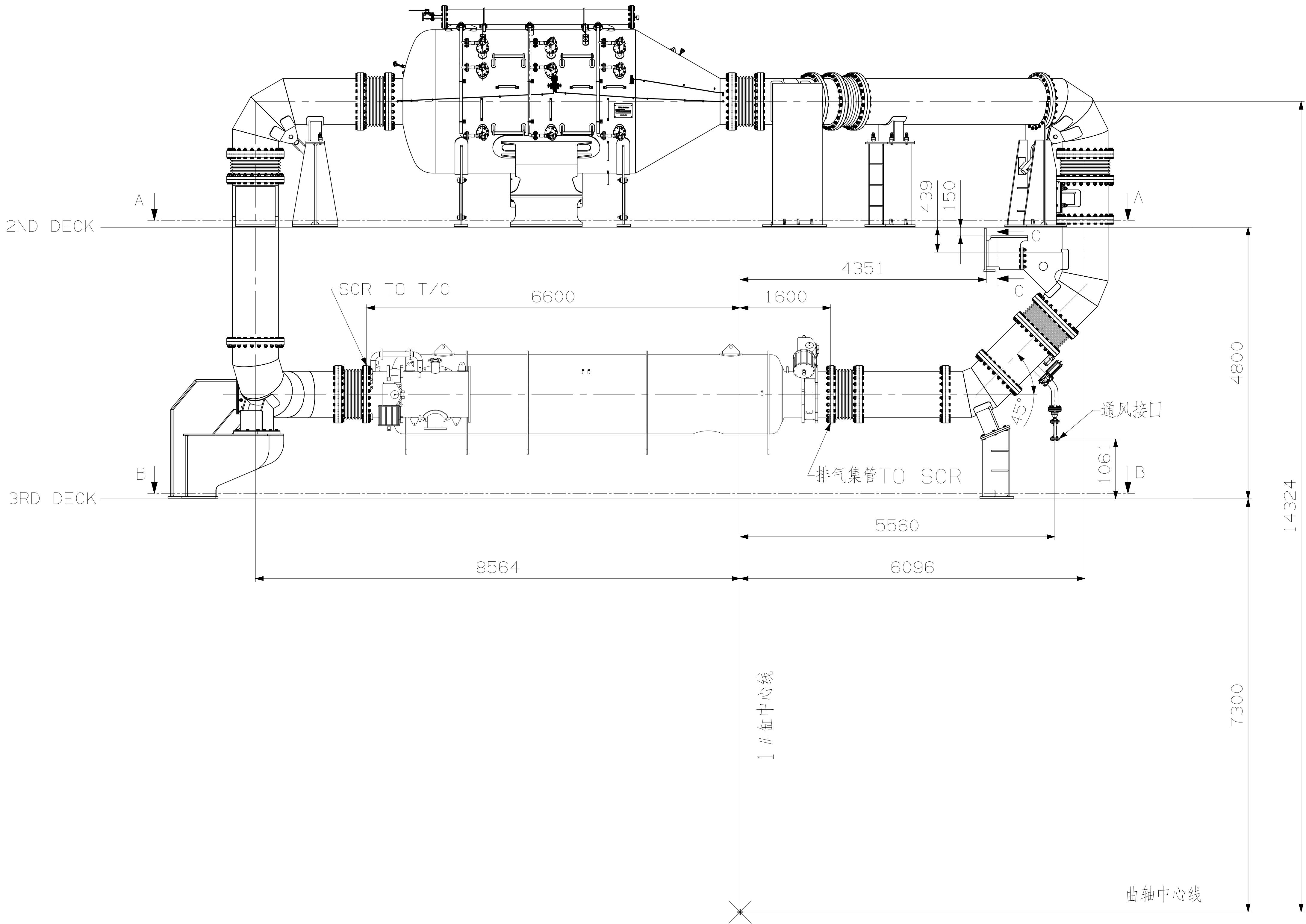
文 件 说 明 Document Remarks		机 型 Eng. Type		6G60 HP-SCR		
		台 份 Set No.		#44~#47		
		工程编号 Engine No.				
		船 厂 Shipyard		江苏新时代造船有限公司		
		船 号 Hull No.		311117~20		
		船 级 社 Classification Society		ABS		
完工资料清单 FINISHED DOCUMENTS LIST						
					00d	
					00c	
					00b	
修 改 说 明 Corrected Description						
					00d	
					00c	
					00b	
徐俊 2018-08-23	侯春国 2018-08-23				陈小雷 2018-08-24 00a	
编 制 Compiled	校 对 Checked	审 核 Confirmed	审 定 Approved	会 签 Countersigned	批 准 Authorized 版本号 Rev.	
 沪东重机有限公司 HUDONG HEAVY MACHINERY CO.,LTD.			文件编号 Document No.	00295643		
			被替代文件编号 Replace No.		总 页 数 Total Pages	3
			设计参考文件编号 Reference No.		页 数 Pages	1

HHM 6G60 HPSCR FINISHED DOCUMENTS LIST	DWG NO.: 00295643.00a
	Page: 2 Total Ps.: 3

No. 序号	Drawing No. 图号或型号	DESCRIPTION 名称	Remark 备注
1	00259562.00a	Product Outline View SCR系统安装布置图	
2	00259563.00a	List Capacities of SCR System SCR系统容量评估表	
3	00259564.00a	Specification of Compressed Air SCR压缩空气质量要求	
4	00230771.00a	Specification of Urea SCR尿素溶液质量规范	
5	00230774.00a	Specification of Urea Storage 尿素溶液储存规范	
6	00230777.00a	Material Specification of Urea Storage 尿素溶液存储材料规范	
7	00259565.00a	SCR P&ID Diagram SCR原理图	
8	00295286.00a	SCR Block Diagram SCR控制系统图	
9	3H-27988.01	SCR System Signal List SCR系统信号清单	
10	3H-27987.01	SCR System Instruments List SCR系统元件清单	
11	3N-04562.02	Electrical Emements Distributing on SCR SCR电气元件布置	
12	2N-06596.01	Electrical Emements Distributing on Reacor 反应器电气元件布置	
13	4H-20489.01	SCR Automation Cabinet Wiring Diagram SCR控制箱接线图	
14	3N-04564.01	SCR Automation Cabinet Outline SCR总控制箱布置图	
15	4H-20491.01	NOX Cabinet Outline and Wiring Diagram NOX控制箱外形图及接线图	
16	4H-20508.02	Wiring of SCR AUS System Control Cabinet SCR辅助系统接线	
17	4H-20624.02	SCR Terminal Box on M.E Connecting Drawing SCR接线箱接线图	
18	4H-20528.02	SCR Standby Heat System SCR 伴热系统	
19	3H-22059.02	MOP MOP面板	

HHM 6G60 HPSCR FINISHED DOCUMENTS LIST	DWG NO.: 00295643.00a
	Page: 3 Total Ps.: 3

20	AD5654261-3.2	ERCS Power Supply ERCS电源	
21	00270555.00b	ERCS to External System Connecting Drawing ERCS 系统对外接线图	
22	00278959.00b	SCR Urea Injection System SCR尿素喷射系统	
23	3H-27836.00	Mixing Pipe 混合管	
24	2N-06598.01	Reactor with Sootblowing Syetem 反应器及吹灰系统总成	
25		HP-SCR Master Manual HP-SCR操作手册	



	DN	PCD	法兰标准
排气集管 TO SCR	800	950	GB/T9119 PN10 FF
SCR TO T/C	800	950	GB/T9119 PN10 FF
* 通风接口	40	110	GB/T9119 PN16 FF
* 还原剂喷枪接口	100	180	GB/T9119 PN16 FF
吹灰压缩空气接口	32	100	GB/T9119 PN10 FF

* 通风接口和还原剂喷枪接口需船厂确认

日期 Date	设计 Des.	批准 Appr.	审核 Rev.	修改/更改说明 Revision change	更改号 Chg. No.	版本 Rev.
20180124	王进	徐俊				002
基础标准: Basic Standards (MBS) SBI			补充图号: Suppl. Drawing No.:			
专利公司名称: Material / Blank			材料: Final User Material:			质量 Mass (kg):
比例: Scale:	图例: Product Type:	图号/图件: M.S./D.G.	图次/页数: Page No.:	图例: Projection:	沪东重机有限公司	
1:40	A0	6G60MEC	1 (3)	ISO	HDDG HEAVY MACHINERY CO., LTD.	
专利公司图号: Item No.:			专利公司图号: Item Name:			图号: Final User Ident. No.:
专利公司图号: Item No.:			图号: Final User Description:			00259562

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SCR系统安装布置图

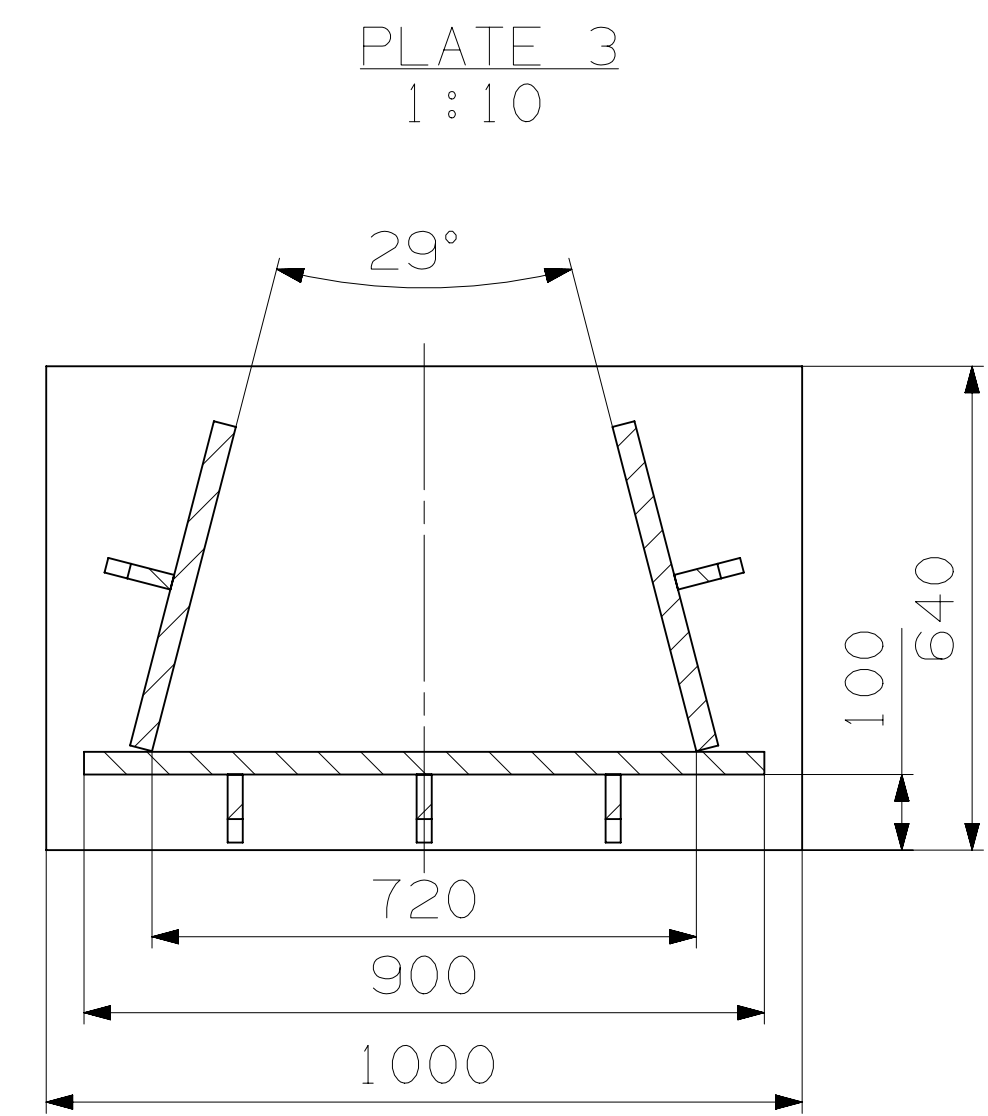
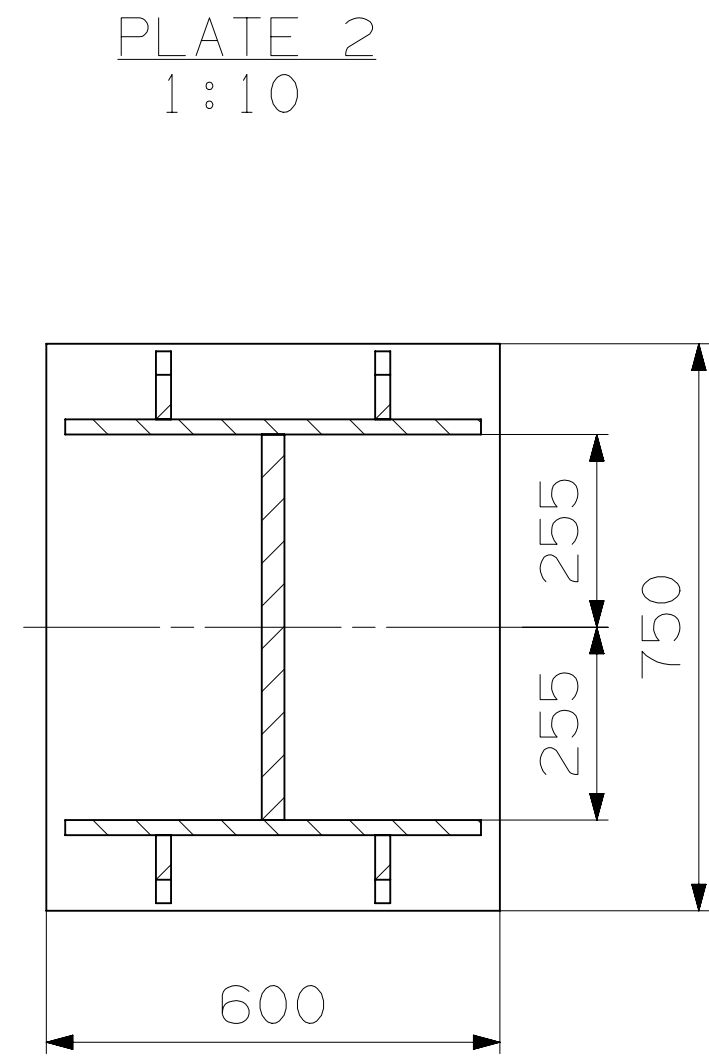
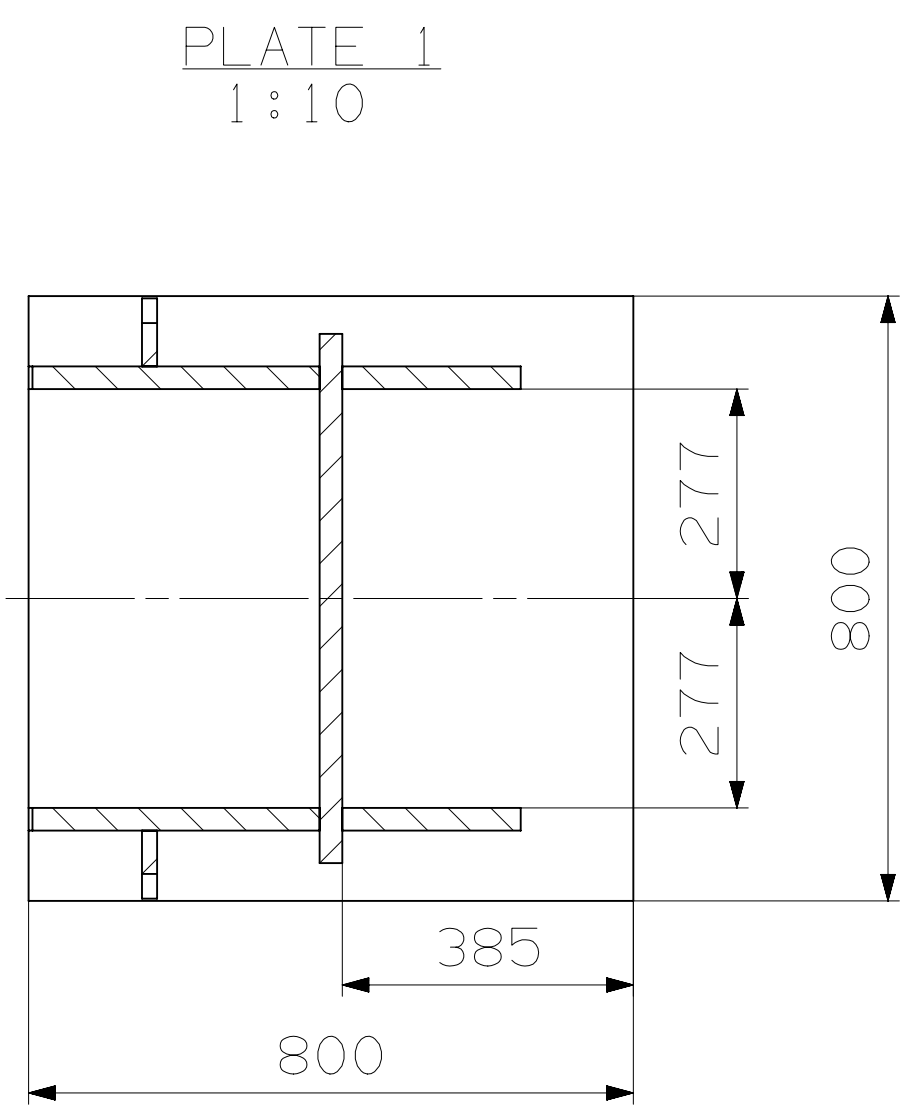
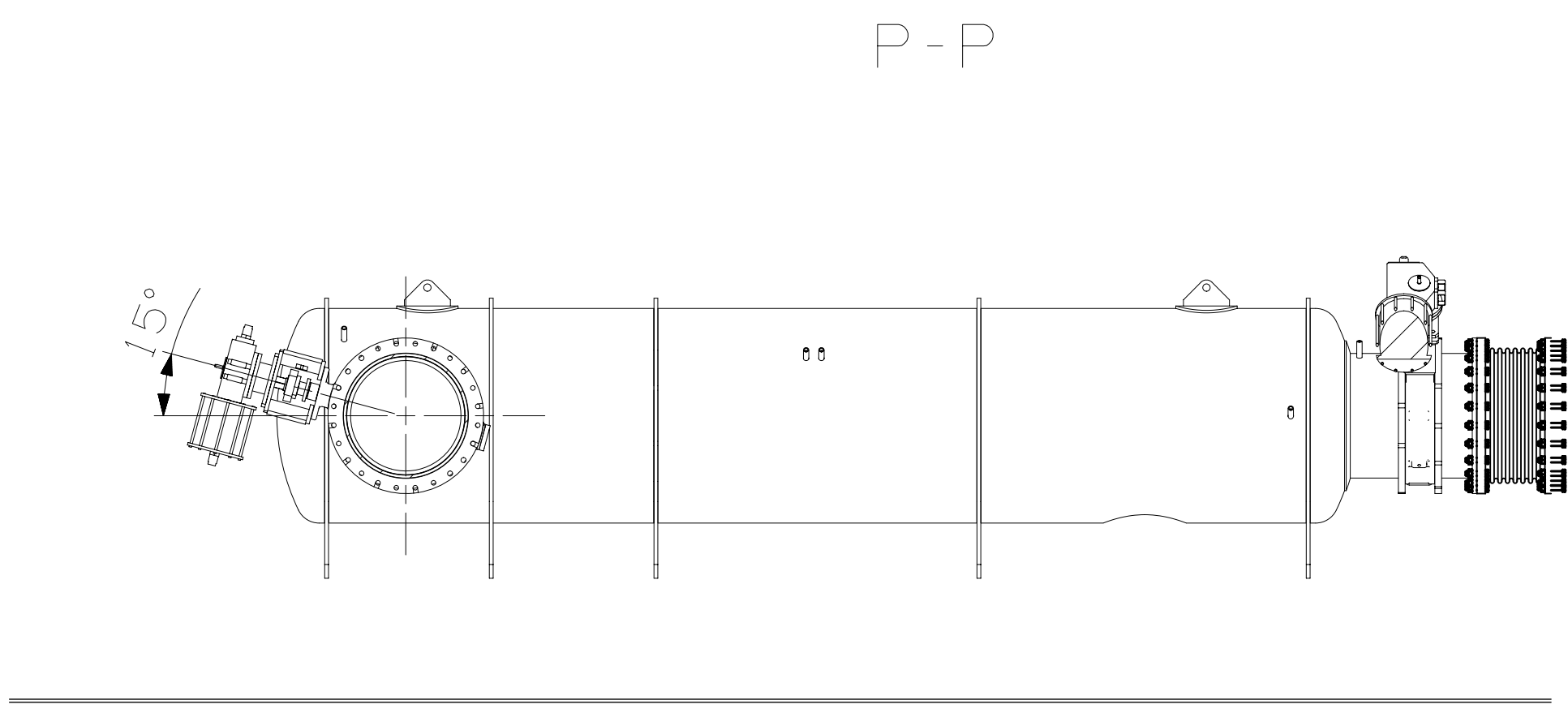
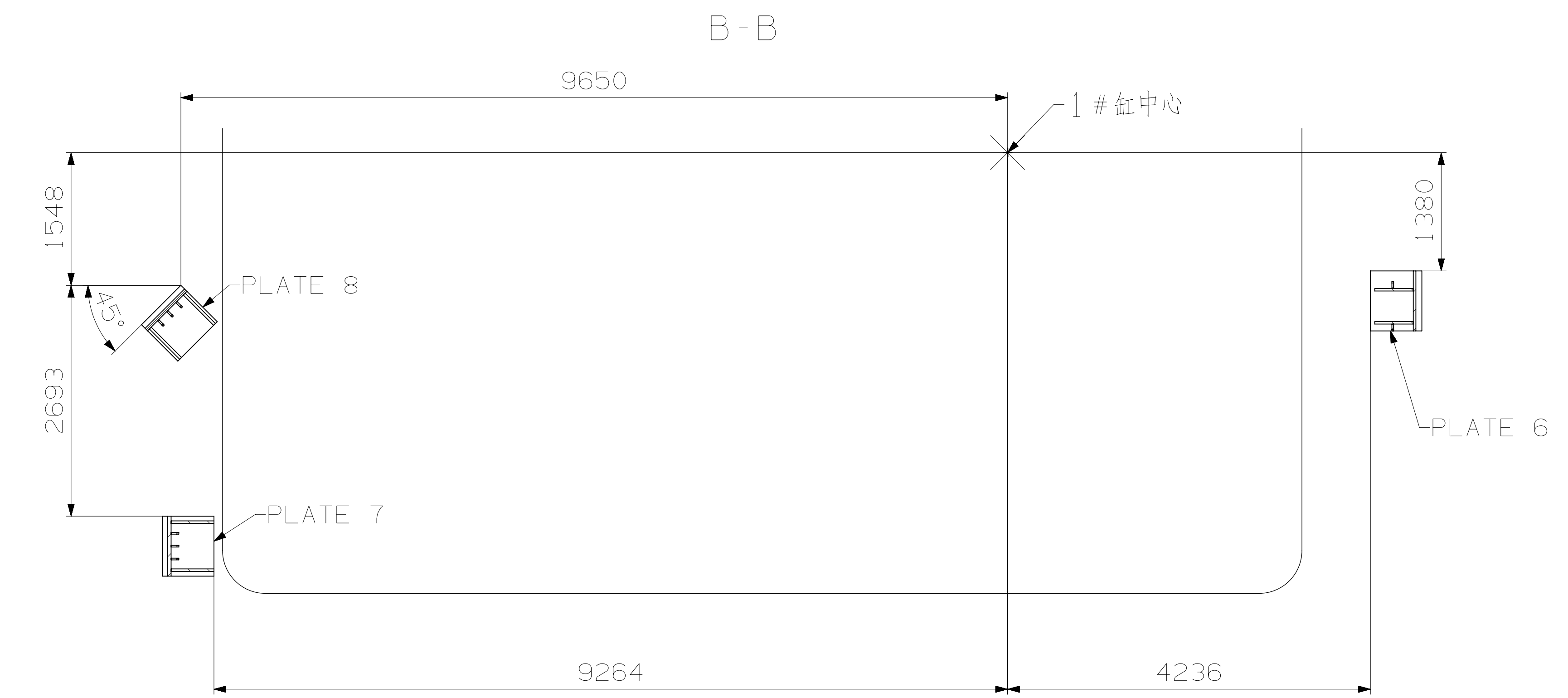
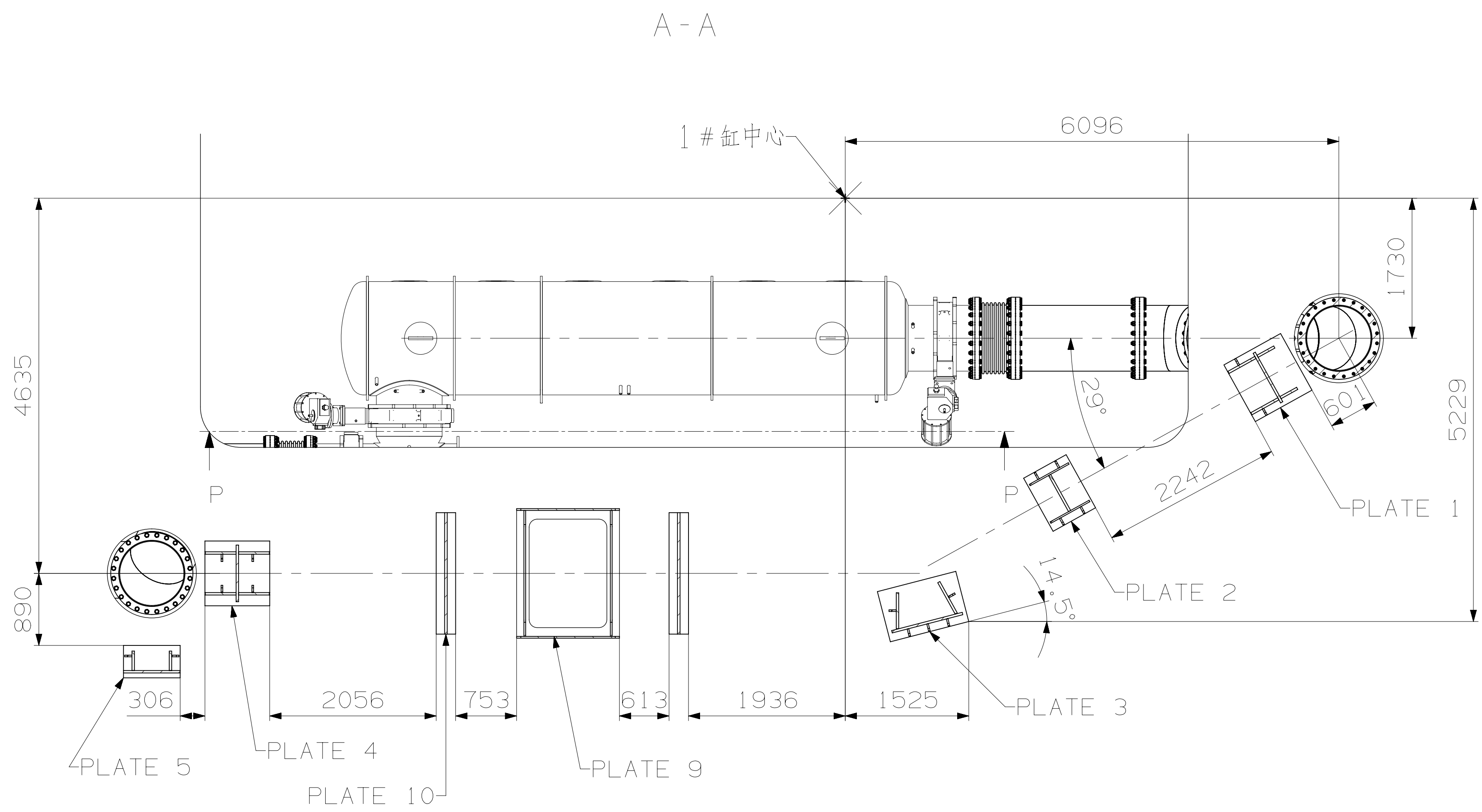


PLATE 4
1:10

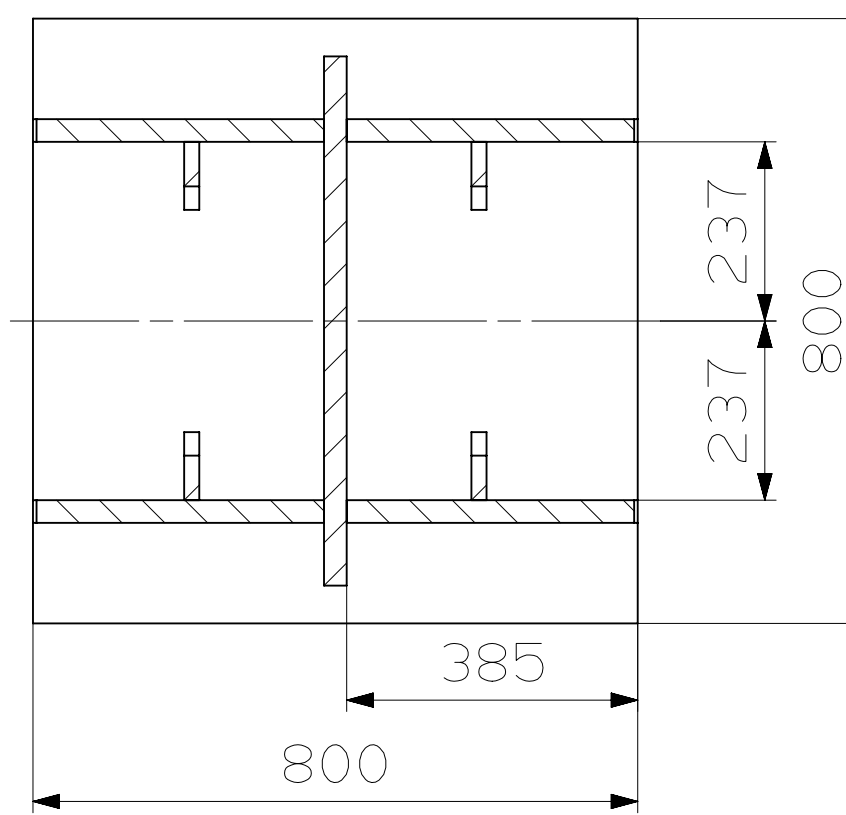


PLATE 5
1:10

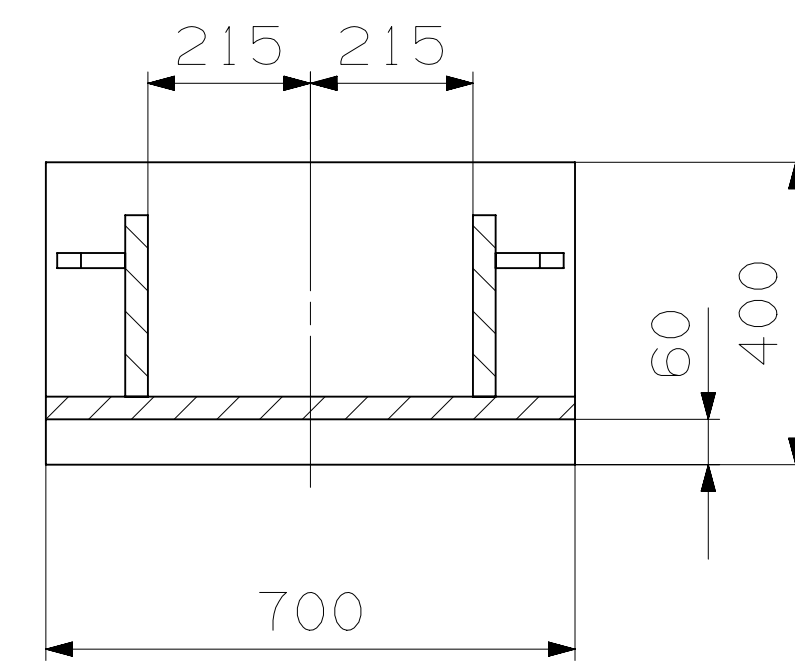


PLATE 6
1:10

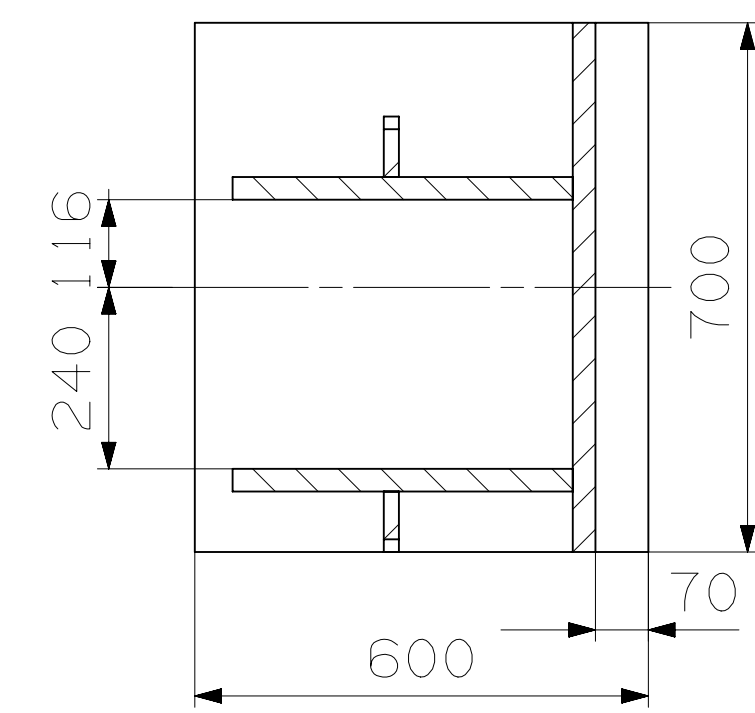


PLATE 7
1:10

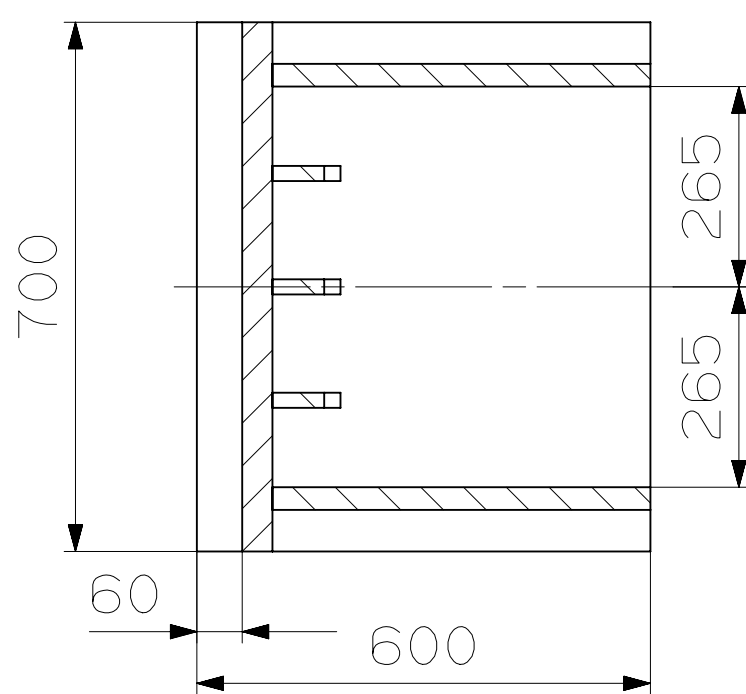


PLATE 8
1:10

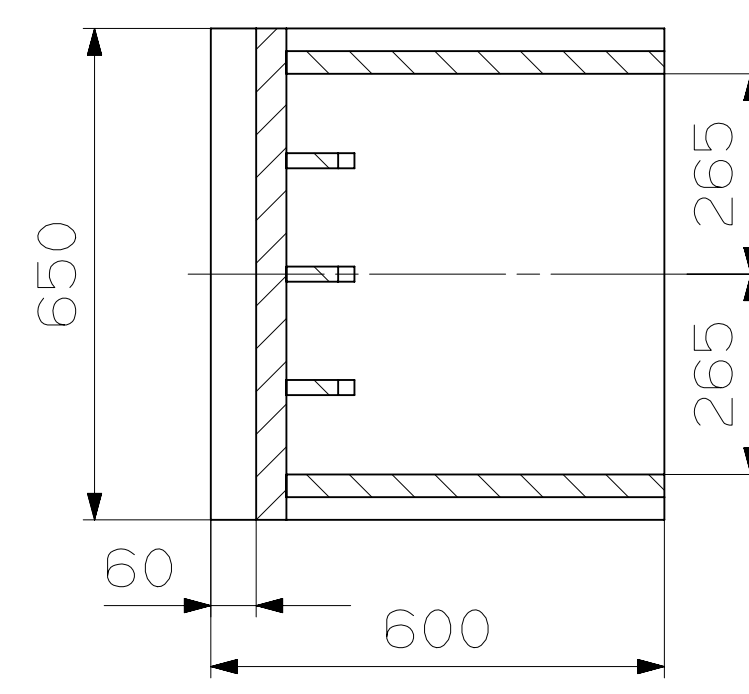


PLATE 9
1:10

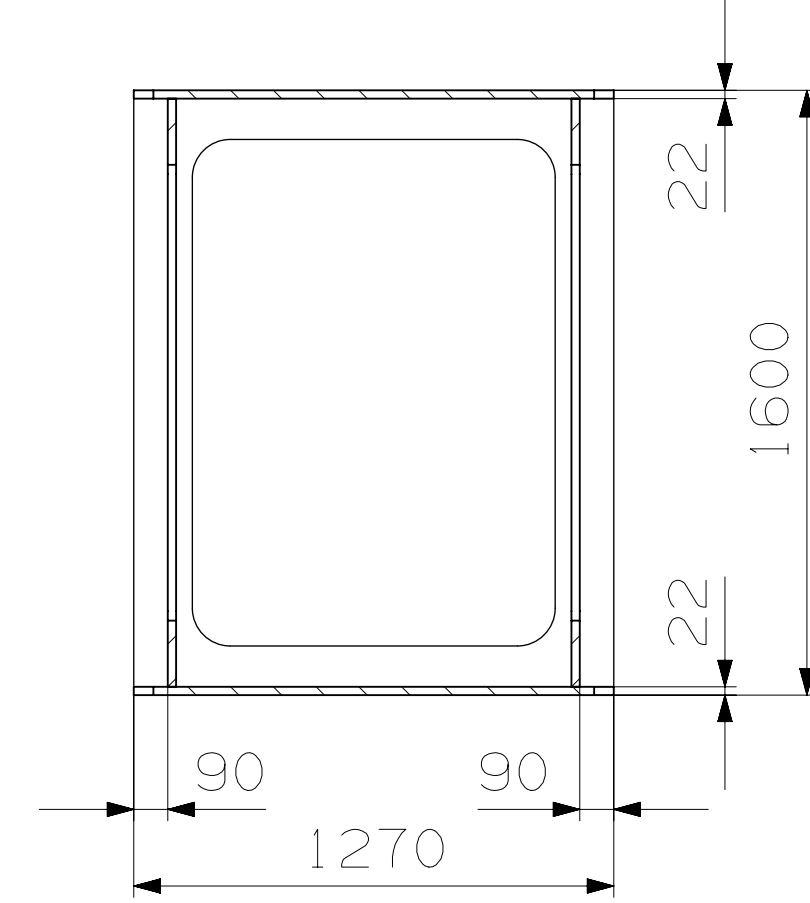
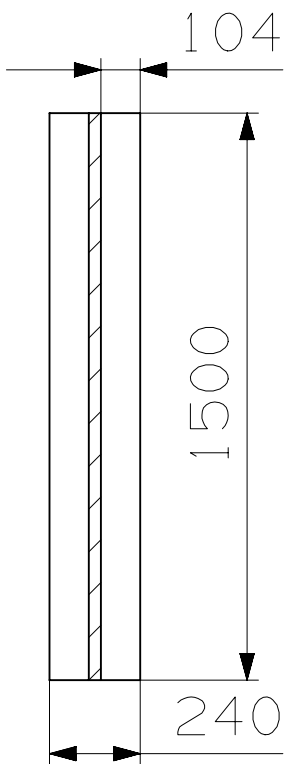
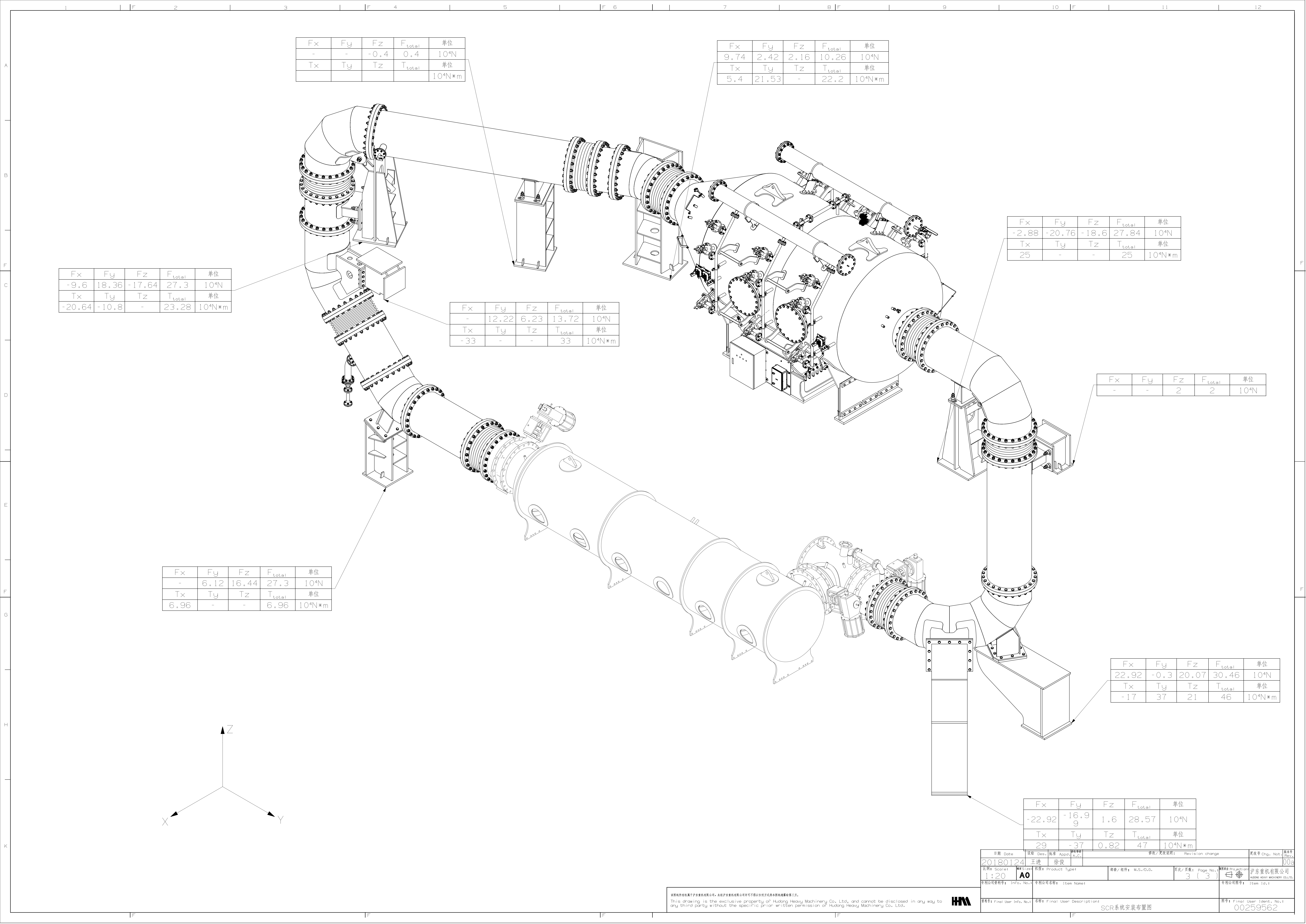


PLATE 10
1:10





Fx	Fy	Fz	F _{total}	单位
-	-	-0.4	0.4	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
				10 ⁴ N*m

Fx	Fy	Fz	F _{total}	单位
9.74	2.42	2.16	10.26	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
5.4	21.53	-	22.2	10 ⁴ N*m

Fx	Fy	Fz	F _{total}	单位
-9.6	18.36	-17.64	27.3	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
-20.64	-10.8	-	23.28	10 ⁴ N*m

Fx	Fy	Fz	F _{total}	单位
-	12.22	6.23	13.72	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
-33	-	-	33	10 ⁴ N*m

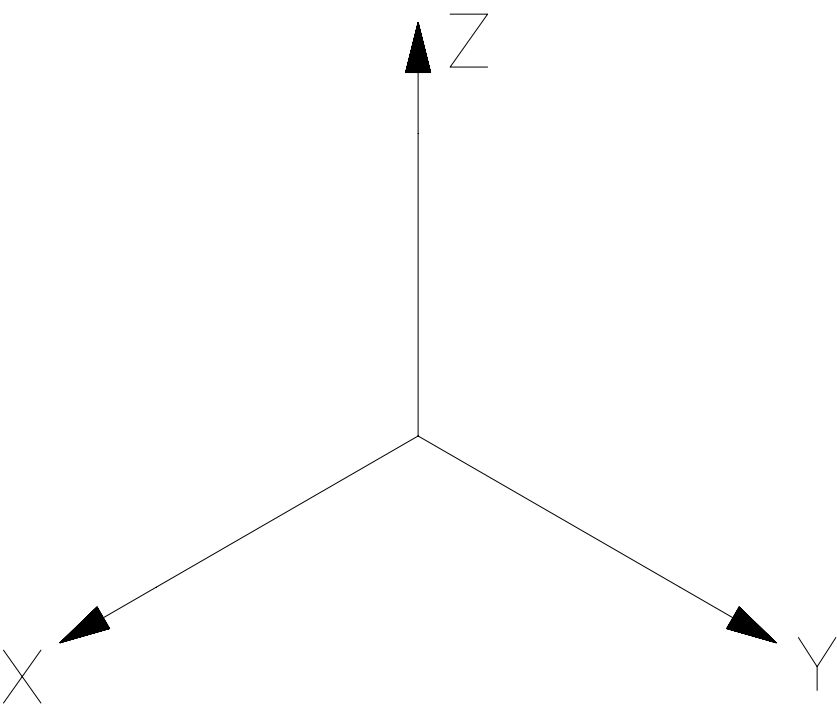
Fx	Fy	Fz	F _{total}	单位
-2.88	-20.76	-18.6	27.84	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
25	-	-	25	10 ⁴ N*m

Fx	Fy	Fz	F _{total}	单位
-	-	2	2	10 ⁴ N

Fx	Fy	Fz	F _{total}	单位
-	6.12	16.44	27.3	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
6.96	-	-	6.96	10 ⁴ N*m

Fx	Fy	Fz	F _{total}	单位
22.92	-0.3	20.07	30.46	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
-17	37	21	46	10 ⁴ N*m

Fx	Fy	Fz	F _{total}	单位
-22.92	-16.99	1.6	28.57	10 ⁴ N
Tx	Ty	Tz	T _{total}	单位
29	-37	0.82	47	10 ⁴ N*m



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日期 Date	设计 Des.	批准 Appr.	审核 Rev.	修改/更改说明 Revision change	更改号 Chg. No.	版本号 Rev. No.
20180124	王斌	徐俊				008
比例 Scale	图例 Legend	标题 Title	图号/组号 M.S./D.G.	页次/页数 Page No.	图例 Legend	沪东重机有限公司
1:20	A0			3 (3)		HUDONG HEAVY MACHINERY CO., LTD.
专利号 Patent No.	专利号 Patent No.	专利号 Patent No.	专利号 Patent No.	专利号 Patent No.	专利号 Patent No.	专利号 Patent No.
最终用户信息 Final User Info. No.	最终用户描述 Final User Description	最终用户描述 Final User Description	最终用户描述 Final User Description	最终用户描述 Final User Description	最终用户描述 Final User Description	最终用户描述 Final User Description

SCR系统安装布置图

图号: Final User Ident. No.: 00259562

6G60ME-C9.5 SMCR 11850KW @ 89RPM HP-SCR System Consumption Estimation

ISO Condition:

40% Wt. Urea Solution Consumption *1)

Load(%)	25	50	75	85	100
Consumption(L/h)	85	140	160	170	160

Compressed Air Consumption

		Max Consumption (NM ³ /h)	Pressure (Bar)
Urea Injection	TIII Model	225 *1)	8-12
Soot Blowing	TIII Model	15	5-7
Venting	TII Model	260 *2)	5-7

Electrical Power Consumption

	Max Power Consumption (KW)	Power Supply
Control Cabinet	0.3	220 VAC, 50/60Hz, 1-phase
Urea injection	7	440 VAC, 60Hz, 3-phase
Soot Blowing	0.1	220 VAC, 60Hz, 1-phase
Heating System	30	440 VAC, 60Hz, 3-phase

*1): The urea solution consumption and the compressed air consumption is not guaranteed, since it is based on estimated engine NOx emissions. The final NOx value are to be determined on testbed. So a tolerance of 25% should apply to the urea consumption and the compressed air consumption of the urea injection.

*2): The compressed air consumption of venting system finally depends on the SCR pipe layout. So if you use this data, a tolerance of 10% should be considered.

日期 Date	设绘 Des.	批准 Appd.	修改等级 A.C.	修改/更改说明: Revision change	更改号 Chg. Not.	版本号 Rev.
2017. 07. 25	夏菊花	侯春国				00a
基础标准: Basic Standards				补充图号: Suppl. Drawing No.:		
专利公司材料: Material/Blank:				材料: Final User Material:		质量 Mass (kg):
比例: Scale:	幅面 Size: A4	机型: Product Type: 6G60ME-C9.5	部套/组件: M.S/D.G.	页次/页数: Page No.: (1/1)	制图画法 Projection:	沪东重机有限公司 HUDONG HEAVY MACHINERY CO. LTD.
专利公司资料号: Info.No.:		专利公司名称: Item Name:			专利公司图号: Item Id.:	
资料号: Final User Info.No.:		名称: Final User Description: HP-SCR 系统容量评估表			图号: Final User Ident. No.: 00259563	



For SCR system, the quality of compressed air should comply with the specification ISO 8573-1, class 2.4.2

Class	Particle size	Particle density	Water ^{*1)}		Oil
	max. in μm	max. in mg/m^3	Pressure dew point in $^{\circ}\text{C}$	Water mg/m^3	Residual oil content in mg/m^3
1	0.1	0.1	-70	3	0.01
2	1	1	-40	120	0.1
3	5	5	-20	880	1
4	15	8	3	6000	5
5	40	10	7	7800	25
6			10	9400	

*1): The requirement for water can be adjusted by the minimum temperature guaranteed by the shipyard in the engine room, and this minimum temperature should be bigger than the relevant pressure dew point according to the specification ISO 8573-1.

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2017.08.27	沈腾	侯春国				00a
基础标准: Basic Standards				补充图号: Suppl. Drawing No.:		
表面粗糙度按 GB/T1031 EN21C Surf. roughness						
专利公司材料: Material/Blank:				材料: Final User Material:		质量 Mass (kg):
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资料号: Final User Info.No.:		名称: Final User Description:				图号: Final User Ident. No.:
		SCR 压缩空气质量要求				00259564.

The quality characteristics of the AUS 40 should be in compliance with the requirements of ISO 18611,which is specified below

Characteristics	Unit	Limits		Test methods
		min.	max.	
Urea content	%(m/m)	39	41	ISO 18611-2,Annex B ISO 18611-2,Annex C
Density at20℃	kg/m3	1105	1177	ISO 3675 or ISO 12185
Refractive index at 20℃	-	1,3947	1,3982	ISO 18611-2,Annex C
Alkalinity as NH3	%(m/m)	-	0.5	ISO 18611-2,Annex D
Biuret	%(m/m)	-	0.8	ISO 18611-2,Annex E
Aldehydes	mg/kg	-	100	ISO 18611-2,Annex F
Insoluble matter	mg/kg	-	50	ISO 18611-2,Annex G
Phosphate (PO4)	mg/kg	-	1	ISO 18611-2,Annex H
Calcium	mg/kg	-	1	ISO 18611-2,Annex I
Iron	mg/kg	-	1	
Magnesium	mg/kg	-	1	
Sodium	mg/kg	-	1	
Potassium	mg/kg	-	1	
Identity	-	identical to reference		ISO 18611-2,Annex J

NOTE1 Should it be necessary to add a tracer to AUS 40,it shall be ensured that the quality of AUS 40 specified in this table is not impaired and that the tracer does not damage the SCR system.

NOTE2 In establishment of these limit values,the terms of ISO 4259 have been applied in fixing a maximum and minimum value,a minimum difference of 4*R (R is the Reproducibility of the test method)has been taken into account.However,in case of urea content,the 4*R rule has not been applied in order to keep the high quality.

NOTE3 The values quoted regarding urea content,density,and refractive index are"true values"(see ISO 4259 for the definition of true values).

NOTE4 The manufacturer of AUS 40 should aim at the target values defined in footnotes a,b,and c. NOTE5 Should it be necessary to clarify the questions as to whether a given urea solution meets the requirement of the specification,the terms of ISO 4259 should be applied.

a Target value 40%(m/m).

b Target value 1110kg/m3.The max.value is for the urea solution containing 0.8% Biuret.

c Target value 1,3965.The max.value is for the urea solution containing 0.8% Biuret.

d For the purposes of this International Standard,the term "%(m/m)"is used to represent the mass fraction of a material.

e Calculated without subtracting nitrogen from ammonia.

The storage tank should be marked by some information below:

- a) product name, packing specification, identification of product
- b) date of production
- c) name of manufacturer, adress and contact information

They shall be continuously monitored by the manufacturer following valid testing plan.

Compliance with the limits specified below shall be verified with the test methods indicated.

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20170103	沈腾	侯春国				00a
基础标准: Basic Standards				补充图号: Suppl.Drawing No.:		
专利公司材料: Material/Blank:				材料: Final User Material:		质量Mass (kg):
比例: Scale:	幅面Size: A3	机型: Product Type:		部套/组件: M.S/D.G.	页次/页数: Page No. 1 (1)	制图画法Projection: 沪东重机有限公司 HUDONG HEAVY MACHINERY CO.LTD.
专利公司资料号: Info.No.:		专利公司名称: Item Name:				专利公司图号: Item Id.:
资料号: Final User Info.No.:		名称: Final User Description: SCR尿素溶液质量规范				图号: Final User Ident. No.: 00230771



In order to avoid any impairment of the AUS 40 quality during transportation and storage, the following conditions should be taken into account:

1 In order to prevent decomposition of the urea, as well as the evaporation of water in the case of vented containers, prolonged transportation or storing above 25 °C should be avoided

2 In order to prevent solidification of AUS 40, storage below 1°C should be avoided

3 In order to avoid excessive temperature rise, AUS 40 should be protected from sunlight

4 In order to protect AUS 40 from any contamination carried by the air, well-closed containers or vented containers with filters should be used

Throughout the entire distribution chain, AUS 40 is expected to remain within the specifications given in this part of ISO 18611 for at least the time periods specified below as a function of the constant fluid temperature, or if fluid temperature is not known, average ambient temperature at which the AUS 40 is stored provided it is not exposed to direct sunlight.

In any case, the time at which AUS 40 is stored above 40°C should be limited as the degradation of the AUS 40 is strongly increasing above this temperature.

Constant ambient storage temperature °C	Minimum shelf life months
0-25	18
<30	12
<35	6
>35	Possible significant loss of shelf life: check every batch before use

NOTE The main factors taken into account to define the shelf life in this table are the ambient storage temperature and the initial alkalinity of AUS 40. The difference in evaporation between vented and non-vented storage containers is an additional factor.

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20170103	沈腾	侯春国				00a
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专利公司资料号: Info.No.:		专利公司名称: Item Name:			专利公司图号: Item Id.:	
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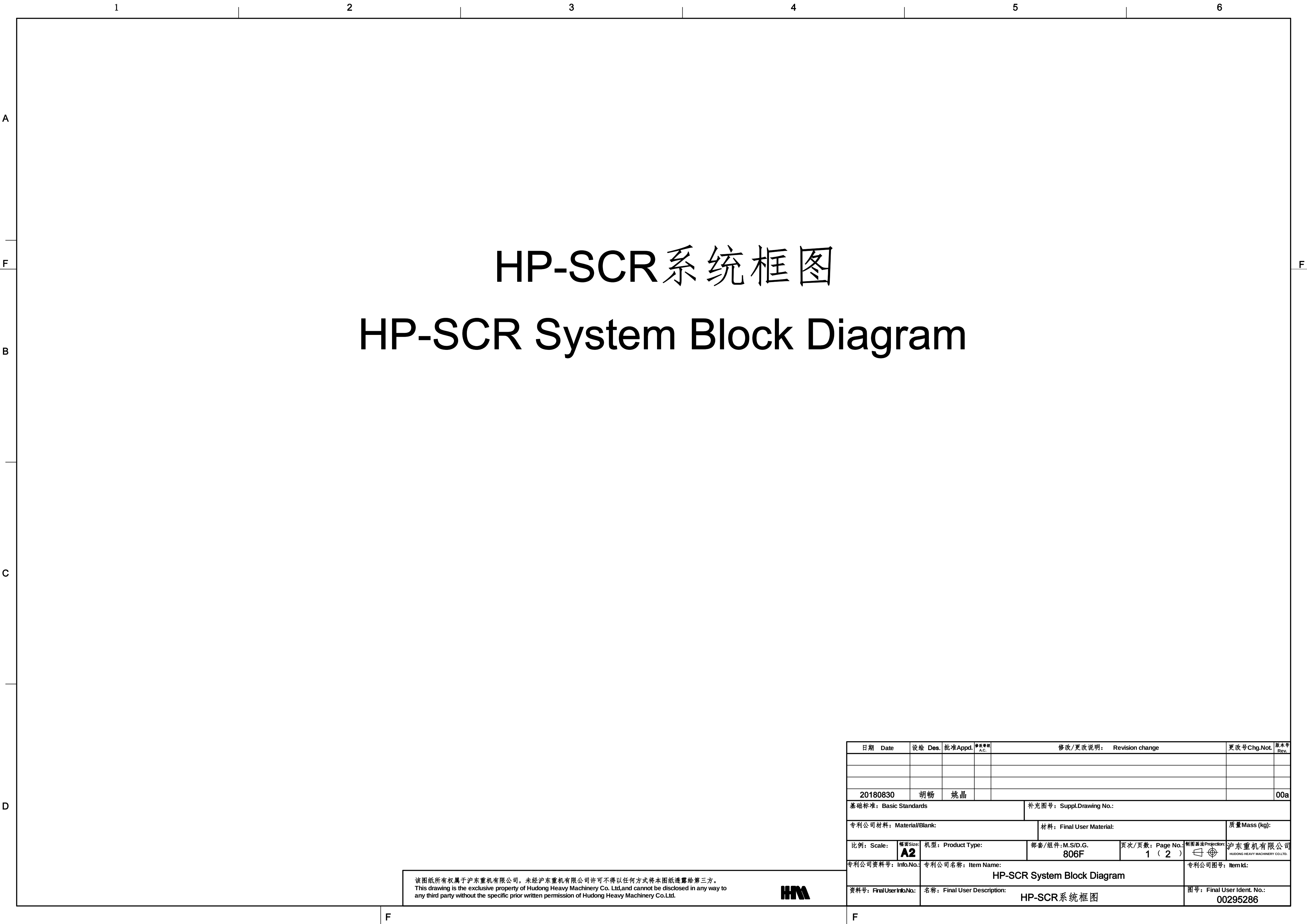
Examples of materials recommended for use with AUS 40 are given below.

Highly alloyed austenitic Cr-Ni-steels and Cr-Ni-Mo-steels, for example, in accordance with EN 10088-1, EN 10088-2, and EN 10088-3 (i. e. 1. 4541 and 1. 4571), or stainless steel 304 (S30400), 304L (S30403), 316 (S31600), and 316L (S31603) in accordance with ASTM A240, ASTM A276, and ASTM A312.
Titaninum
Ni-Mo-Cr-Mn-Cu-Si-Fe alloys, e. g. hastelloy c/c-276
Polyethylene, free of additives
Polypropylene, free of additives
Polyisobutylene, free of additives
Perfluoroalkoxyl alkane (PFA), free of additives
Polyfluoroethylene (PFE), free of additives
Polytetrafluoroethylene (PTFE), free of additives
NOTE 1 The sequence given in this list does not constitute a ranking of the recommended materials.
NOTE 2 Materials made of plastics can contain various kinds of additives used either for processing or for special kinds of serviceability. These additives can possibly migrate into AUS 40. For this reason, it is advisable that special care be taken for testing the contamination of AUS 40 by additives from plastic materials used in direct contact with AUS 40.
Copolymers of vinylidene fluoride and hexafluoropropylene, free of additives
FIBREGLASS based on a proper resin
NOTE 1 The sequence given in this list does not constitute a ranking of the recommended materials.
NOTE 2 Materials made of plastics can contain various kinds of additives used either for processing or for special kinds of serviceability. These additives can possibly migrate into AUS 40. For this reason, it is advisable that special care be taken for testing the contamination of AUS 40 by additives from plastic materials used in direct contact with AUS 40.

Examples of materials not recommended are given below.

Materials forming compounds as a result of reaction with ammonia, which might negatively interfere with the SCR converter system: carbon steels, zinc coated carbon steels, mild iron
Non-ferrous metals and alloys: copper alloys, zinc, lead
Solders containing lead, silver, zinc, or copper
Aluminium, aluminium alloys
Magnesium, magnesium alloys
Plastics or metals coated with nickel

日期 Date	设绘 Des.	批准 Appd.	修改等级 A.C.	修改/更改说明: Revision change	更改号 Chg. Not.	版本号 Rev.
20170103	沈腾	侯春国				00a
基础标准: Basic Standards				补充图号: Suppl. Drawing No.:		
专利公司材料: Material/Blank:				材料: Final User Material:	质量 Mass (kg):	
比例: Scale:	幅面 Size:	机型: Product Type:	部套/组件: M.S/D.G.	页次/页数: Page No.	制图画法 Projection:	沪东重机有限公司 HUDONG HEAVY MACHINERY CO. LTD.
	A3			1 (1)		
专利公司资料号: Info.No.:	专利公司名称: Item Name:				专利公司图号: Item Id.:	
资料号: Final User Info.No.:	名称: Final User Description:				图号: Final User Ident. No.:	
	SCR尿素溶液存储材料规范				00230777	



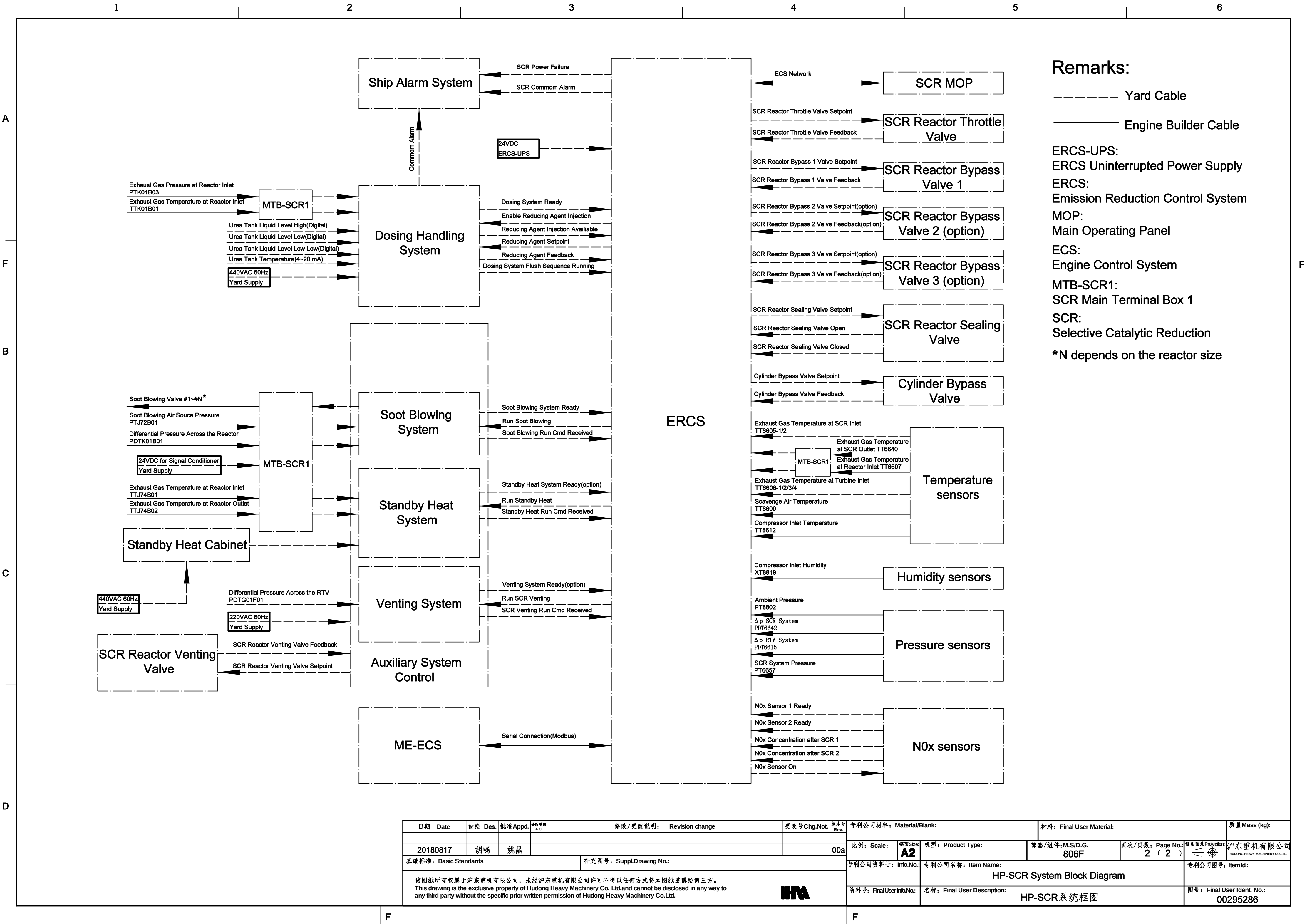
HP-SCR系统框图

HP-SCR System Block Diagram

日期Date	设绘Des.	批准Appd.	修改日期A.C.	修改/更改说明Revision change	更改号Chg.Not.	版本号Rev.
20180830	胡畅	姚晶				00a
基础标准: Basic Standards				补充图号: Suppl.Drawing No.:		
专利公司材料: Material/Blank:				材料: Final User Material:		质量Mass (kg):
比例: Scale:	幅面Size: A2	机型: Product Type:	部套/组件: M.S/D.G.	页次/页数: Page No.	制图画法Projection:	沪东重机有限公司 HUDONG HEAVY MACHINERY CO.LTD.
			806F	1 (2)		
专利公司资料号: Info.No.:	专利公司名称: Item Name:				专利公司图号: Item Id.:	
	HP-SCR System Block Diagram					
资料号: Final User Info.No.:	名称: Final User Description:				图号: Final User Ident. No.:	
	HP-SCR系统框图				00295286	

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日期 Date	设计 Des.	批准 Appd.	修改号 A.C.	修改/更改说明: Revision change	更改号 Chg.No.	版本号 Rev.	专利公司材料: Material/Blank:	材料: Final User Material:	质量 Mass (kg):
20180817	胡畅	姚晶				00a	比例: Scale: 幅面Size: A2	机型: Product Type: 部套/组件: M.S/D.G. 806F	页次/页数: Page No. 2 (2)
基础标准: Basic Standards				补充图号: Suppl.Drawing No.:			专利公司资料号: Info.No.:	专利公司名称: Item Name:	专利公司图号: Item Id.:
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资料号: Final User Info.No.:							名称: Final User Description: HP-SCR系统框图		图号: Final User Ident. No.: 00295286

HP-SCR SIGNAL LIST

HP-SCR信号清单

Basic Standards (MBD SB) & Suppl. Drawing No.:					EN21C Surf. roughness		Projection: 		Material / Blank:	
					EN21F-m Tolerances		Mass (kg):		Final User Material:	
Date	Des.	Chk.	Appd.	A.C.	Change / Replacement					C.No
				*	Replaced by Ident. No.:					5
				*						4
				*						3
				*						2
20180622	邱斌斌	宁军		*	清单信号规格更新 CSD07617					1
20180104	邱斌斌	宁军		*	CE0560A					0
Similar Drawing No.:							Replacement for Ident. No.:			
Scale: *	Size: A3	Type:					Page No.:	01 (03)		
Info. No.:		Description:							Ident. No.:	
Final User Info. No.:		Final User Description:							Final User Ident. No.:	
806F		HP-SCR信号清单							3H-27988	

CAD Drawing - do not correct by hand

SCR SIGNAL LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	信号规格（量程） SIGNAL RANGE
TT6607	806A1	SCR反应器进口废气温度 Exhaust gas temprature at SCR reactoer inlet	4-20mA 0-600℃
TT6640	806A1	SCR反应器出口废气温度 Exhaust gas temperature at SCR reactor outlet	4-20mA 0-600℃
PDTK01B01	806AA1	反应器前后压差 DP across the reactor	4-20mA 0-100mbar
PTK01B03	806AB1	反应器前废气压力 Exhaust gas pressure before reactor	4-20mA 0-6bar
TTK01B01	806AC1	反应器前废气温度 Exhaust gas temperature before reactor	4-20mA 0-600℃
TTJ74B01	806AC1	反应器温度1 Exhaust gas temperature 1 of the reactor	4-20mA 0-600℃
TTJ74B02	806AD1	反应器温度2 Exhaust gas temperature 2 of the reactor	4-20mA 0-600℃
PTJ72B01	806AF2	吹灰空气进口压力 air pressure before soot blowing	4-20mA 0-16bar
TT6605-1	806C1	SCR进口废气温度1 Exhaust gas temprature at SCR inlet 1	4-20mA 0-600℃
TT6605-2	806C1	SCR进口废气温度2 Exhaust gas temprature at SCR inlet 2	4-20mA 0-600℃
TT6606-1	806C1	增压器前废气温度1 Exhaust gas temperature before turbocharger 1	4-20mA 0-600℃
TT6606-2	806C1	增压器前废气温度2 Exhaust gas temperature before turbocharger 2	4-20mA 0-600℃
TT6606-3	806C1	增压器前废气温度3 Exhaust gas temperature before turbocharger 3	4-20mA 0-600℃
TT6606-4	806C1	增压器前废气温度4 Exhaust gas temperature before turbocharger 4	4-20mA 0-600℃
XT6622-1	806CB1	增压器后废气中NOX浓度1 Exhaust gas after turbocharger NOX concentration 1	4-20mA 0-2000ppm

SCR SIGNAL LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	信号规格（量程） SIGNAL RANGE
XT6622-2	806CB1	增压器后废气中NOX浓度2 Exhaust gas after turbocharger NOX concentration 2	4-20mA 0-2000ppm
PDT6642	806CC1	反应器旁通阀前后压差 DP across reactor bypass valve	4-20mA -50-200mbar
TT8609	806CD1	扫气集管温度 Temperature in scavenge air reciver	4-20mA 0-120℃
TT8612	806CE2	机舱温度 Engine room temperature	4-20mA -40-+60℃
PT8802	806CE2	环境压力 Ambient air pressure	4-20mA 940-1100mbar
XT8819	806CE2	增压器空气滤器扫气湿度 Scavenge air humidity at turbocharger filter	4-20mA 0-100%
PT6657	806CF1	反应器节流阀前废气压力 Exhaust gas pressure before reactor throttle valve	4-20mA 0-6bar
PDT6615	806CG1	反应器节流阀前后压差 DP across reactor throttle valve	4-20mA -4-+4bar
PDTG01F01	806CI1	SCR系统压差 DP SCR system (for venting system)	4-20mA 0-0.2bar
6613	806D	反应器节流阀 Reactor throttle valve	4-20mA=open to full closed valve
6616	802A	反应器密封阀 Reactor sealing valve	0-24V 0V=open 24V=closed
6635	802E	气缸旁通阀 Cylinder bypass valve	4-20mA=closed to full open valve
6619	802B	反应器旁通阀 Reactor bypass valve	4-20mA=open to full closed valve
VVJ03B01	802C	通风阀 venting valve	4-20mA=closed to full open valve

HP-SCR SYSTEM INSTRUMENTS LIST

HP-SCR系统元件清单

Basic Standards (MBD SB) & Suppl. Drawing No.:					EN21C Surf. roughness		Projection: 		Material / Blank:	
					EN21F-m Tolerances		Mass (kg):		Final User Material:	
Date	Des.	Chk.	Appd.	A.C.	Change / Replacement					C.No
				*	Replaced by Ident. No.:					5
				*						4
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				*						2
20180623	邱斌斌	宁军		*	TT8818改为TT8612;CSD07617					1
20180104	邱斌斌	宁军		*	CE0560A					0
Similar Drawing No.:							Replacement for Ident. No.:			
Scale: *	Size: A3	Type: HPSCR 1xT/C				Page No.: 01 (08)		 CSSC-MES		
Info. No.:		Description:							Ident. No.:	
Final User Info. No.: 806G		Final User Description: HP-SCR系统元件清单							Final User Ident. No.: 3H-27987	

SCR INSTRUMENT LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
806C SCR系统电气元件（主机部分） SCR system instrument (engine part)			
TT6605-1	806C1	SCR进口废气温度1 Exhaust gas temprature at SCR inlet 1	
TT6605-2	806C1	SCR进口废气温度2 Exhaust gas temprature at SCR inlet 2	
TT6606-1	806C1	增压器前废气温度1 Exhaust gas temperature before turbocharger 1	
TT6606-2	806C1	增压器前废气温度2 Exhaust gas temperature before turbocharger 2	
TT6606-3	806C1	增压器前废气温度3 Exhaust gas temperature before turbocharger 3	
TT6606-4	806C1	增压器前废气温度4 Exhaust gas temperature before turbocharger 4	
XT6622-1	806CB1	增压器后废气中NOX浓度1 Exhaust gas after turbocharger NOX concentration 1	
XT6622-2	806CB1	增压器后废气中NOX浓度2 Exhaust gas after turbocharger NOX concentration 2	
PDT6642	806CC1	反应器旁通阀前后压差 DP across reactor bypass valve	
TT8609	806CD1	扫气集管温度 Temperature in scavenge air reciver	
TT8612	806CE2	机舱温度 Engine room temperature	
PT8802	806CE2	环境压力 Ambient air pressure	

SCR INSTRUMENT LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
XT8819	806CE2	增压器空气滤器扫气湿度 Scavenge air humidigy at turbocharger filter	
PT6657	806CF1	反应器节流阀前废气压力 Exhaust gas pressure before reactor throttle valve	
PDT6615	806CG1	反应器节流阀前后压差 DP across reactor throttle valve	
6613	802D	反应器节流阀 Reactor throttle valve	
6616	802A	反应器密封阀 Reactor sealing valve	
6635	802E	气缸旁通阀 Cylinder bypass valve	
6619	802B	反应器旁通阀 Reactor bypass valve	
VVJ03B01	802C	通风阀 venting valve	
801S SCR还原剂泵站和计量单元 SCR reducing agent pump and dosing unit			
BV K01B01	801S	1#尿素进口滤器前压力指示仪表球阀 NO.1 urea pump inlet pressure indicate ball valve before filter	
BV K01B02	801S	2#尿素进口滤器前压力指示仪表球阀 NO.2 urea pump inlet pressure indicate ball valve before filter	
BV K01B03	801S	1#尿素泵出口球阀 NO.1 urea pump outlet ball valve	
BV K01B04	801S	2#尿素泵出口球阀 NO.2 urea pump outlet ball valve	

SCR INSTRUMENT LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
BV K01B05	801S	压缩空气滤器进口球阀 Compressed air ball valve before filter	
BV K01B06	801S	压缩空气滤器出口球阀 Compressed air ball valve after filter	
BV K01B07	801S	压缩空气扫气支路球阀 Compressed air ball valve at scavenging branch	
BV K01B08	801S	压缩空气扫气支路球阀 Compressed air ball valve at scavenging branch	
FF K01B01	801S	1#尿素泵进口滤器 NO.1 urea pump inlet filter	
FF K01B02	801S	2#尿素泵进口滤器 NO.2 urea pump inlet filter	
PT K01B01	801S	1#尿素进口滤器后压力 NO.1 urea pump inlet pressure after filter	
PT K01B02	801S	2#尿素进口滤器后压力 NO.2 urea pump inlet pressure after filter	
NRV K01B01	801S	1#尿素泵出口止回阀 NO.1 urea pump outlet non return valve	
NRV K01B02	801S	2#尿素泵出口止回阀 NO.2 urea pump outlet non return valve	
NRV K01B03	801S	压缩空气扫气支路止回阀 Compressed air non return valve at scavenging branch	
PI K01B01	801S	尿素泵后压力指示 Pressure indicate after urea pump	
PI K01B02	801S	压缩空气流量计后压力指示 Compressed air pressure indicate after flow meter	

SCR INSTRUMENT LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
PIS K01B01	801S	压缩空气滤器前压力开关 Compressed air pressure switch before manual filter	
MF K01B01	801S	手动滤器调压单元 Manual filter/regulator	
PCV K01B01	801S	自动调压控制单元 Automatic pressure control unit	
CV K01B01	801S	电磁阀开关 Solenoid valve	
CV K01B02	801S	电磁阀开关 Solenoid valve	
FM K01B01	801S	尿素溶液流量计 Urea flow meter	
FM K01B02	801S	压缩空气流量计 Compressed air flow meter	
SV K01B01	801S	尿素泵安全阀 Urea pump safety valve	
801N SCR还原剂混合单元 SCR reducing agent mixing unit			
BV K02B01	801N	喷嘴前球阀 Ball valve before nozzle	
BV K02B02	801N	喷嘴前球阀 Ball valve before nozzle	
BV K02B03	801N	喷嘴前球阀 Ball valve before nozzle	
BV K02B04	801N	喷嘴前球阀 Ball valve before nozzle	

SCR INSTRUMENT LIST

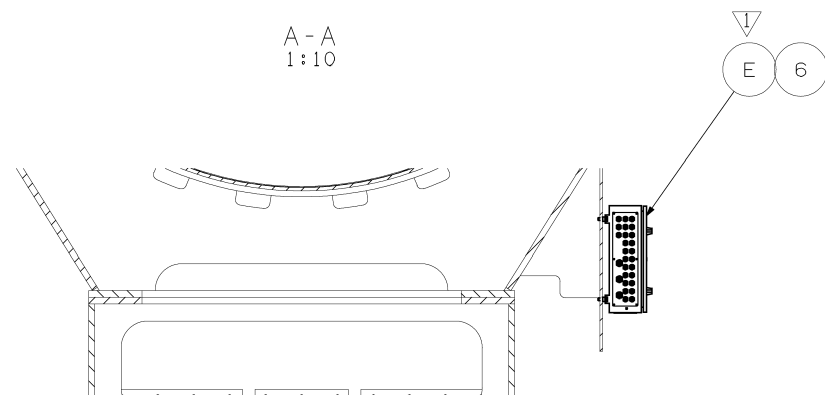
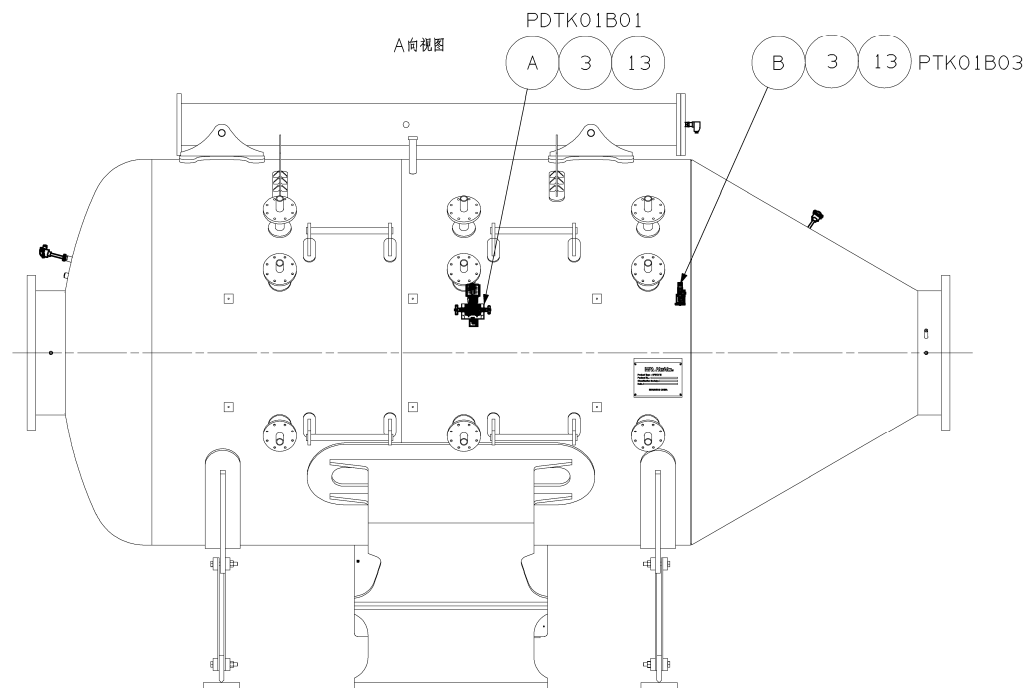
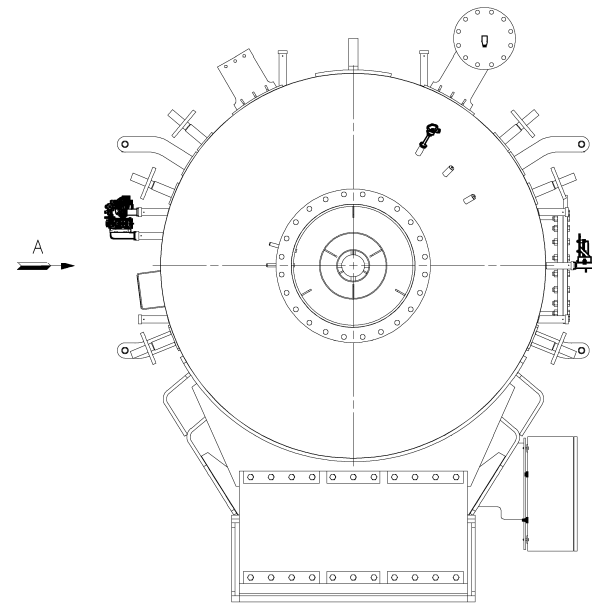
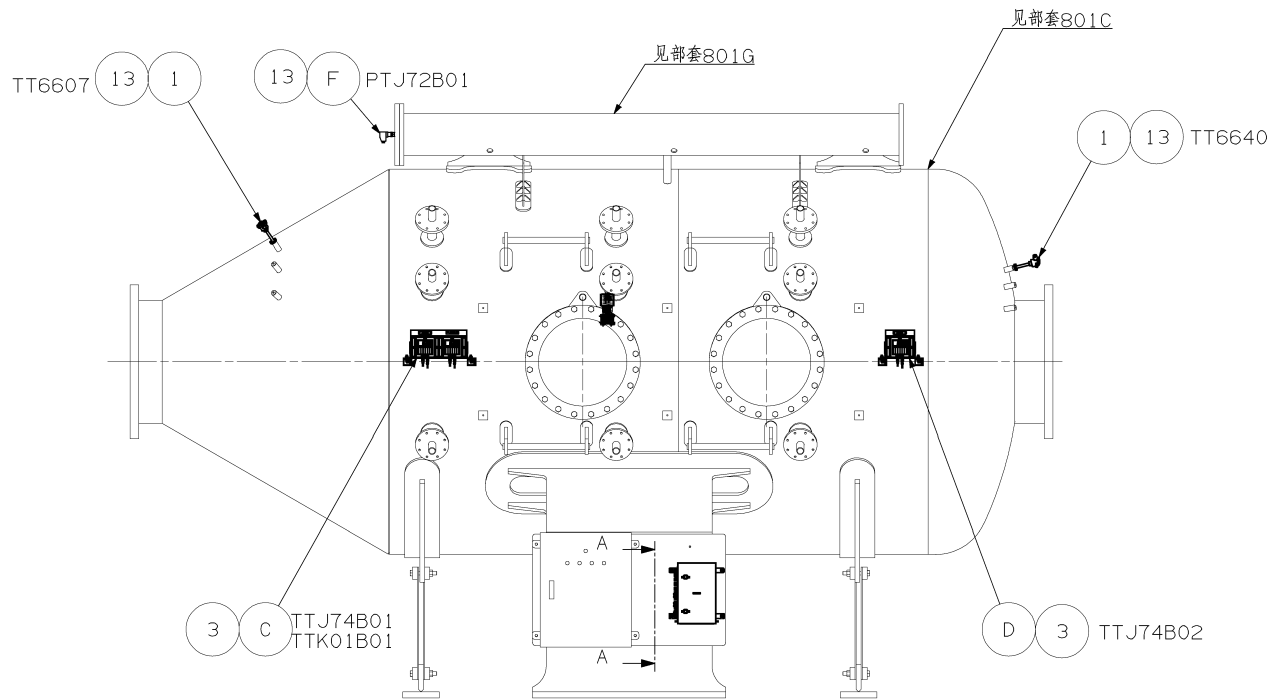
编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
PT K02B01	801N	喷嘴前尿素溶液压力 Urea pressure before nozzle	
PT K02B02	801N	喷嘴前压缩空气压力 Compressed air pressure before nozzle	
NRV K02B01	801N	喷嘴前尿素溶液止回阀 Urea non return valve before nozzle	
NRV K02B02	801N	喷嘴前压缩空气止回阀 Compressed air non return valve before nozzle	
806A SCR反应器电气元件 SCR reactor instrument			
TT6607	806A1	SCR反应器进口废气温度 Exhaust gas temprature at SCR reactor inlet	
TT6640	806A1	SCR反应器出口废气温度 Exhaust gas temperature at SCR reactor outlet	
PDT K01B01	806AA1	反应器前后压差 Exhaust gas differential pressure over reactor	
PT K01B03	806AB1	反应器前废气压力 Exhaust gas pressure before reactor	
TT K01B01	806AC1	反应器前废气温度 Exhaust gas temperature before reactor	
TT J74B01	806AC1	反应器温度1 Exhaust gas temperature 1 of the reactor	
TT J74B02	806AD1	反应器温度2 Exhaust gas temperature 2 of the reactor	
801G SCR吹灰系统 SCR sootblowing system			

SCR INSTRUMENT LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
SBV J72B01	801G	1#吹灰阀 NO.1 sootblowing valve	
SBV J72B02	801G	2#吹灰阀 NO.2 sootblowing valve	
SBV J72B03	801G	3#吹灰阀 NO.3 sootblowing valve	
SBV J72B04	801G	4#吹灰阀 NO.4 sootblowing valve	
SBV J72B05	801G	5#吹灰阀 NO.5 sootblowing valve	
SBV J72B06	801G	6#吹灰阀 NO.6 sootblowing valve	
SBV J72B07	801G	7#吹灰阀 NO.7 sootblowing valve	
SBV J72B08	801G	8#吹灰阀 NO.8 sootblowing valve	
SBV J72B09	801G	9#吹灰阀 NO.9 sootblowing valve	
SBV J72B10	801G	10#吹灰阀 NO.10 sootblowing valve	
SBV J72B11	801G	11#吹灰阀 NO.11 sootblowing valve	
SBV J72B12	801G	12#吹灰阀 NO.12 sootblowing valve	
SBV J72B13	801G	13#吹灰阀 NO.13 sootblowing valve	

SCR INSTRUMENT LIST

编号 NO.	部件号 SYRUCT NO.	描述 DESCRIPTION	备注 REMARKS
SBV J72B14	801G	14#吹灰阀 NO.14 sootblowing valve	
SBV J72B15	801G	15#吹灰阀 NO.15 sootblowing valve	
SBV J72B16	801G	16#吹灰阀 NO.16 sootblowing valve	
SBV J72B17	801G	17#吹灰阀 NO.17 sootblowing valve	
SBV J72B18	801G	18#吹灰阀 NO.18 sootblowing valve	
SV J72B01	801G	吹灰系统安全阀 Sootblowing system safety valve	
BV J72B01	801G	吹灰系统气源进口球阀 Sootblowing system ball valve at air source inlet	
PT J72B01	806AF2	吹灰系统压力 Sootblowing system pressure	
SCR 通风系统 SCR venting system			
PDTG01F01	806CI1	SCR系统压差（用于通风系统） DP SCR system(for venting system)	



Date	Des.	Chk.	APRD.	A.C.	Revision change	CSD No.	Rev.	
							03	
							02	
20180102	于怀先	邱斌斌			件E的安装位置修改	07217A	01	
20180102	于怀先	邱斌斌					00	
Basic Standards (MGB SB):				similar, Drawing No.:		5N-02889		
EN21F-n Tolerances		EN21C Surf. roughness						
Material / Blank:				Final User Material:		Mass (kg):		
Scale:	Size:	Product Type:			Page No.:	Projection:		
1:17.5	A1	6G60MEC9.5			1 (1)			
Info. No.:		Item Name:				Item Id.:		
Final User Info. No.:		Final User Description:				Final User Ident. No.:		
806A		SCR反应器电气元件布置图				2N-06596		

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Plan History 文件说明		Engine Type 机型	HP-SCR通用		
		Engine No 工程编号			
		Yard/Hull NO 船厂/船号			
		Classification 船级社			
WIRING OF HP-SCR CONTROL SYSTEM HP-SCR控制系统接线图					
					5
					4
					3
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20180622	邱斌斌	宁军	原文图纸升级到5668277-2.9,CSD07617		1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	邱斌斌 20171226		Drawing NO 图号	4H-20489	
Check 校对	宁军 20171226				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 38
Verify 审定			Reference 设计参考图号	5668277-2.9	
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					

SCR Selective Catalytic Reduction Control System For ME and ME-B

High Pressure SCR

Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
20180205	LKOL	JYA	Z3	Ambient sensor updated		.09
20171205	JYA	LKOL	Z3	Connection to ambient sensor u	125509	08
20170330	LKOL	JYA	Z3	IRM Jumper to ERCS-MOP added		07
20150123	LKOL	JYA				00
Basic Standards (MBO SB):				Suppl. Drawing No.:		
EN21F-m Tolerances EN21C Surf. roughness						
Material / Blank:				Final User Material:		Mass (kg):
Scale:	Size:	Product Type:			Projection:	Page No.:
1: 1	A3	ME, ME-B				1 (37)
Info. No.:		Item Name:			Item Id.:	
7B4258		SELECTIVE CATALYTIC REDUCTION			5668277-2	
Final User Info. No.:		Final User Description:			Final User Ident. No.:	

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prior written permission of MAN Diesel & Turbo.



Reference Designations		Description		Reference Designations		Description				
6613		SCR Reactor Throttle Valve								
6619-1		SCR Reactor Bypass Valve, RBV-1,								
6619-2		SCR Reactor Bypass Valve 2, RBV-2								
6619-3		SCR Reactor Bypass Valve 3, RBV-3								
6635		SCR Cylinder bypass valve								
8612/8819/8802		Ambient Sensor								
ACU-1		Auxiliary Control Unit 1								
AMS		Alarm & Monitoring System								
DHS		Dosing Handling System								
ECC1		Engine Control Cabinet 1								
ERCS-MOP		ERCS Main Operating Panel								
ERCS-UPS		ERCS - Uninterrupted power supply								
JB 6616		JB-SCR Reactor Sealing Valve								
MOP-ERCS		Main Operating Panel-ERCS								
SBS		Soot Blowing System								
SCR NOx CB		SCR NOx Cabinet								
SCR-CU		SCR Control Unit								
SCR-CU-CB		SCR-CU Cabinet								
SCR-I1		SCR Interface Unit 1								
SCR-I1-CB		SCR I1 Cabinet								
SCR-I2		SCR Interface Unit 2								
SCR-I2-CB		SCR-I2 Cabinet								
SCR-I2.-CB		SCR-I2 Cabinet								
SHS		Standby Heat System								
SVS		SCR-Venting System								
Reference list				Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
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				Final User Info. No.:		Final User Description:			Final User Ident. No.:	



1 TABLE OF CONTENTS

Page 4...4

TABLE OF CONTENTS	Date			Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
	20180205			LKOL	JYA	Z3	Ambient sensor updated			.09
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Table of contents List

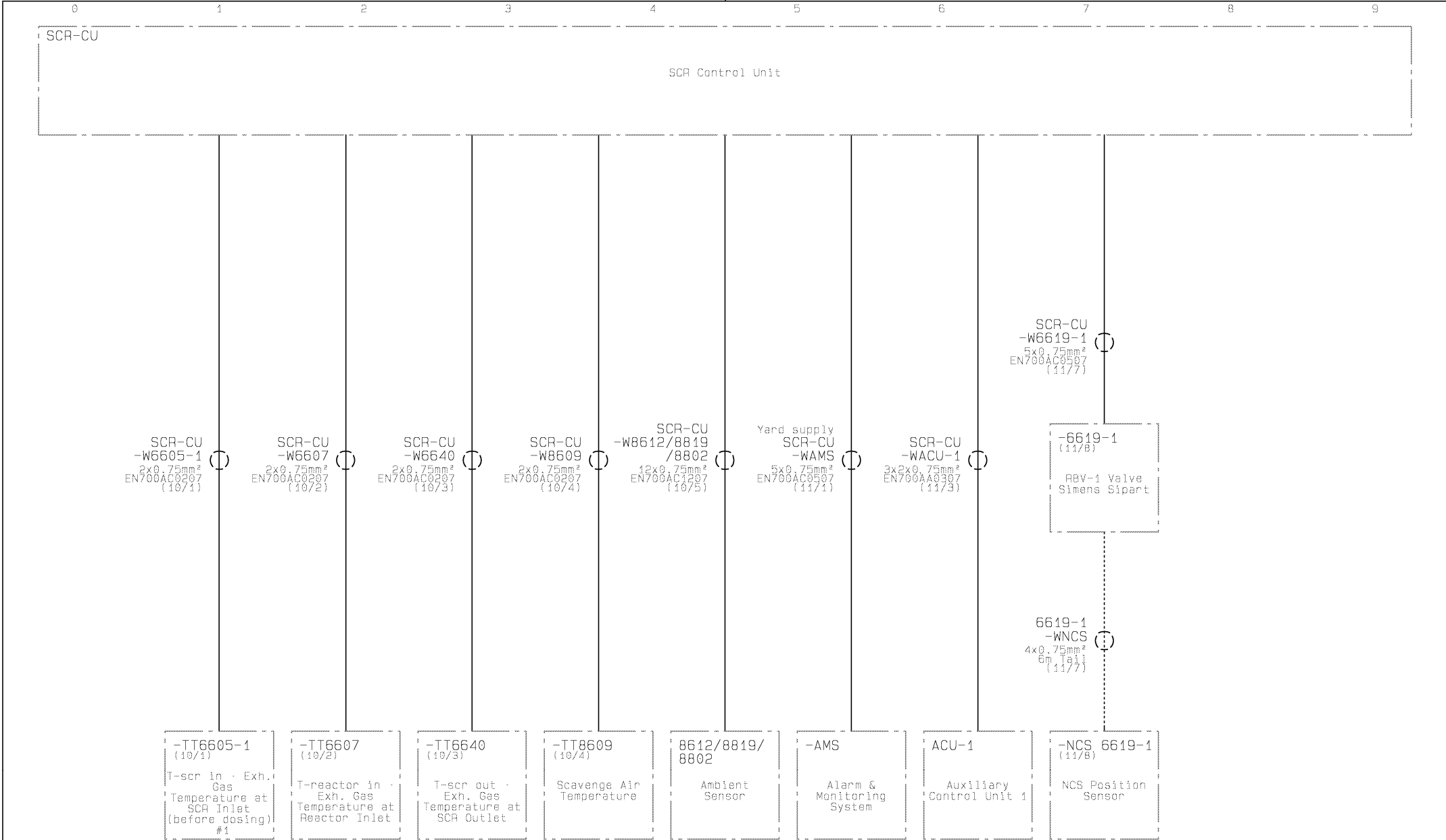
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2 SCR installation

Page 6...17

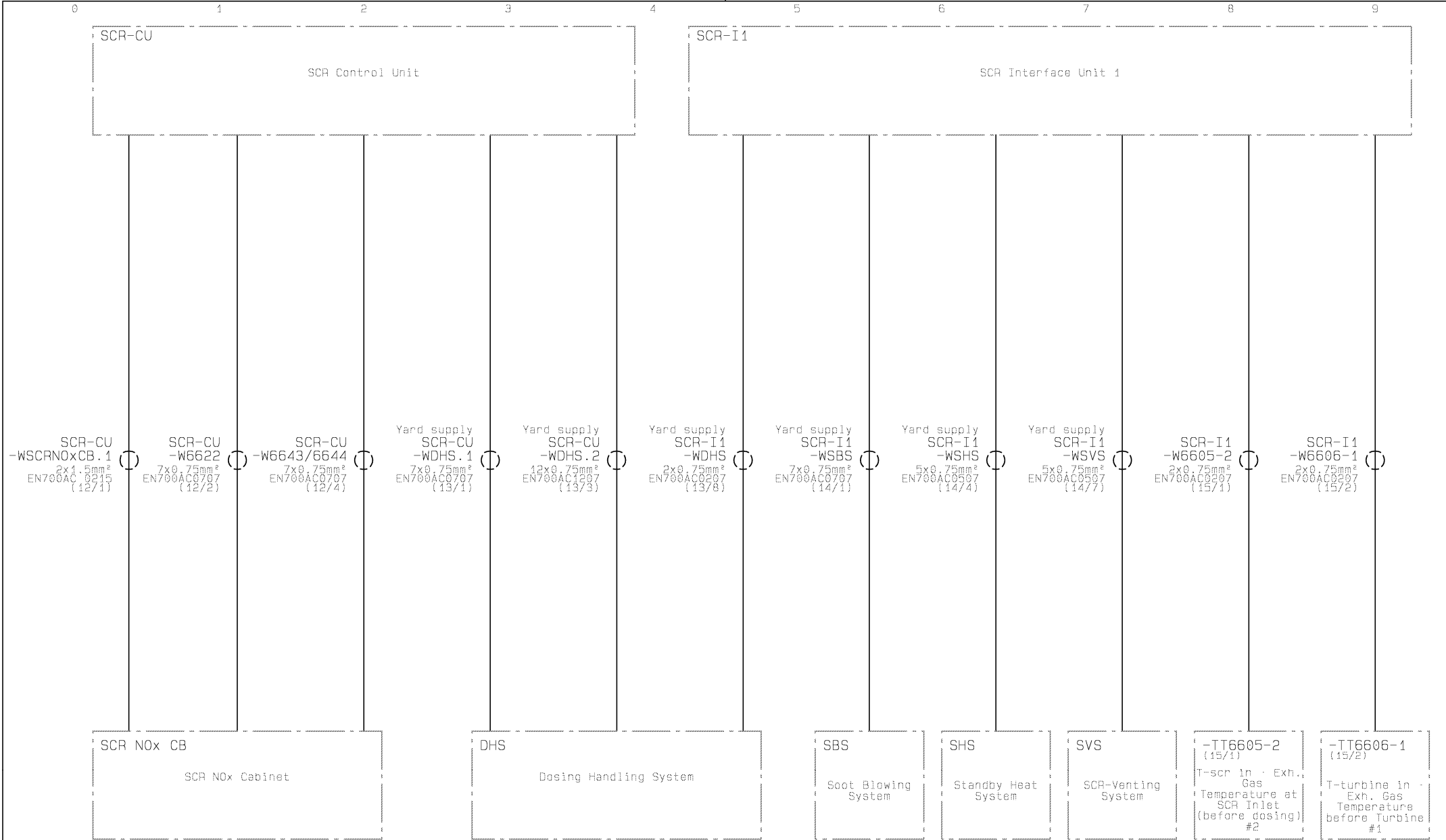
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Overveiw SCR-CU installation	Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
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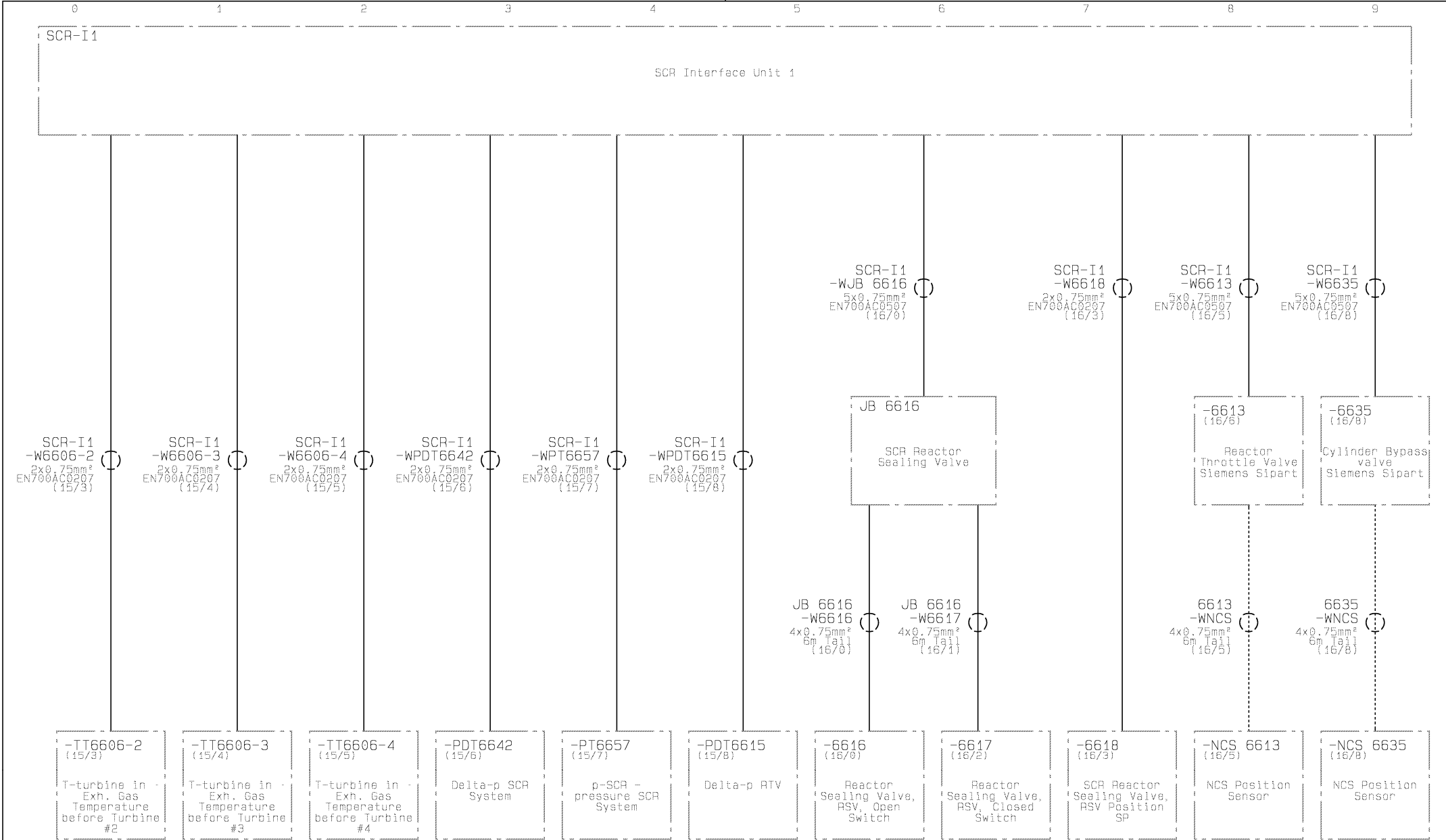


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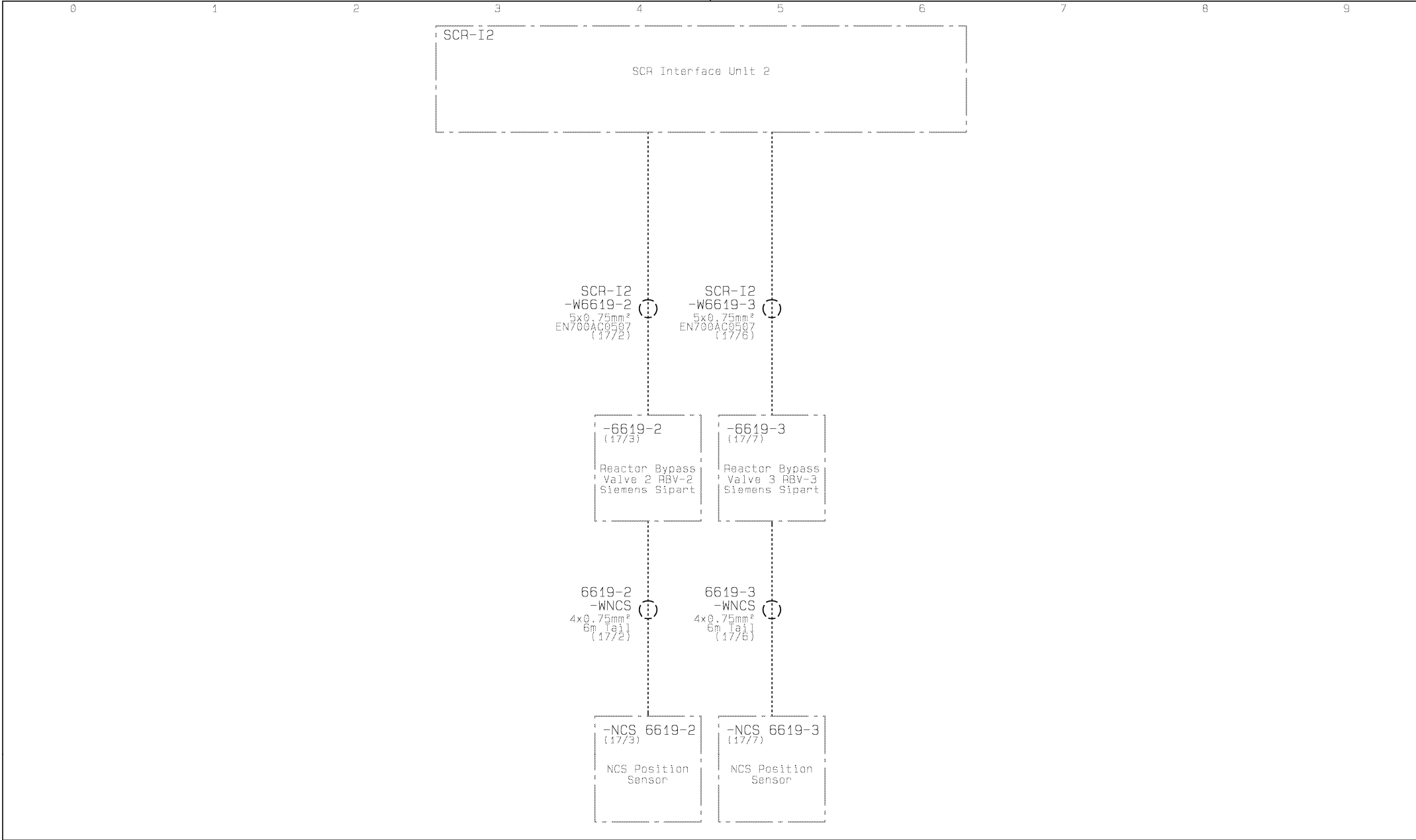
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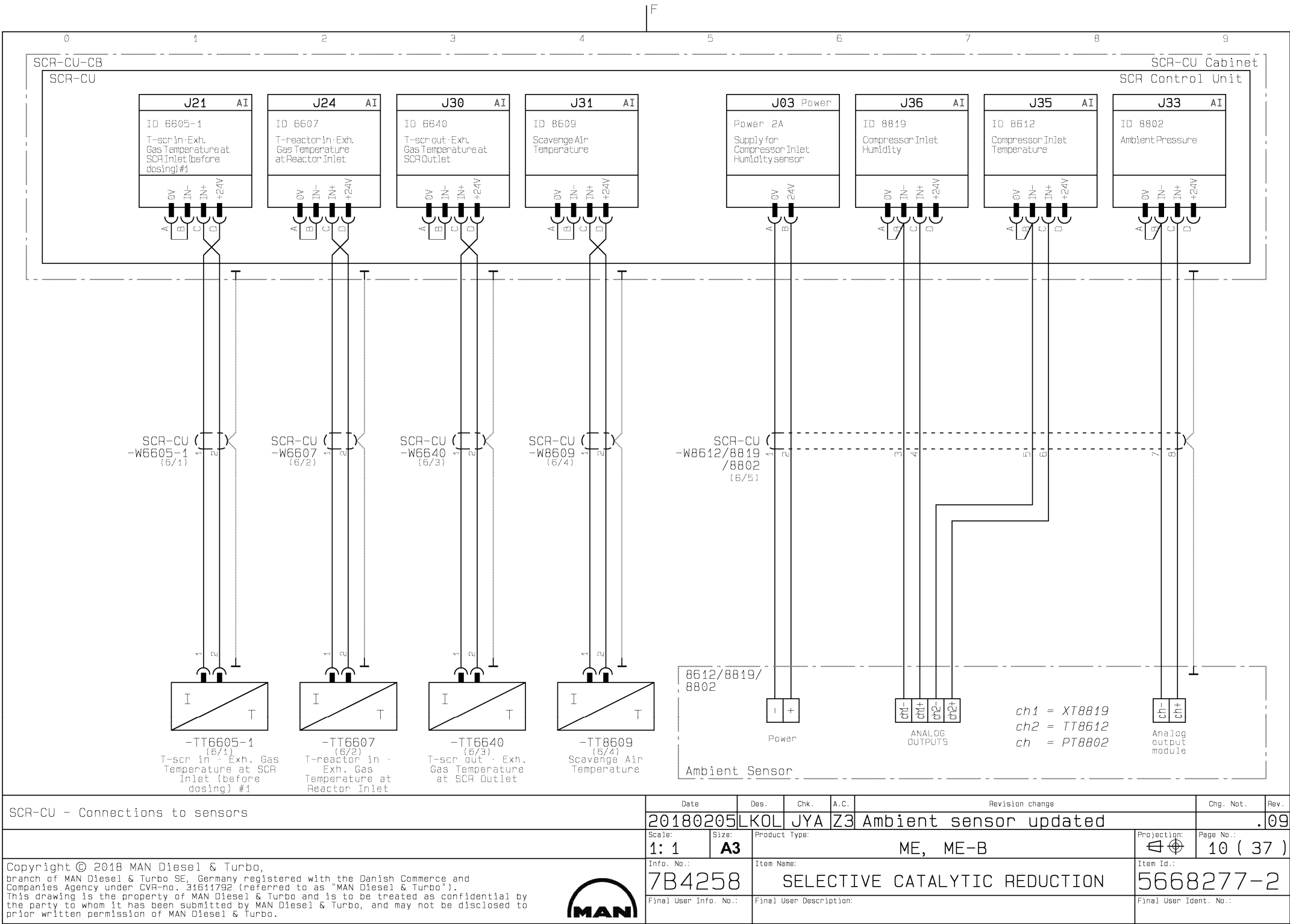
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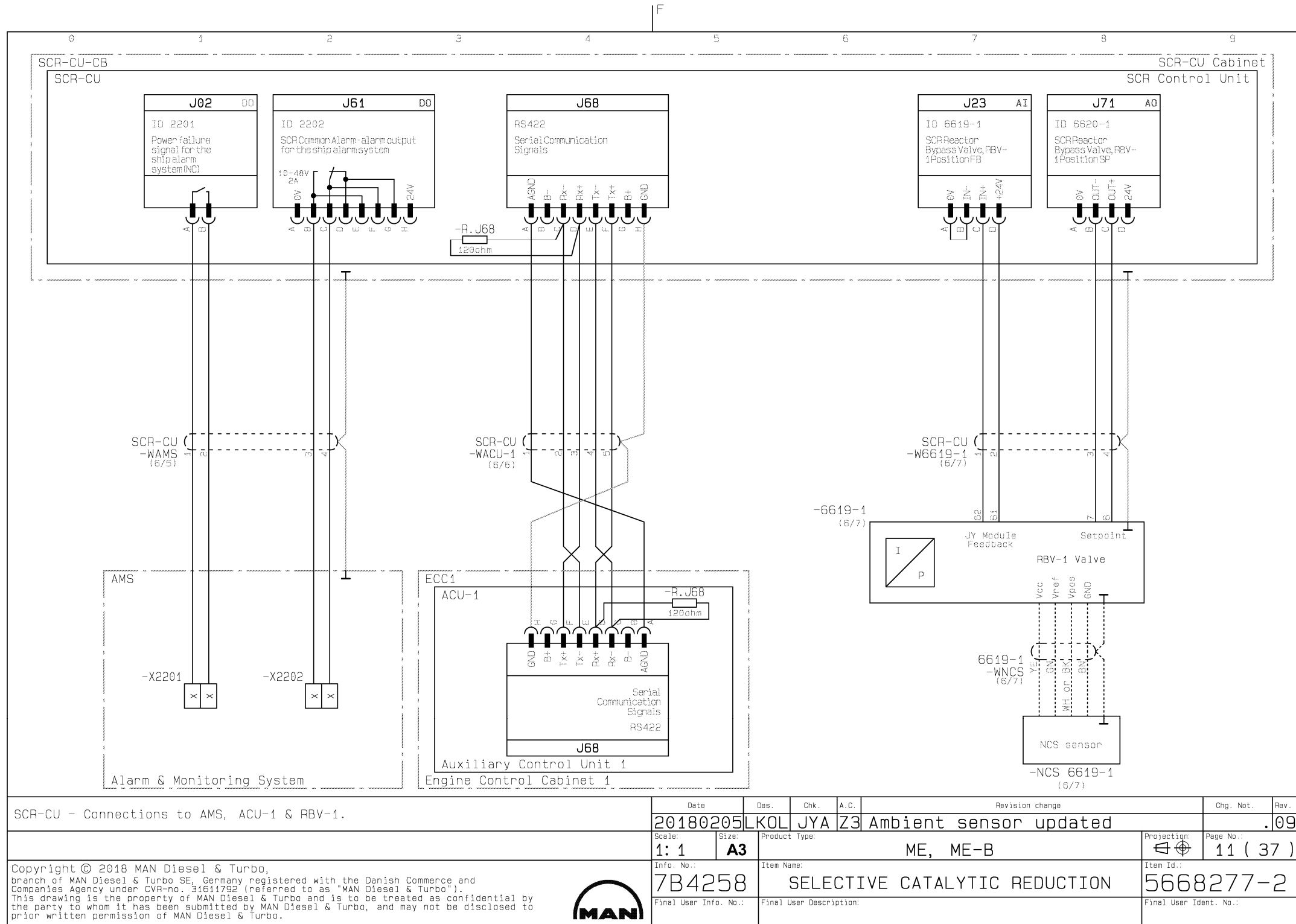


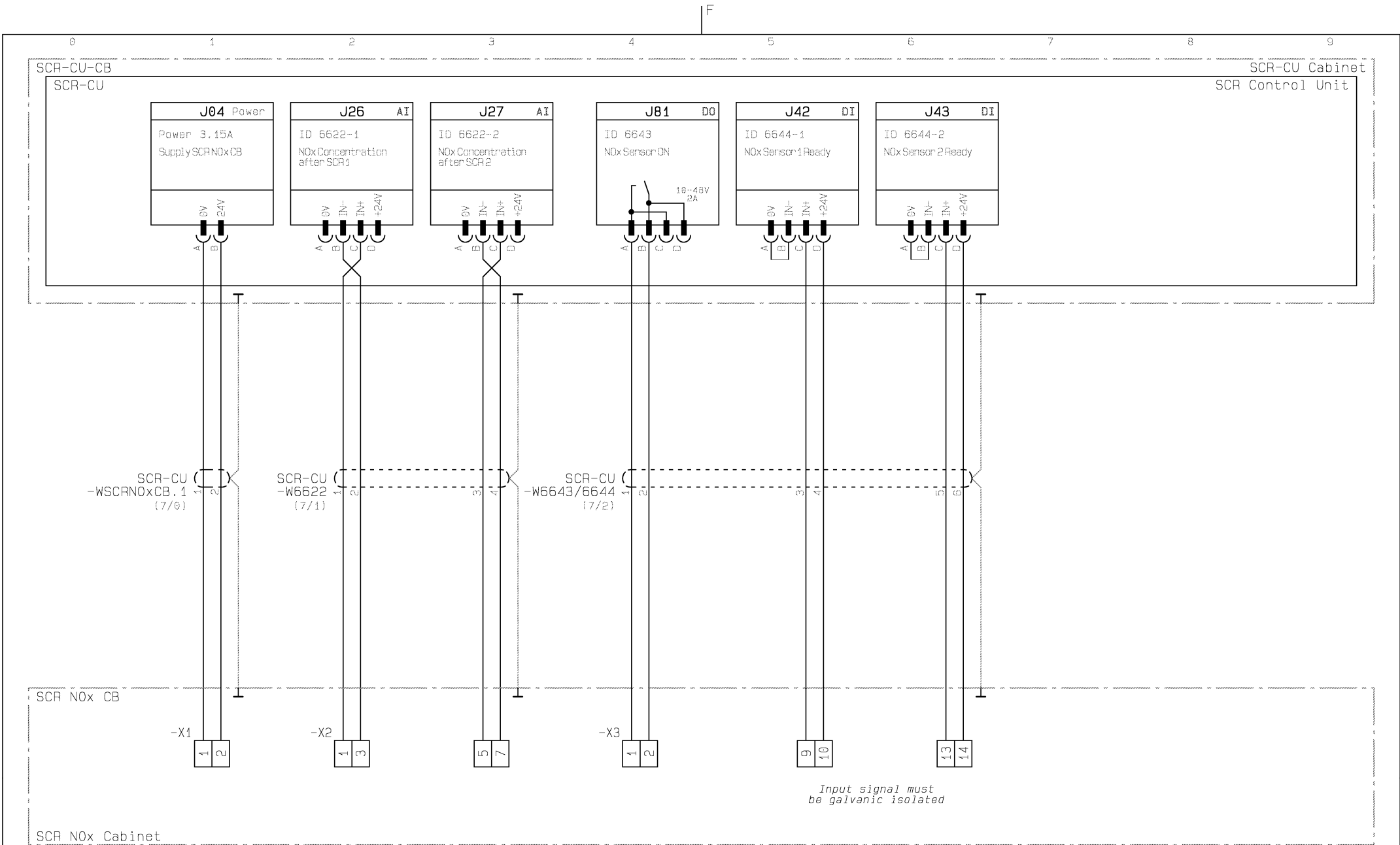
SCR-CU - Connections to sensors

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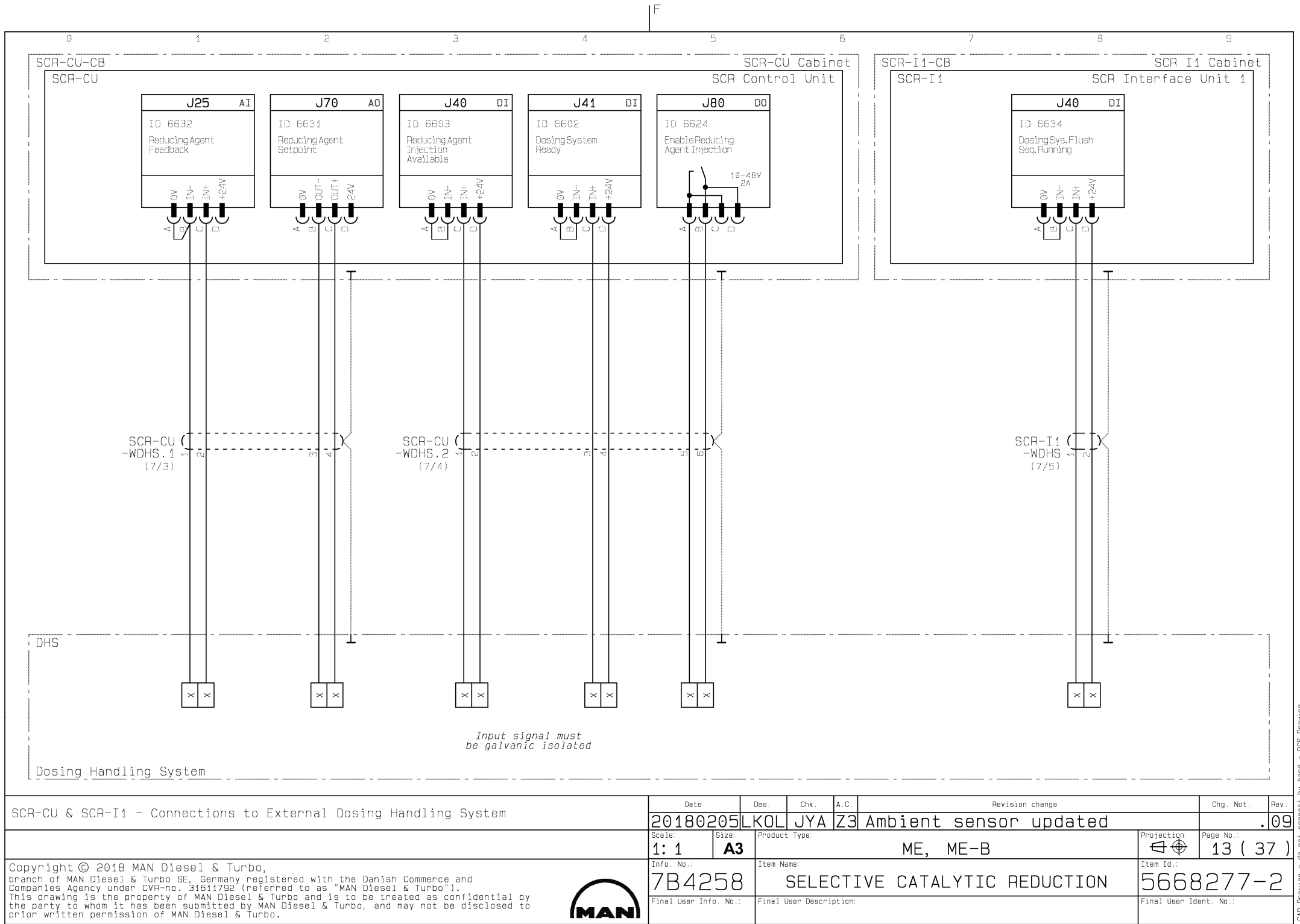


SCR-CU - Connections to NOx Cabinet

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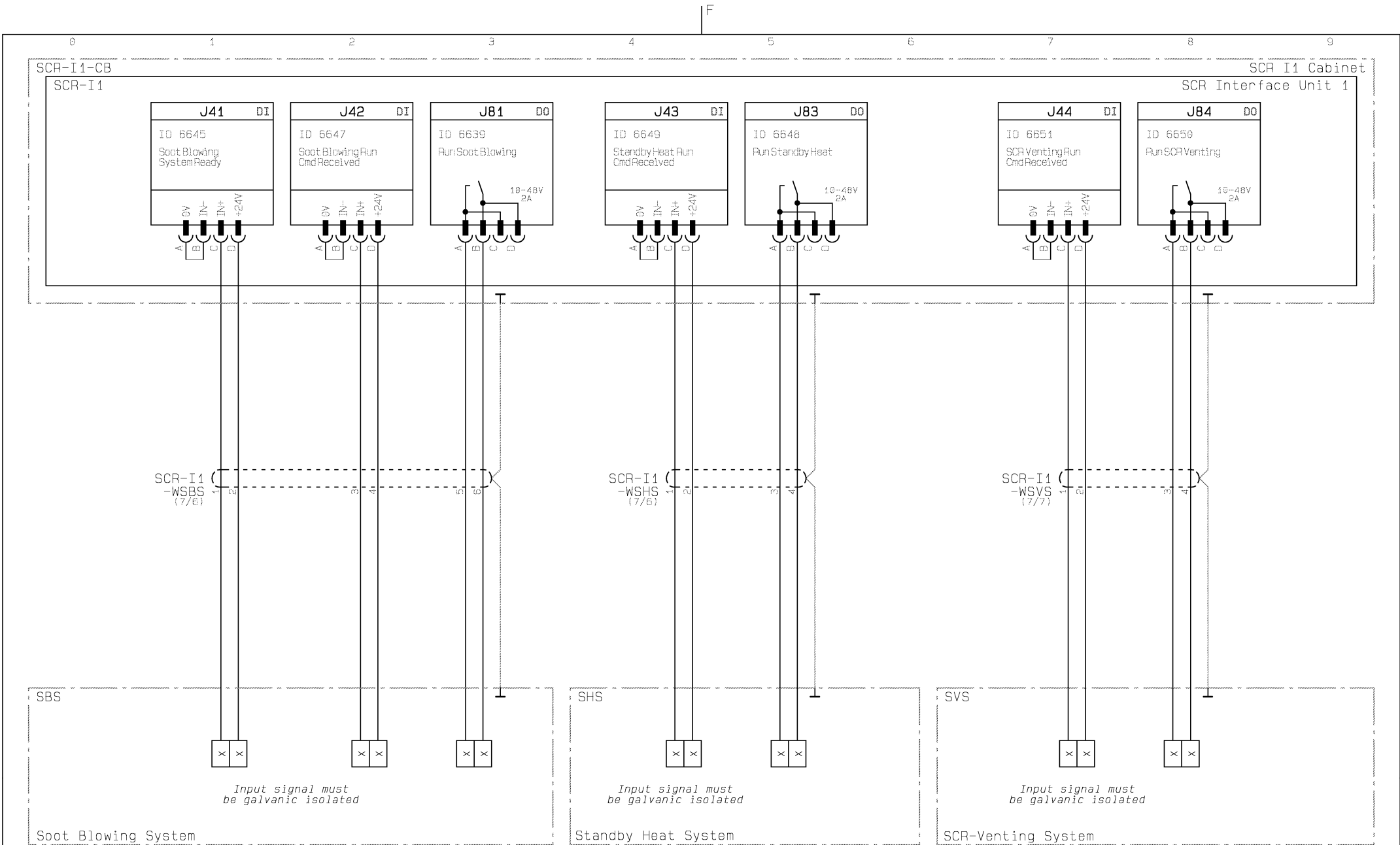


SCR-CU & SCR-I1 - Connections to External Dosing Handling System

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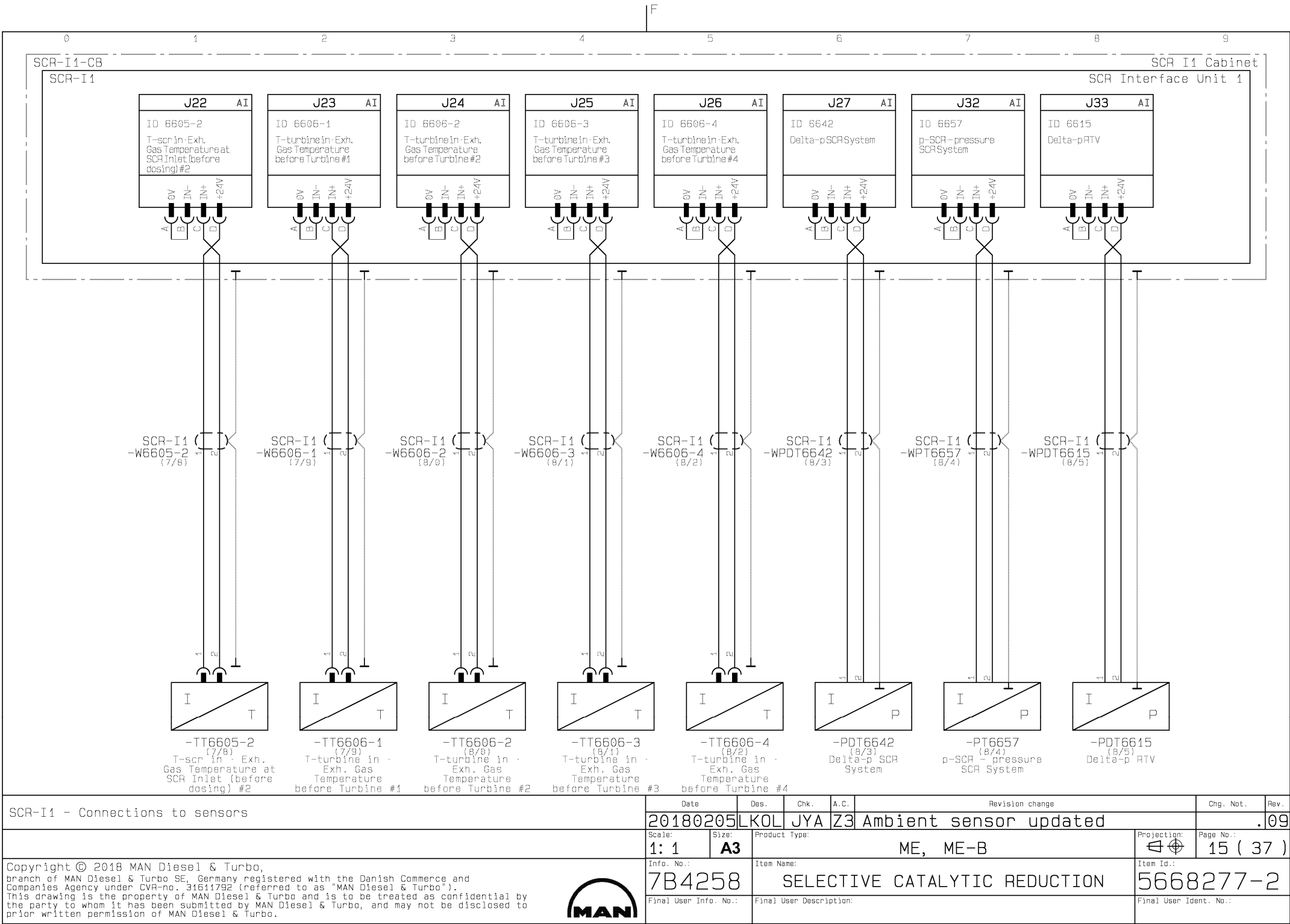


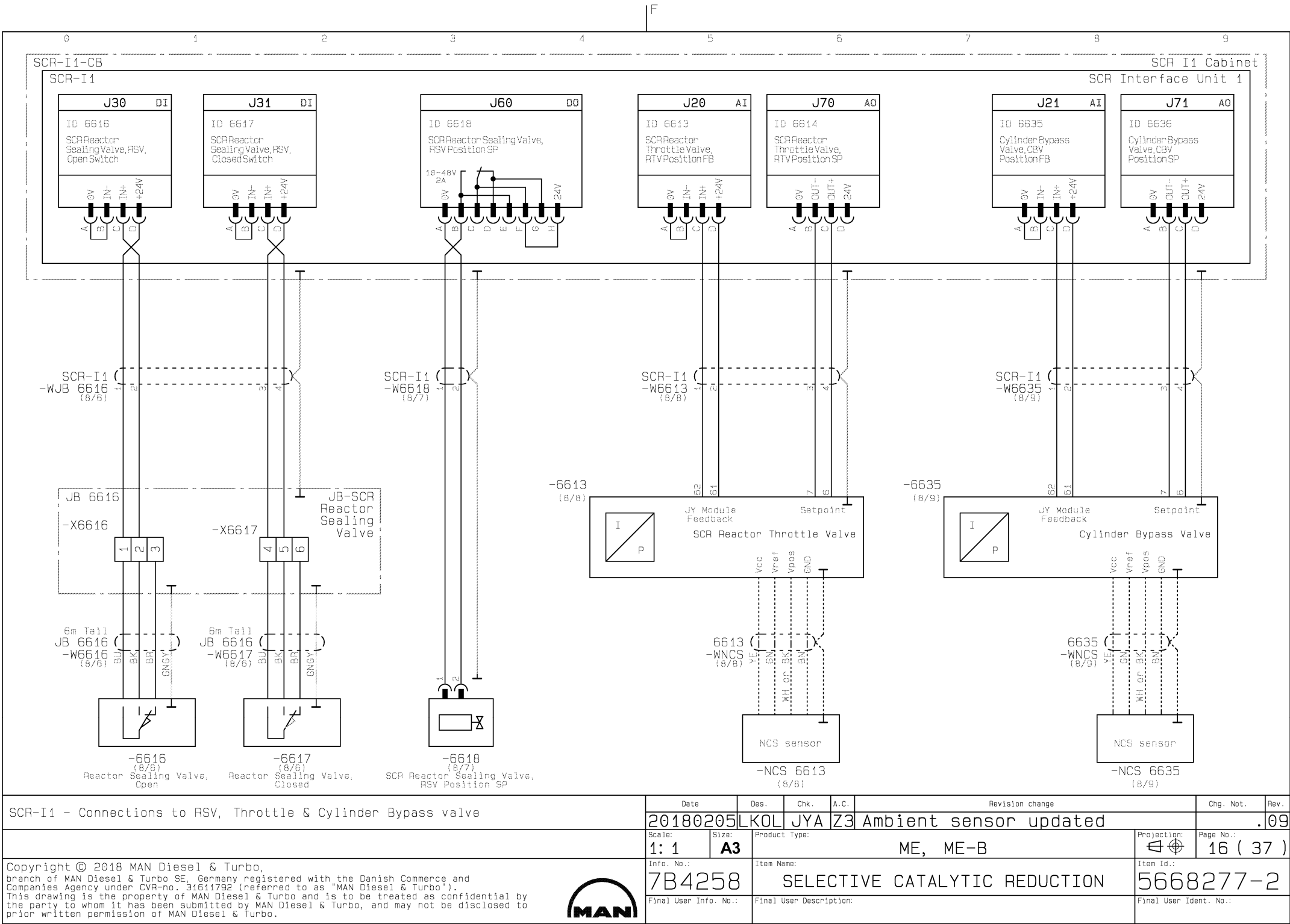
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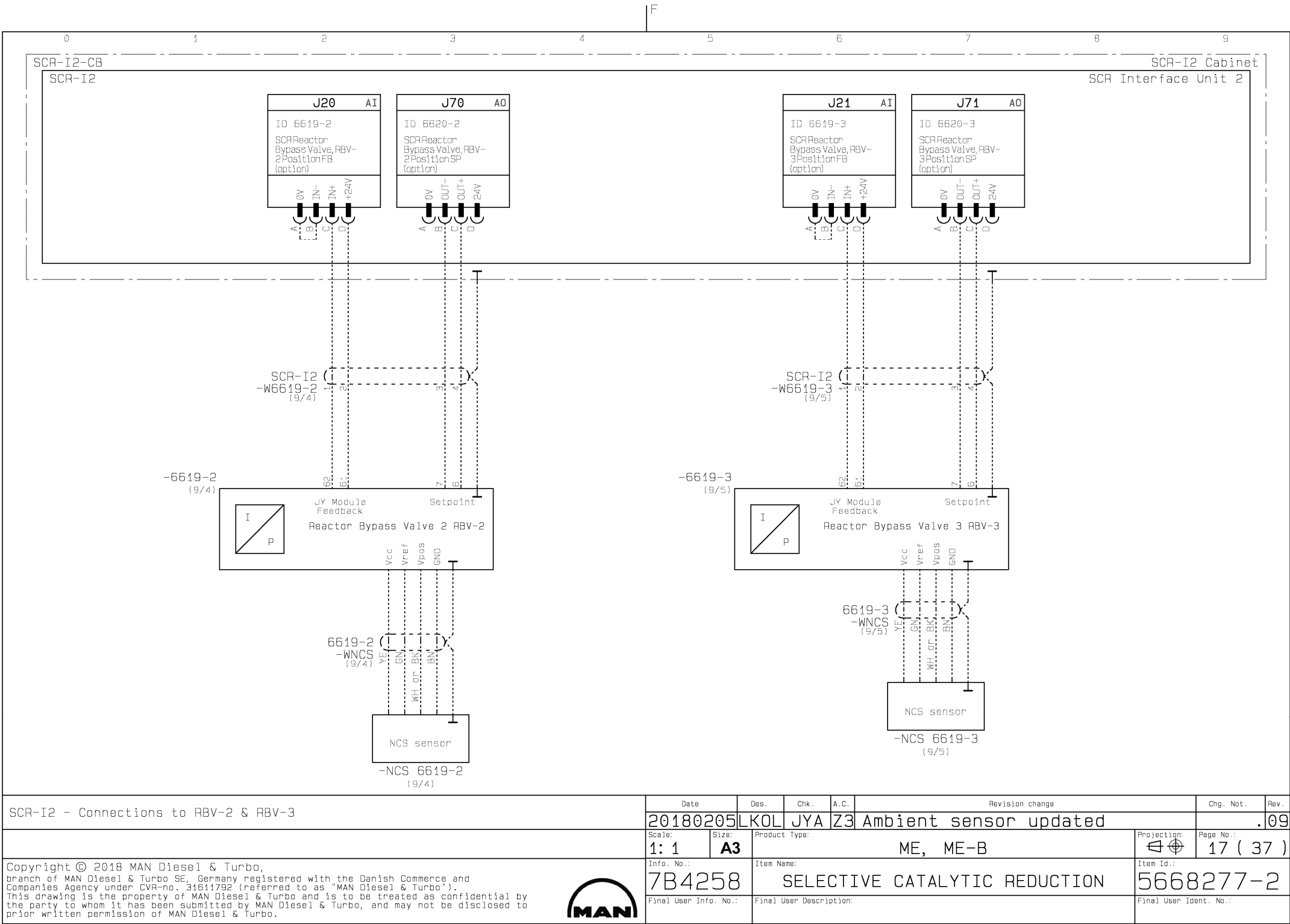
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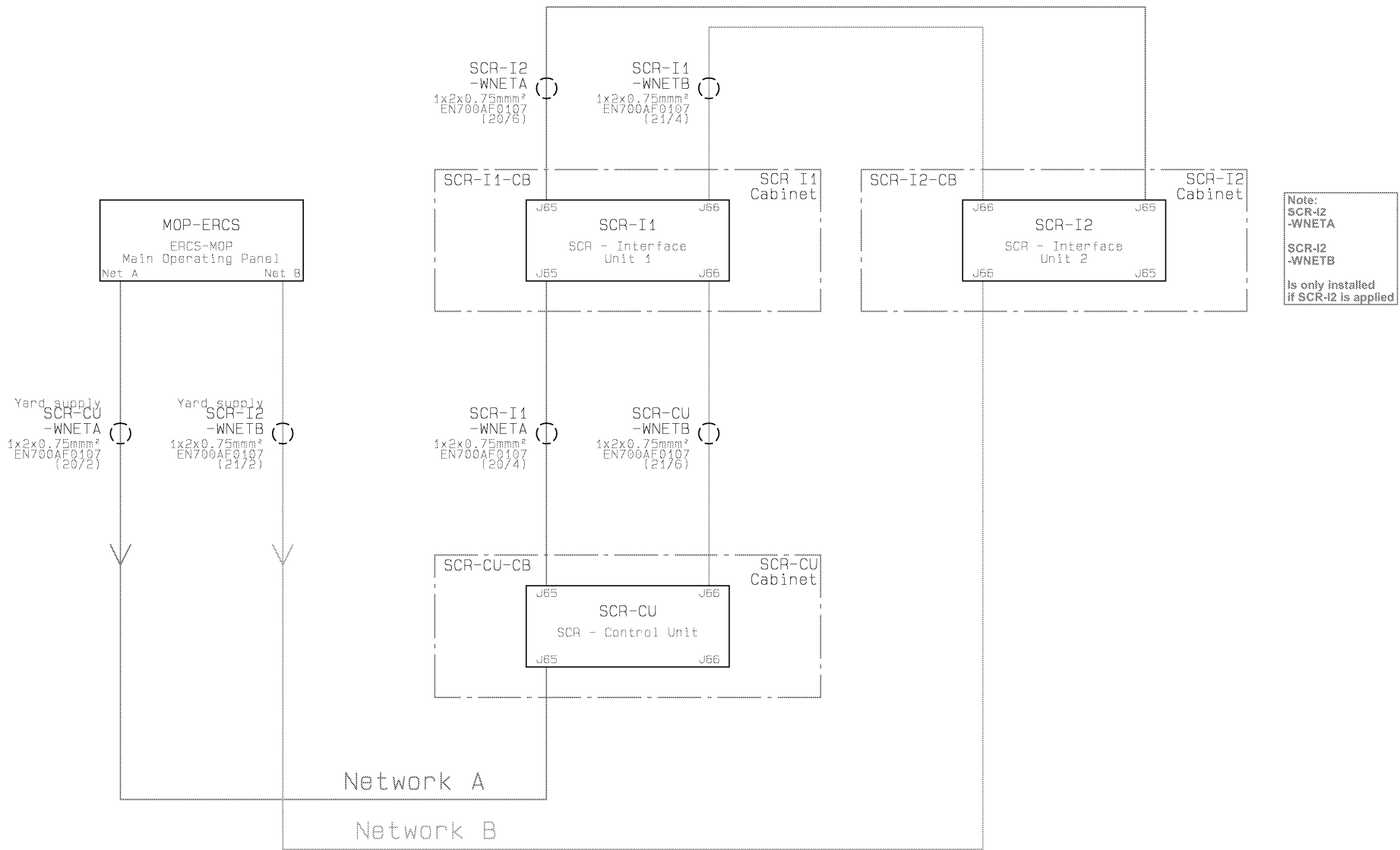




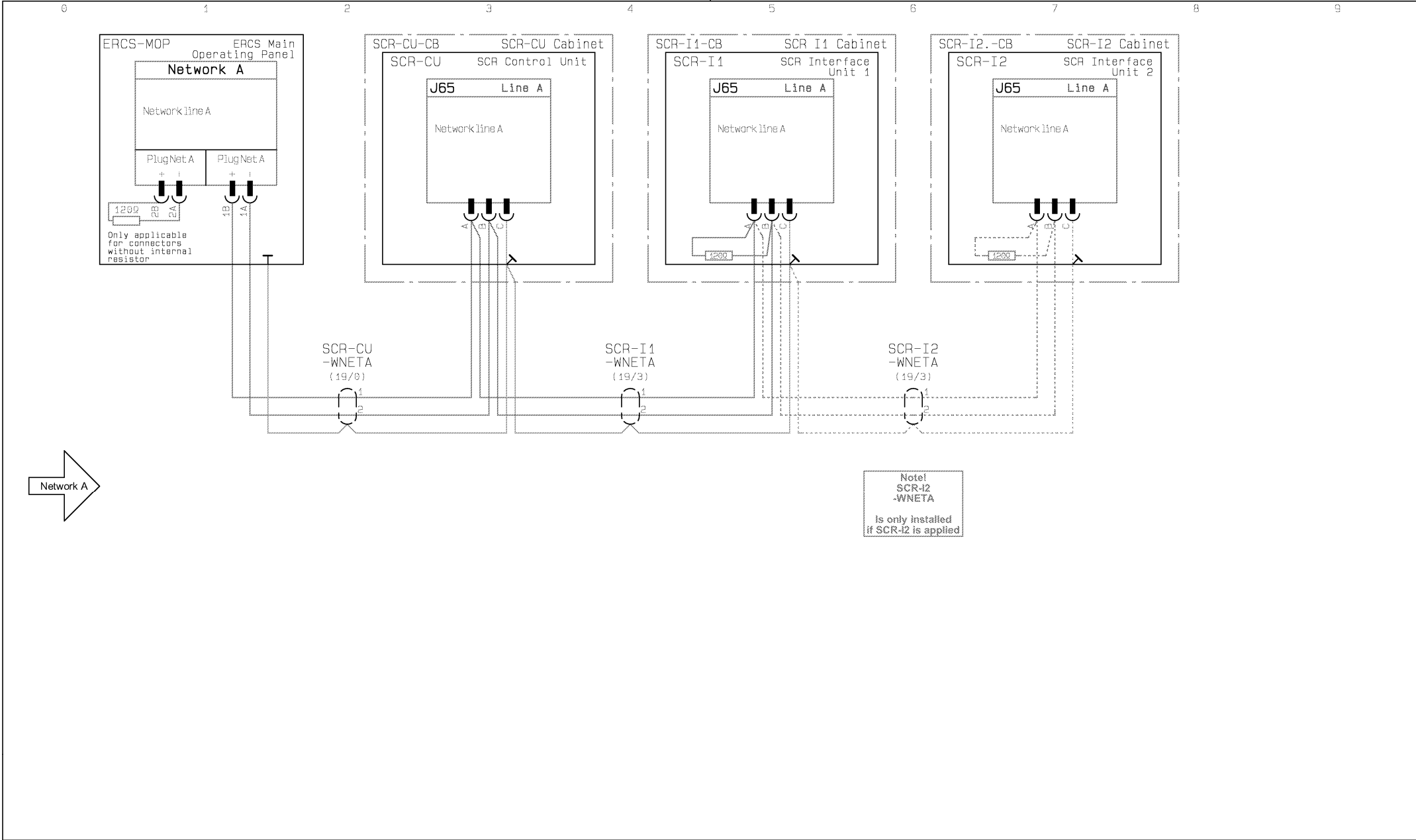
3 NETWORK

Page 19...21

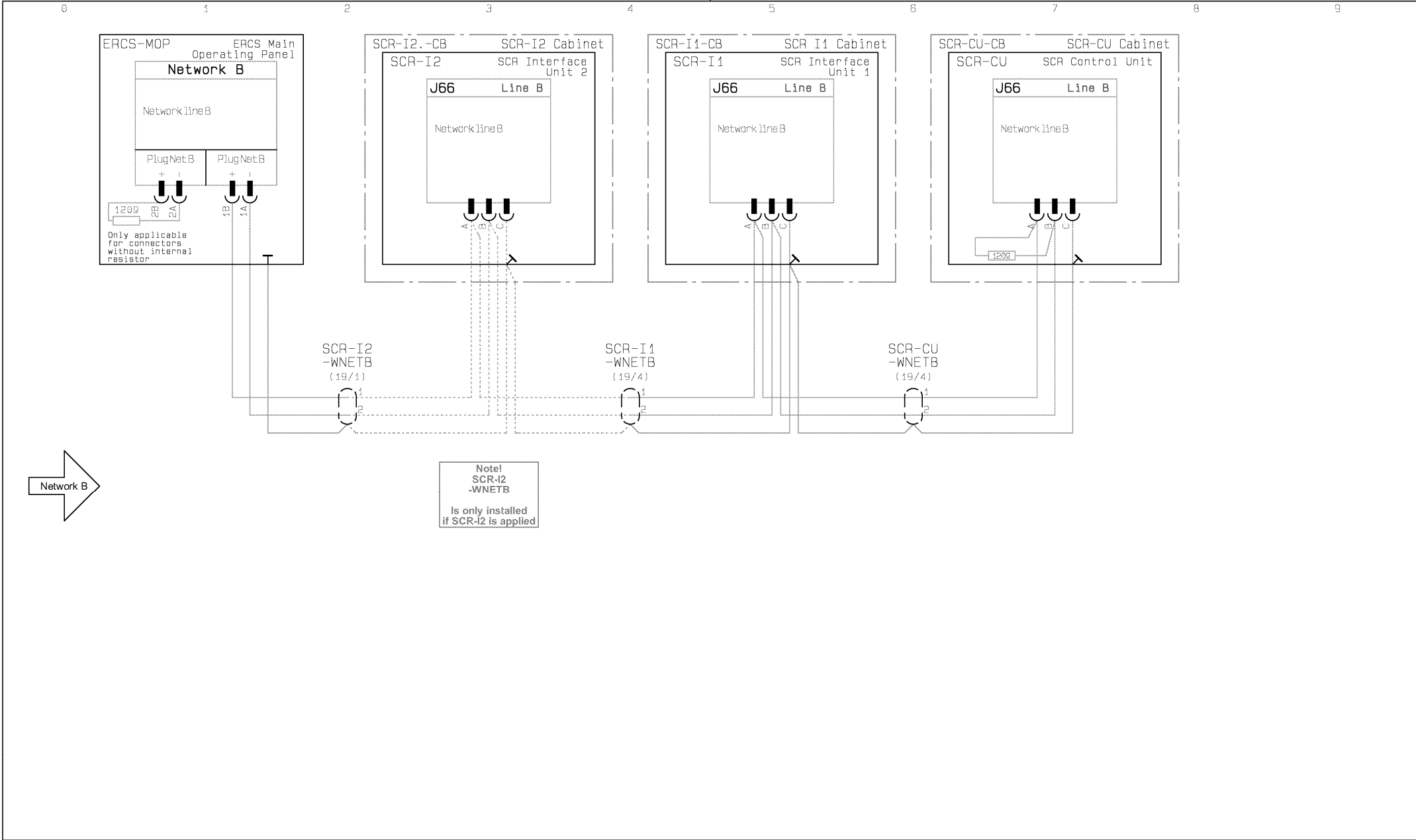
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Network A	Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
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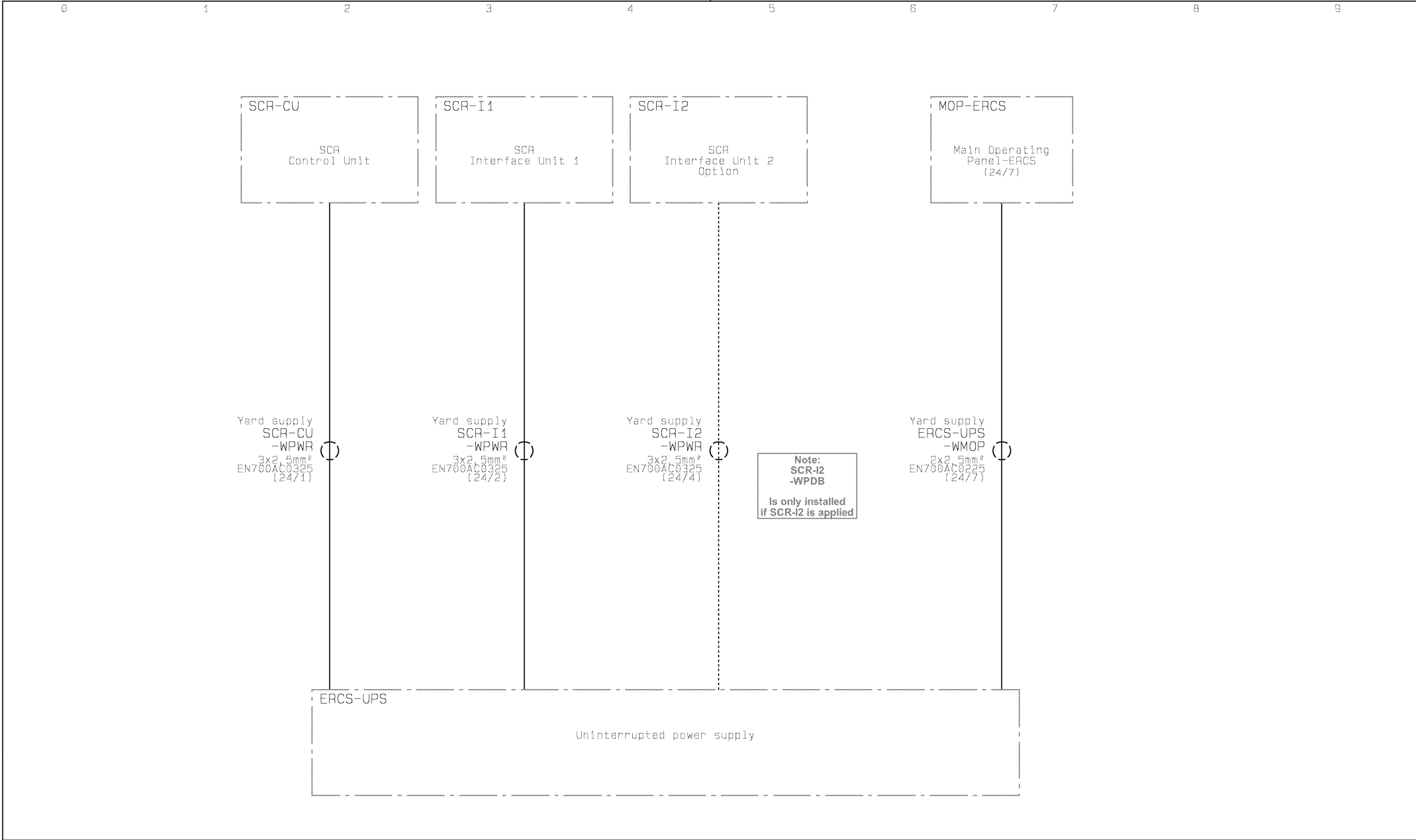
4 POWER

Page 23...25

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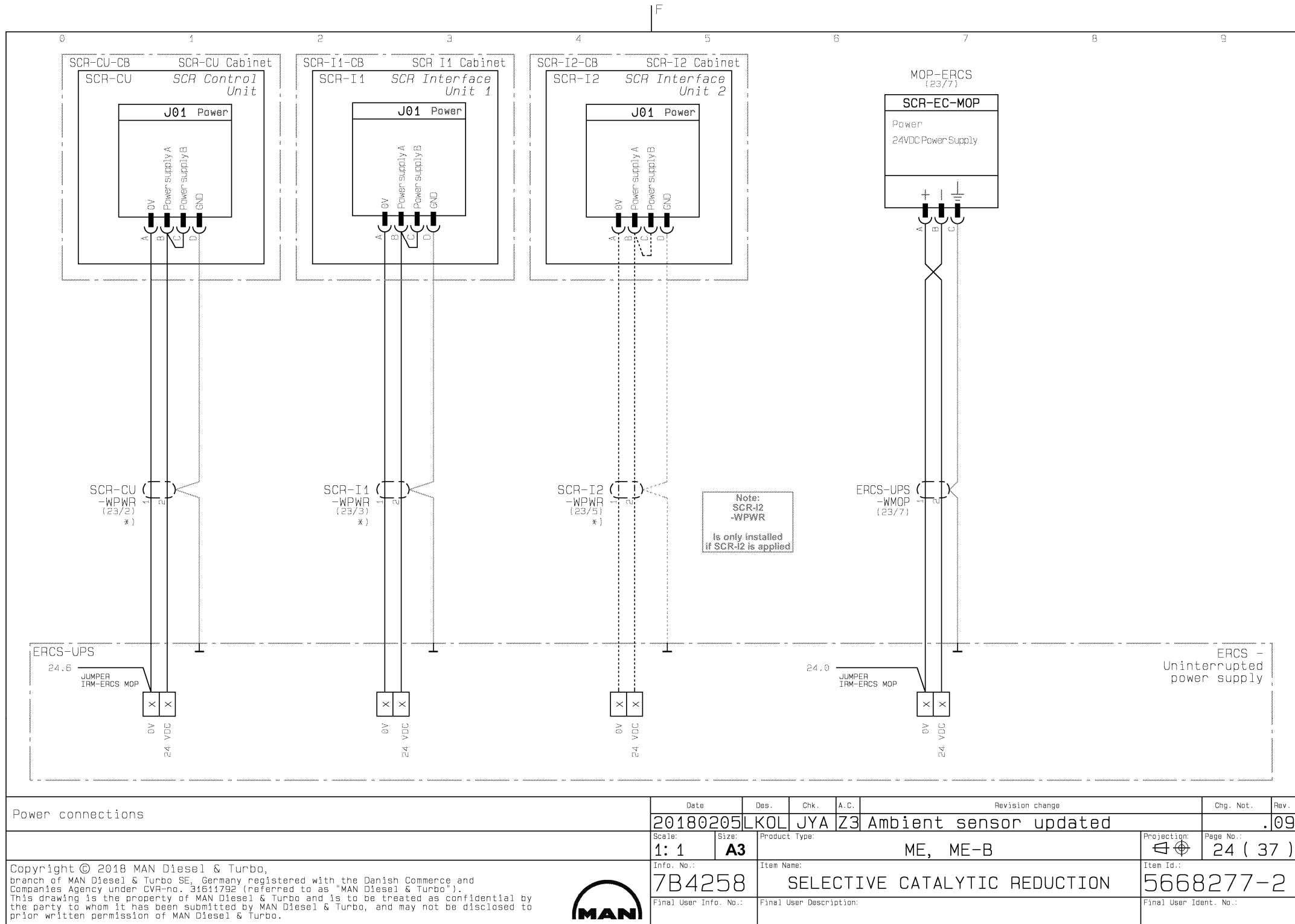
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Overveiw Power connections	Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
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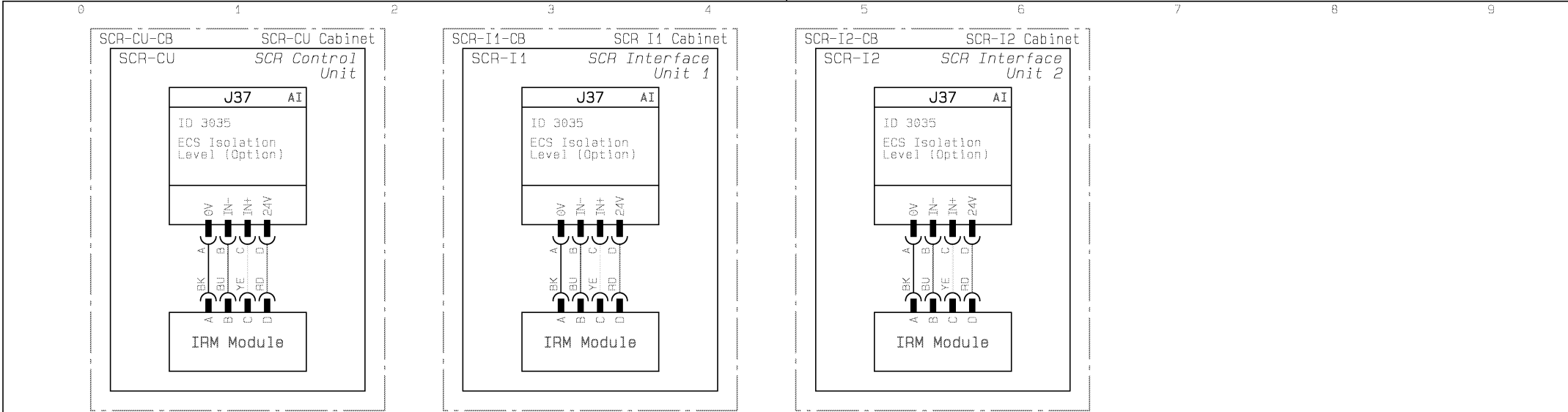


Power connections

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SCR-CS - IRM Modules, SCR-CU + SCR-I1 + SCR-I2	Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
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F

5 I/O

Page 27...28

I/O	Date		Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
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F

CAD Drawing - do not correct by hand - PCS Drawing

IO List

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I/O (DI/DO/AI/AO) Lists	Date				Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
	20180205				LKOL	JYA	Z3	Ambient sensor updated			.09
	Scale:		Size:		Product Type:				Projection:	Page No.:	
	1: 1		A3		ME, ME-B					27 (37)	
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		7B4258		SELECTIVE CATALYTIC REDUCTION				5668277-2			
		Final User Info. No.:		Final User Description:				Final User Ident. No.:			

IO List

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I/O (DI/DO/AI/AO) Lists					Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
					20180205	LKOL	JYA	Z3	Ambient sensor updated			.09
	Scale: 1: 1		Size: A3		Product Type: ME, ME-B					Projection: 	Page No.: 28 (37)	
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					Final User Info. No.:		Final User Description:				Final User Ident. No.:	
												

6 ENGINE BUILDER CABLE LIST

Page 30...34

ENGINE BUILDER CABLE LIST	Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
	20180205	LKOL	JYA	Z3	Ambient sensor updated		.09
	Scale: 1: 1	Size: A3	Product Type: ME, ME-B			Projection: 	Page No.: 29 (37)
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	Final User Info. No.:	Final User Description:			Final User Ident. No.:		

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prior written permission of MAN Diesel & Turbo.



Cable Connection List

Cable	Wire	From : Terminal	Page/Grid	To : Terminal	Page/Grid	Yard Supply Type	Part no.
6613-WNCS	BN	-6613 : GND	16/6	-NCS 6613 : 4	16/6	4x0.75mm²	6m Tail
6613-WNCS	GN	-6613 : Vref	16/6	-NCS 6613 : 2	16/6	4x0.75mm²	6m Tail
6613-WNCS	WH or BK	-6613 : Vpos	16/6	-NCS 6613 : 3	16/6	4x0.75mm²	6m Tail
6613-WNCS	YE	-6613 : Vcc	16/5	-NCS 6613 : 1	16/5	4x0.75mm²	6m Tail
6613-WNCS	SCREEN	-6613 : Vref	16/6	-NCS 6613 : Not connected	16/6	4x0.75mm²	6m Tail
6619-1-WNCS	BN	-6619-1 : GND	11/8	-NCS 6619-1 : 4	11/8	4x0.75mm²	6m Tail
6619-1-WNCS	GN	-6619-1 : Vref	11/8	-NCS 6619-1 : 2	11/8	4x0.75mm²	6m Tail
6619-1-WNCS	WH or BK	-6619-1 : Vpos	11/8	-NCS 6619-1 : 3	11/8	4x0.75mm²	6m Tail
6619-1-WNCS	YE	-6619-1 : Vcc	11/8	-NCS 6619-1 : 1	11/8	4x0.75mm²	6m Tail
6619-1-WNCS	SCREEN	-6619-1 : Vref	11/8	-NCS 6619-1 : Not connected	11/8	4x0.75mm²	6m Tail
6619-2-WNCS	BN	-6619-2 : GND	17/3	-NCS 6619-2 : 4	17/3	4x0.75mm²	6m Tail
6619-2-WNCS	GN	-6619-2 : Vref	17/3	-NCS 6619-2 : 2	17/3	4x0.75mm²	6m Tail
6619-2-WNCS	WH or BK	-6619-2 : Vpos	17/3	-NCS 6619-2 : 3	17/3	4x0.75mm²	6m Tail
6619-2-WNCS	YE	-6619-2 : Vcc	17/3	-NCS 6619-2 : 1	17/3	4x0.75mm²	6m Tail
6619-2-WNCS	SCREEN	-6619-2 : Vref	17/3	-NCS 6619-2 : Not connected	17/3	4x0.75mm²	6m Tail
6619-3-WNCS	BN	-6619-3 : GND	17/7	-NCS 6619-3 : 4	17/7	4x0.75mm²	6m Tail
6619-3-WNCS	GN	-6619-3 : Vref	17/7	-NCS 6619-3 : 2	17/7	4x0.75mm²	6m Tail
6619-3-WNCS	WH or BK	-6619-3 : Vpos	17/7	-NCS 6619-3 : 3	17/7	4x0.75mm²	6m Tail
6619-3-WNCS	YE	-6619-3 : Vcc	17/7	-NCS 6619-3 : 1	17/7	4x0.75mm²	6m Tail
6619-3-WNCS	SCREEN	-6619-3 : Vref	17/7	-NCS 6619-3 : Not connected	17/7	4x0.75mm²	6m Tail
6635-WNCS	BN	-6635 : GND	16/9	-NCS 6635 : 4	16/9	4x0.75mm²	6m Tail
6635-WNCS	GN	-6635 : Vref	16/8	-NCS 6635 : 2	16/8	4x0.75mm²	6m Tail
6635-WNCS	WH or BK	-6635 : Vpos	16/8	-NCS 6635 : 3	16/8	4x0.75mm²	6m Tail
6635-WNCS	YE	-6635 : Vcc	16/8	-NCS 6635 : 1	16/8	4x0.75mm²	6m Tail
6635-WNCS	SCREEN	-6635 : Vref	16/9	-NCS 6635 : Not connected	16/9	4x0.75mm²	6m Tail
JB 6616-W6616	BK	JB 6616-X1 : 2	16/1	-6616 : 2	16/1	4x0.75mm²	6m Tail
JB 6616-W6616	BR	JB 6616-X1 : 3	16/1	-6616 : 3	16/1	4x0.75mm²	6m Tail
JB 6616-W6616	BU	JB 6616-X6616 : 1	16/0	-6616 : 1	16/0	4x0.75mm²	6m Tail
JB 6616-W6616	GNGY	JB 6616 : Screen in gland	16/1	-6616 : Screen	16/1	4x0.75mm²	6m Tail
JB 6616-W6617	BK	JB 6616-X6617 : 5	16/2	-6617 : 2	16/2	4x0.75mm²	6m Tail
JB 6616-W6617	BR	JB 6616-X6617 : 6	16/2	-6617 : 3	16/2	4x0.75mm²	6m Tail
JB 6616-W6617	BU	JB 6616-X6617 : 4	16/2	-6617 : 1	16/2	4x0.75mm²	6m Tail
JB 6616-W6617	GNGY	JB 6616 : Screen in gland	16/2	-6617 : Screen	16/2	4x0.75mm²	6m Tail
SCR-CU-W6605-1	1	SCR-CU.J21 : D	10/1	-TT6605-1 : 1	10/1	2x0.75mm²	EN700AC0207
SCR-CU-W6605-1	2	SCR-CU.J21 : C	10/1	-TT6605-1 : 2	10/1	2x0.75mm²	EN700AC0207
SCR-CU-W6605-1	Screen	SCR-CU-CB : Screen in gland	10/1	-TT6605-1 : Not connected	10/1	2x0.75mm²	EN700AC0207

Cable list	Date		Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
	20180205		LKOL	JYA	Z3	Ambient sensor updated			.09
	Scale:	Size:	Product Type:				Projection:	Page No.:	
	1: 1	A3	ME, ME-B					30 (37	
	Info. No.:		Item Name:				Item Id.:		
	7B4258		SELECTIVE CATALYTIC REDUCTION				5668277-2		
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Cable Connection List

Cable	Wire	From : Terminal	Page/Grid	To : Terminal	Page/Grid	Yard Supply Type	Part no.
SCR-CU-W6607	1	SCR-CU.J24 : D	10/2	-TT6607 : 1	10/2	2x0.75mm²	EN700AC0207
SCR-CU-W6607	2	SCR-CU.J24 : C	10/2	-TT6607 : 2	10/2	2x0.75mm²	EN700AC0207
SCR-CU-W6607	Screen	SCR-CU-CB : Screen in gland	10/2	-TT6607 : Not connected	10/2	2x0.75mm²	EN700AC0207
SCR-CU-W6619-1	1	SCR-CU.J23 : C	11/7	-6619-1 : 62	11/7	5x0.75mm²	EN700AC0507
SCR-CU-W6619-1	2	SCR-CU.J23 : D	11/7	-6619-1 : 61	11/7	5x0.75mm²	EN700AC0507
SCR-CU-W6619-1	3	SCR-CU.J71 : B	11/8	-6619-1 : 7	11/8	5x0.75mm²	EN700AC0507
SCR-CU-W6619-1	4	SCR-CU.J71 : C	11/8	-6619-1 : 6	11/8	5x0.75mm²	EN700AC0507
SCR-CU-W6619-1	Screen	SCR-CU-CB : Screen in gland	11/8	-6619-1 : 5	11/8	5x0.75mm²	EN700AC0507
SCR-CU-W6622	1	SCR-CU.J26 : C	12/2	SCR NOx CB-X2 : 1	12/2	7x0.75mm²	EN700AC0707
SCR-CU-W6622	2	SCR-CU.J26 : B	12/2	SCR NOx CB-X2 : 3	12/2	7x0.75mm²	EN700AC0707
SCR-CU-W6622	3	SCR-CU.J27 : C	12/3	SCR NOx CB-X2 : 5	12/3	7x0.75mm²	EN700AC0707
SCR-CU-W6622	4	SCR-CU.J27 : B	12/3	SCR NOx CB-X2 : 7	12/3	7x0.75mm²	EN700AC0707
SCR-CU-W6622	Screen	SCR-CU-CB2 : EMC Bus bar	12/3	SCR NOx CB : Screen in gland	12/3	7x0.75mm²	EN700AC0707
SCR-CU-W6640	1	SCR-CU.J30 : D	10/3	-TT6640 : 1	10/3	2x0.75mm²	EN700AC0207
SCR-CU-W6640	2	SCR-CU.J30 : C	10/3	-TT6640 : 2	10/3	2x0.75mm²	EN700AC0207
SCR-CU-W6640	Screen	SCR-CU-CB : Screen in gland	10/3	-TT6640 : Not connected	10/3	2x0.75mm²	EN700AC0207
SCR-CU-W6643/6644	1	SCR-CU.J81 : A	12/4	SCR NOx CB-X3 : 1	12/4	7x0.75mm²	EN700AC0707
SCR-CU-W6643/6644	2	SCR-CU.J81 : B	12/4	SCR NOx CB-X3 : 2	12/4	7x0.75mm²	EN700AC0707
SCR-CU-W6643/6644	3	SCR-CU.J42 : C	12/5	SCR NOx CB-X3 : 9	12/5	7x0.75mm²	EN700AC0707
SCR-CU-W6643/6644	4	SCR-CU.J42 : D	12/5	SCR NOx CB-X3 : 10	12/5	7x0.75mm²	EN700AC0707
SCR-CU-W6643/6644	5	SCR-CU.J43 : C	12/6	SCR NOx CB-X3 : 13	12/6	7x0.75mm²	EN700AC0707
SCR-CU-W6643/6644	6	SCR-CU.J43 : D	12/6	SCR NOx CB-X3 : 14	12/6	7x0.75mm²	EN700AC0707
SCR-CU-W6643/6644	Screen	SCR-CU-CB2 : EMC Bus bar	12/7	SCR NOx CB : Screen in gland	12/7	7x0.75mm²	EN700AC0707
SCR-CU-W8609	1	SCR-CU.J31 : D	10/4	-TT8609 : 1	10/4	2x0.75mm²	EN700AC0207
SCR-CU-W8609	2	SCR-CU.J31 : C	10/4	-TT8609 : 2	10/4	2x0.75mm²	EN700AC0207
SCR-CU-W8609	Screen	SCR-CU-CB : Screen in gland	10/4	-TT8609 : Not connected	10/4	2x0.75mm²	EN700AC0207
SCR-CU-W8612/8819 /8802	1	SCR-CU.J03 : A	10/6	8612/8819/8802 : -	10/6	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	2	SCR-CU.J03 : B	10/6	8612/8819/8802 : +	10/6	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	3	SCR-CU.J36 : B	10/7	8612/8819/8802 : ch1-	10/7	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	4	SCR-CU.J36 : C	10/7	8612/8819/8802 : ch1+	10/7	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	5	SCR-CU.J35 : B	10/8	8612/8819/8802 : ch2-	10/7	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	6	SCR-CU.J35 : C	10/8	8612/8819/8802 : ch2+	10/7	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	7	SCR-CU.J33 : B	10/9	8612/8819/8802 : ch-	10/9	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	8	SCR-CU.J33 : C	10/9	8612/8819/8802 : ch+	10/9	12x0.75mm²	EN700AC1207
SCR-CU-W8612/8819 /8802	Screen	SCR-CU-CB : Screen in gland	10/9	8612/8819/8802 : Screen in gland	10/9	12x0.75mm²	EN700AC1207

Cable list	Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
	20180205	LKOL	JYA	Z3	Ambient sensor updated			.09
	Scale: 1: 1	Size: A3	Product Type: ME, ME-B				Projection: 	Page No.: 31 (37)
	Info. No.: 7B4258		Item Name: SELECTIVE CATALYTIC REDUCTION				Item Id.: 5668277-2	
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Cable Connection List

Cable	Wire	From : Terminal	Page/Grid	To : Terminal	Page/Grid	Yard Supply Type	Part no.
SCR-CU-WACU-1	1	SCR-CU.J68 : A	11/4	-SACU-1.J68 : A	11/4	3x2x0,75mm ²	EN700AA0307
SCR-CU-WACU-1	2	SCR-CU.J68 : C	11/4	-SACU-1.J68 : E	11/4	3x2x0,75mm ²	EN700AA0307
SCR-CU-WACU-1	3	SCR-CU.J68 : D	11/4	-SACU-1.J68 : F	11/4	3x2x0,75mm ²	EN700AA0307
SCR-CU-WACU-1	4	SCR-CU.J68 : E	11/4	-SACU-1.J68 : C	11/4	3x2x0,75mm ²	EN700AA0307
SCR-CU-WACU-1	5	SCR-CU.J68 : F	11/4	-SACU-1.J68 : D	11/4	3x2x0,75mm ²	EN700AA0307
SCR-CU-WACU-1	Screen	SCR-CU.J68 : H	11/4	-SACU-1.J68 : H	11/4	3x2x0,75mm ²	EN700AA0307
SCR-CU-WNETB	1	SCR-I1.J66 : A	21/5	SCR-CU.J66 : A	21/7	1x2x0.75mm ²	EN700AF0107
SCR-CU-WNETB	2	SCR-I1.J66 : B	21/5	SCR-CU.J66 : B	21/7	1x2x0.75mm ²	EN700AF0107
SCR-CU-WNETB	Screen	SCR-I1 : Screen in gland	21/5	SCR-CU5 : Screen in gland	21/7	1x2x0.75mm ²	EN700AF0107
SCR-CU-WSCRNOxCB.1	1	SCR-CU.J09 : A	12/1	SCR NOx CB-X1 : 1	12/1	2x1.5mm ²	EN700AC0215
SCR-CU-WSCRNOxCB.1	2	SCR-CU.J09 : B	12/1	SCR NOx CB-X1 : 2	12/1	2x1.5mm ²	EN700AC0215
SCR-CU-WSCRNOxCB.1	SCREEN	SCR-CU-CB2 : EMC Bus bar	12/1	SCR NOx CB-X15 : EMC busbar	12/1	2x1.5mm ²	EN700AC0215
SCR-I1-W6605-2	1	SCR-I1.J22 : D	15/1	-TT6605-2 : 1	15/1	2x0.75mm ²	EN700AC0207
SCR-I1-W6605-2	2	SCR-I1.J22 : C	15/1	-TT6605-2 : 2	15/1	2x0.75mm ²	EN700AC0207
SCR-I1-W6605-2	Screen	SCR-I1-CB-SCR-CU : Screen in gland	15/1	-TT6605-2 : Not connected	15/1	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-1	1	SCR-I1.J23 : D	15/2	-TT6606-1 : 1	15/2	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-1	2	SCR-I1.J23 : C	15/2	-TT6606-1 : 2	15/2	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-1	Screen	SCR-I1-CB-SCR-CU : Screen in gland	15/2	-TT6606-1 : Not connected	15/2	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-2	1	SCR-I1.J24 : D	15/3	-TT6606-2 : 1	15/3	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-2	2	SCR-I1.J24 : C	15/3	-TT6606-2 : 2	15/3	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-2	Screen	SCR-I1-CB-SCR-CU : Screen in gland	15/3	-TT6606-2 : Not connected	15/3	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-3	1	SCR-I1.J25 : D	15/4	-TT6606-3 : 1	15/4	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-3	2	SCR-I1.J25 : C	15/4	-TT6606-3 : 2	15/4	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-3	Screen	SCR-I1-CB-SCR-CU : Screen in gland	15/4	-TT6606-3 : Not connected	15/4	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-4	1	SCR-I1.J26 : D	15/5	-TT6606-4 : 1	15/5	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-4	2	SCR-I1.J26 : C	15/5	-TT6606-4 : 2	15/5	2x0.75mm ²	EN700AC0207
SCR-I1-W6606-4	Screen	SCR-I1-CB-SCR-CU : Screen in gland	15/5	-TT6606-4 : Not connected	15/5	2x0.75mm ²	EN700AC0207
SCR-I1-W6613	1	SCR-I1.J20 : C	16/5	-6613 : 62	16/5	5x0.75mm ²	EN700AC0507
SCR-I1-W6613	2	SCR-I1.J20 : D	16/5	-6613 : 61	16/5	5x0.75mm ²	EN700AC0507
SCR-I1-W6613	3	SCR-I1.J70 : B	16/6	-6613 : 7	16/6	5x0.75mm ²	EN700AC0507
SCR-I1-W6613	4	SCR-I1.J70 : C	16/6	-6613 : 6	16/6	5x0.75mm ²	EN700AC0507
SCR-I1-W6613	Screen	SCR-I1-CB : Screen in gland	16/6	-6613 : 5	16/6	5x0.75mm ²	EN700AC0507

Cable list	Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
	20180205	LKOL	JYA	Z3	Ambient sensor updated		.09
	Scale: 1: 1	Size: A3	Product Type: ME, ME-B	Projection: 	Page No.: 32 (37)		
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	Final User Info. No.:		Final User Description:			Final User Ident. No.:	

CAD Drawing - do not correct by hand - PCS Drawing

Cable Connection List

Cable	Wire	From : Terminal	Page/Grid	To : Terminal	Page/Grid	Yard Supply Type	Part no.
SCR-I1-W6618	1	SCR-I1.J60 : B	16/3	-6618 : 1	16/3	2x0.75mm²	EN700AC0207
SCR-I1-W6618	2	SCR-I1.J60 : A	16/3	-6618 : 2	16/3	2x0.75mm²	EN700AC0207
SCR-I1-W6618	Screen	SCR-I1-CB : Screen in gland	16/3	-6618 : Not conneted	16/3	2x0.75mm²	EN700AC0207
SCR-I1-W6635	1	SCR-I1.J21 : C	16/8	-6635 : 62	16/8	5x0.75mm²	EN700AC0507
SCR-I1-W6635	2	SCR-I1.J21 : D	16/8	-6635 : 61	16/8	5x0.75mm²	EN700AC0507
SCR-I1-W6635	3	SCR-I1.J71 : B	16/9	-6635 : 7	16/9	5x0.75mm²	EN700AC0507
SCR-I1-W6635	4	SCR-I1.J71 : C	16/9	-6635 : 6	16/9	5x0.75mm²	EN700AC0507
SCR-I1-W6635	Screen	SCR-I1-CB : Screen in gland	16/9	-6635 : 5	16/9	5x0.75mm²	EN700AC0507
SCR-I1-WJB 6616	1	SCR-I1.J30 : D	16/1	JB 6616-X6616 : 1	16/0	5x0.75mm²	EN700AC0507
SCR-I1-WJB 6616	2	SCR-I1.J30 : C	16/0	JB 6616-X1 : 2	16/1	5x0.75mm²	EN700AC0507
SCR-I1-WJB 6616	3	SCR-I1.J31 : D	16/2	JB 6616-X6617 : 4	16/2	5x0.75mm²	EN700AC0507
SCR-I1-WJB 6616	4	SCR-I1.J31 : C	16/2	JB 6616-X6617 : 5	16/2	5x0.75mm²	EN700AC0507
SCR-I1-WJB 6616	Screen	SCR-I1-CB : Screen in gland	16/2	JB 6616 : Screen in gland	16/2	5x0.75mm²	EN700AC0507
SCR-I1-WNETA	1	SCR-CU.J65 : A	20/3	SCR-I1.J65 : A	20/5	1x2x0.75mm²	EN700AF0107
SCR-I1-WNETA	2	SCR-CU.J65 : B	20/3	SCR-I1.J65 : B	20/5	1x2x0.75mm²	EN700AF0107
SCR-I1-WNETA	Screen	SCR-CU : Screen in gland	20/3	SCR-I1 : Screen in gland	20/5	1x2x0.75mm²	EN700AF0107
SCR-I1-WNETB	1	SCR-I2.J66 : A	21/3	SCR-I1.J66 : A	21/5	1x2x0.75mm²	EN700AF0107
SCR-I1-WNETB	2	SCR-I2.J66 : B	21/3	SCR-I1.J66 : B	21/5	1x2x0.75mm²	EN700AF0107
SCR-I1-WNETB	Screen	SCR-I2 : Screen in gland	21/3	SCR-I1 : Screen in gland	21/5	1x2x0.75mm²	EN700AF0107
SCR-I1-WPDT6615	1	SCR-I1.J27 : D	15/8	-PDT6615 : 1	15/8	2x0.75mm²	EN700AC0207
SCR-I1-WPDT6615	2	SCR-I1.J27 : C	15/8	-PDT6615 : 2	15/8	2x0.75mm²	EN700AC0207
SCR-I1-WPDT6615	Screen	SCR-I1-CB : Screen in gland	15/8	-PDT6615 : Screen	15/8	2x0.75mm²	EN700AC0207
SCR-I1-WPDT6642	1	SCR-I1.J27 : D	15/6	-PDT6642 : 1	15/6	2x0.75mm²	EN700AC0207
SCR-I1-WPDT6642	2	SCR-I1.J27 : C	15/6	-PDT6642 : 2	15/6	2x0.75mm²	EN700AC0207
SCR-I1-WPDT6642	Screen	SCR-I1-CB : Screen in gland	15/6	-PDT6642 : Screen	15/6	2x0.75mm²	EN700AC0207
SCR-I1-WPT6657	1	SCR-I1.J32 : D	15/7	-PT6657 : 1	15/7	2x0.75mm²	EN700AC0207
SCR-I1-WPT6657	2	SCR-I1.J32 : C	15/7	-PT6657 : 2	15/7	2x0.75mm²	EN700AC0207
SCR-I1-WPT6657	Screen	SCR-I1-CB : Screen in gland	15/7	-PT6657 : Screen	15/7	2x0.75mm²	EN700AC0207
SCR-I2-W6619-2	1	SCR-I2.J20 : C	17/2	-6619-2 : 62	17/2	5x0.75mm²	EN700AC0507
SCR-I2-W6619-2	2	SCR-I2.J20 : D	17/2	-6619-2 : 61	17/2	5x0.75mm²	EN700AC0507
SCR-I2-W6619-2	3	SCR-I2.J70 : B	17/3	-6619-2 : 7	17/3	5x0.75mm²	EN700AC0507
SCR-I2-W6619-2	4	SCR-I2.J70 : C	17/3	-6619-2 : 6	17/3	5x0.75mm²	EN700AC0507
SCR-I2-W6619-2	Screen	SCR-I2-CB-SCR-CU2 : Screen in gland	17/3	-6619-2 : 5	17/3	5x0.75mm²	EN700AC0507

Cable list	Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
	20180205	LKOL	JYA	Z3	Ambient sensor updated		.09
	Scale:	Size:	Product Type:			Projection:	Page No.:
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		7B4258	SELECTIVE CATALYTIC REDUCTION			5668277-2	
		Final User Info. No.:	Final User Description:			Final User Ident. No.:	

CAD Drawing - do not correct by hand - PCS Drawing

[illegible]

Cable list	Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev
	20180205	LKOL	JYA	Z3	Ambient sensor updated		.09
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	7B4258	SELECTIVE CATALYTIC REDUCTION			5668277-2		
	Final User Info. No.:	Final User Description:			Final User Ident. No.:		

7 YARD SUPPLY CABLE LIST

Page 36...37

YARD SUPPLY CABLE LIST	Date		Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
	20180205		LKOL	JYA	Z3	Ambient sensor updated			.09
	Scale:	Size:	Product Type:				Projection:	Page No.:	
	1: 1	A3	ME, ME-B					35 (37)	
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			7B4258		SELECTIVE CATALYTIC REDUCTION		5668277-2		
			Final User Info. No.:		Final User Description:		Final User Ident. No.:		

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CAD Drawing - do not correct by hand - PCS Drawing

Cable Connection List

Cable	Wire	From : Terminal	Page/Grid	To : Terminal	Page/Grid	Yard Supply Type	Part no.
ERCS-UPS-WMOP	1	MOP-ERCS : B	24/7	ERCS-UPS : x	24/7	Yard supply 2x2,5mm²	EN700AC0225
ERCS-UPS-WMOP	2	MOP-ERCS : A	24/7	ERCS-UPS : x	24/7	Yard supply 2x2,5mm²	EN700AC0225
ERCS-UPS-WMOP	Screen	MOP-ERCS : C	24/7	ERCS-UPS : EMC bus bar	24/7	Yard supply 2x2,5mm²	EN700AC0225
SCR-CU-WAMS	1	SCR-CU.J02 : A	11/1	AMS-X2201 : x	11/1	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WAMS	2	SCR-CU.J02 : B	11/1	AMS-X2201 : x	11/1	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WAMS	3	SCR-CU.J61 : B	11/2	AMS-X2202 : x	11/2	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WAMS	4	SCR-CU.J61 : C	11/2	AMS-X2202 : x	11/2	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WAMS	Screen	SCR-CU-CB : Screen in gland	11/2	AMS1 : Screen in gland	11/2	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WDHS.1	1	SCR-CU.J25 : B	13/1	DHS : x	13/1	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WDHS.1	2	SCR-CU.J25 : C	13/1	DHS : x	13/1	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WDHS.1	3	SCR-CU.J70 : B	13/2	DHS : x	13/2	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WDHS.1	4	SCR-CU.J70 : C	13/2	DHS : x	13/2	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WDHS.1	Screen	SCR-CU-CB : Screen in gland	13/2	DHS : Screen in gland	13/2	Yard supply 5x0.75mm²	EN700AC0507
SCR-CU-WDHS.2	1	SCR-CU.J40 : C	13/3	DHS : x	13/3	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WDHS.2	2	SCR-CU.J40 : D	13/3	DHS : x	13/3	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WDHS.2	3	SCR-CU.J41 : C	13/4	DHS : x	13/4	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WDHS.2	4	SCR-CU.J41 : D	13/4	DHS : x	13/4	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WDHS.2	5	SCR-CU.J80 : A	13/5	DHS : x	13/5	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WDHS.2	6	SCR-CU.J80 : B	13/5	DHS : x	13/5	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WDHS.2	Screen	SCR-CU-CB : Screen in gland	13/5	DHS : Screen in gland	13/5	Yard supply 12x0.75mm²	EN700AC1207
SCR-CU-WNETA	1	ERCS-MOP.NETWORK B : 1B	20/1	SCR-CU.J65 : A	20/3	Yard supply 1x2x0.75mm²	EN700AF0107
SCR-CU-WNETA	2	ERCS-MOP.NETWORK B : 1A	20/1	SCR-CU.J65 : B	20/3	Yard supply 1x2x0.75mm²	EN700AF0107
SCR-CU-WNETA	Screen	ERCS-MOP2 : Screen in gland	20/1	SCR-CU : Screen in gland	20/3	Yard supply 1x2x0.75mm²	EN700AF0107
SCR-CU-WPWR	1	SCR-CU.J01 : A	24/1	ERCS-UPS : x	24/1	Yard supply 3x2,5mm²	EN700AC0325
SCR-CU-WPWR	2	SCR-CU.J01 : B	24/1	ERCS-UPS : x	24/1	Yard supply 3x2,5mm²	EN700AC0325
SCR-CU-WPWR	Screen	SCR-CU.J01 : D	24/1	ERCS-UPS : EMC bus bar	24/1	Yard supply 3x2,5mm²	EN700AC0325
SCR-I1-WDHS	1	SCR-I1.J40 : C	13/8	DHS-XSCR-RCS : x	13/8	Yard supply 5x0.75mm²	EN700AC0507
SCR-I1-WDHS	2	SCR-I1.J40 : D	13/8	DHS-XSCR-RCS : x	13/8	Yard supply 5x0.75mm²	EN700AC0507
SCR-I1-WDHS	Screen	SCR-I1-CB : EMC Bus bar	13/8	DHS : Screen in gland	13/8	Yard supply 5x0.75mm²	EN700AC0507
SCR-I1-WPWR	1	SCR-I1.J01 : A	24/3	ERCS-UPS : x	24/3	Yard supply 3x2,5mm²	EN700AC0325
SCR-I1-WPWR	2	SCR-I1.J01 : B	24/3	ERCS-UPS : x	24/3	Yard supply 3x2,5mm²	EN700AC0325
SCR-I1-WPWR	Screen	SCR-I1.J01 : D	24/3	ERCS-UPS : EMC bus bar	24/3	Yard supply 3x2,5mm²	EN700AC0325

Cable list	Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
	20180205	LKOL	JYA	Z3	Ambient sensor updated		.09
	Scale: 1: 1	Size: A3	Product Type: ME, ME-B			Projection: 	Page No.: 36 (37)
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	Final User Info. No.:		Final User Description:			Final User Ident. No.:	
							

Cable Connection List

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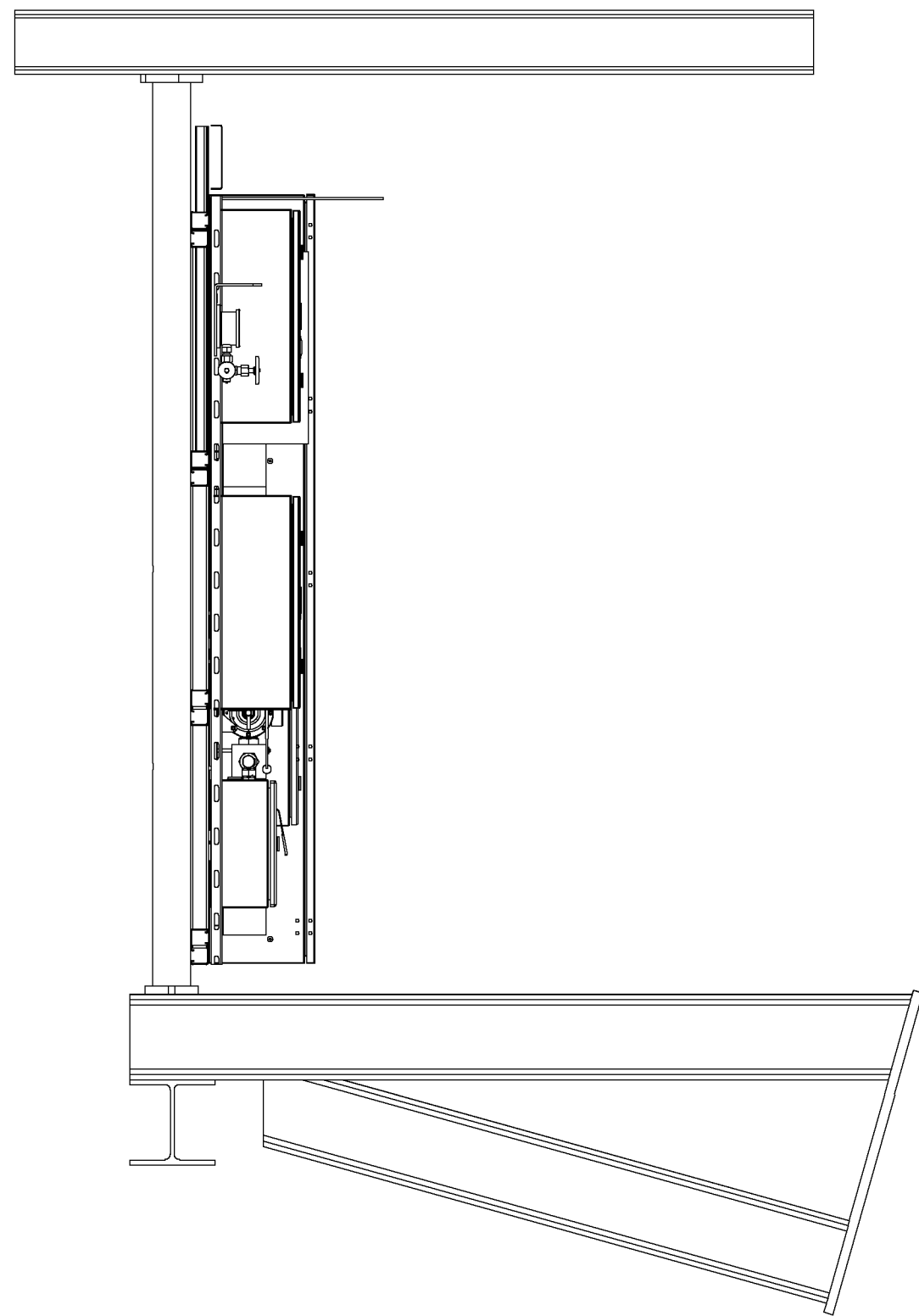
Cable list	Date				Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
	20180205				LKOL	JYA	Z3	Ambient sensor updated			.09
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	7B4258		SELECTIVE CATALYTIC REDUCTION						5668277-2		
	Final User Info. No.:		Final User Description:						Final User Ident. No.:		



从中层排侧看

后端

前端



A
1:5

电脑

鼠标 键盘

Date	Des.	Chk.	APRD.	A.C.	Revision change	CSD No.	Rev.
							03
							02
20180106	李治国	邱斌斌			增加件7,8,9	07217A01	00
20171230	于怀先	邱斌斌					
Basic Standards (MBD SBI):					similar. Drawing No.:	5N-02678	
EN21F-m Tolerances					EN21C Surf. roughness		
Material / Blank:					Final User Material:	Mass (kg):	
Scale:	Size:	Product Type:			Page No.:	Projection:	
1:15	A1				1 (1)		
Info. No.:		Item Name:				Item Id.:	
Final User Info. No.:		Final User Description:				Final User Ident. No.:	
806D		SCR系统电气箱				3N-04564	

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do not correct by hand - US Drawing

Plan History 文件说明		Engine Type 机型	HP-SCR通用		
		Engine No 工程编号			
		Yard/Hull NO 船厂/船号			
		Classification 船级社			
WIRING OF HP-SCR NO_x SENSORS HP-SCR NO_x传感器接线图					
					5
					4
					3
					2
20180623	邱斌斌	宁军	根据原文图纸升级，CSD07617		1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	邱斌斌 20171226		Drawing NO 图号	4H-20491	
Check 校对	宁军 20171226				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 19
Verify 审定			Reference 设计参考图号	5668277-2.8	
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					

SCR - Selective Catalytic Reduction

NOx installation

Make: 1368

Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
20180516	JYA	CAHV	Z3	Pos.27, 29, 32 rem., 2, 19, 20 ch.		-08
20180423	LKOL	JYA	X2	NOx sensor replaced	125987	07
20150320	LKOL	JYA	Z3	Cable information added		06
20140702	LKOL	JYA				00
Basic Standards (MBO SB):				Suppl. Drawing No.:		
EN21F-m Tolerances				EN21C Surf. roughness		
Material / Blank:				Final User Material:		Mass (kg):
Scale:	Size:	Product Type:			Projection:	Page No.:
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7B4258		SELECTIVE CATALYTIC REDUCTION			5627230-5	
Final User Info. No.:		Final User Description:			Final User Ident. No.:	

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Reference Designations		Description	Reference Designations		Description
SCR NOx CB		SCR NOx Cabinet			
SCR NOx JB		SCR NOx Junction Box			

1	TABLE OF CONTENTS	Page 5...5
2	NETWORK & POWER	Page 7...8
3	I/O CONNECTIONS	Page 10...10
4	CABINET LAYOUT	Page 12...13
5	CABLE LIST	Page 15...15
6	COMPONENT LISTS	Page 17...18
7		
8		
9		
10		

SCR - Selective Catalytic Reduction

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Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
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Info. No.: 7B4258	Item Name: SELECTIVE CATALYTIC REDUCTION	Item Id.: 5627230-5				
Final User Info. No.:	Final User Description:	Final User Ident. No.:				

1 TABLE OF CONTENTS

Page 5...5

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Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
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Final User Info. No.:			Final User Description:			Final User Ident. No.:

Table of Contents

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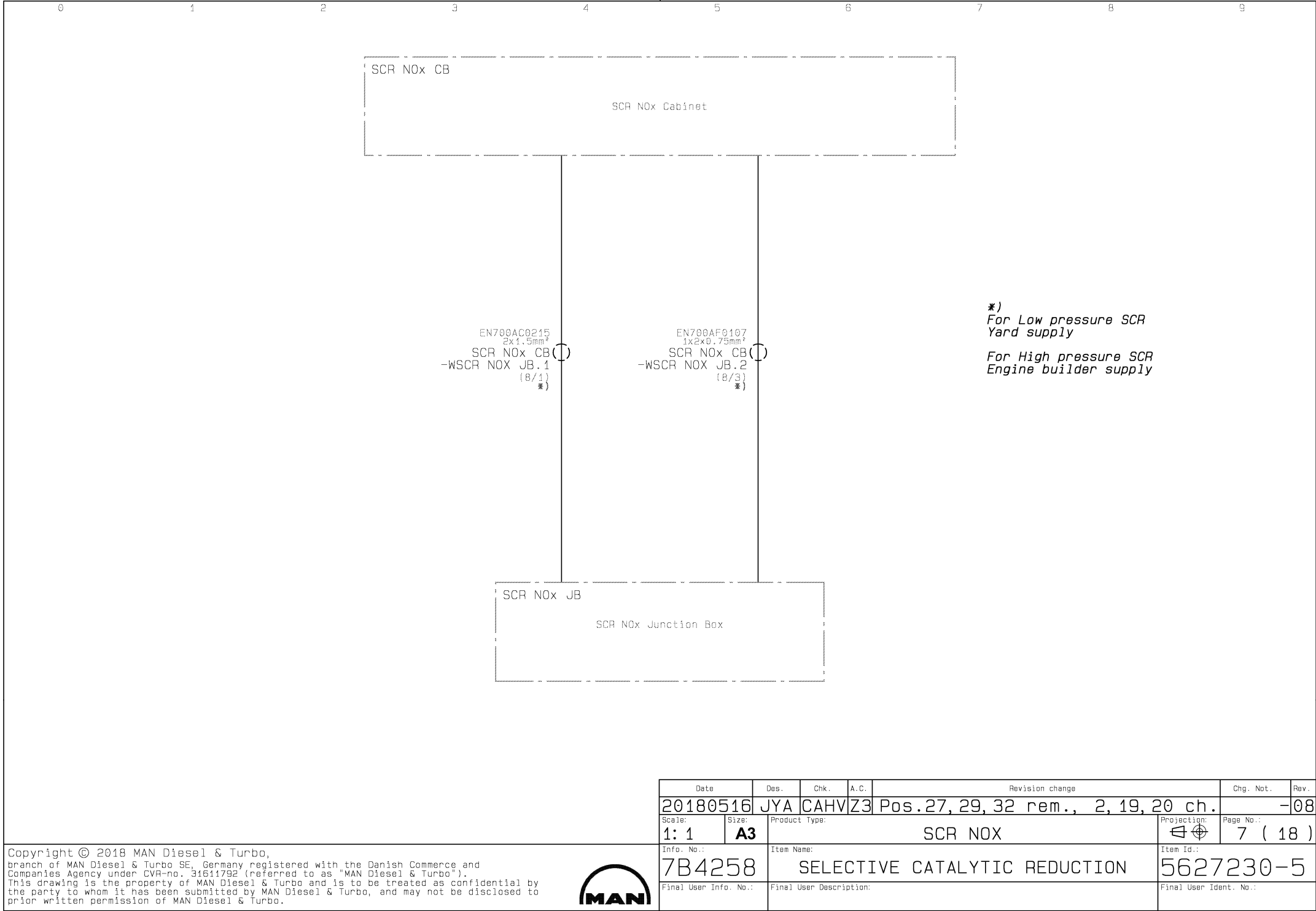
2 NETWORK & POWER

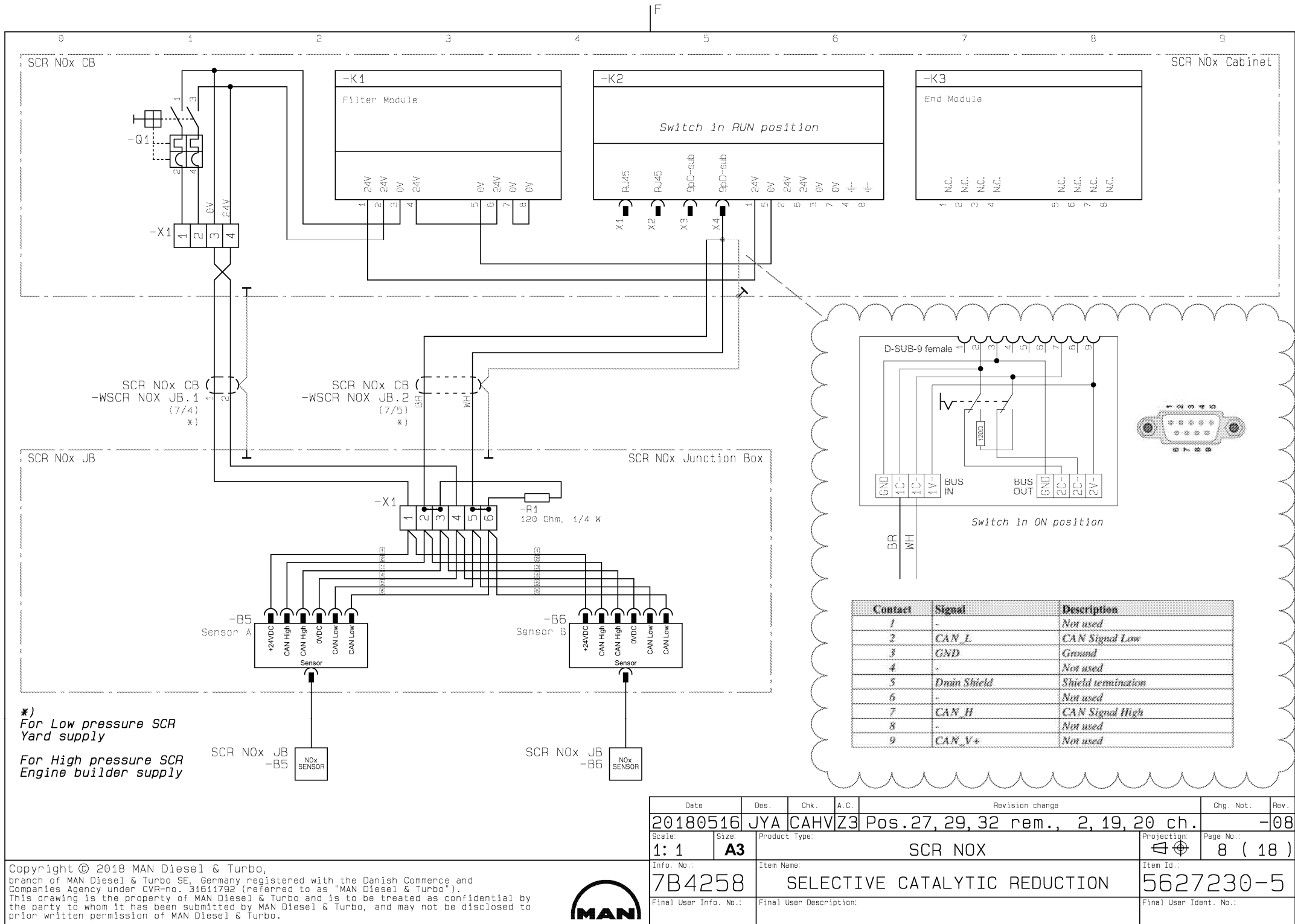
Page 7...8

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Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
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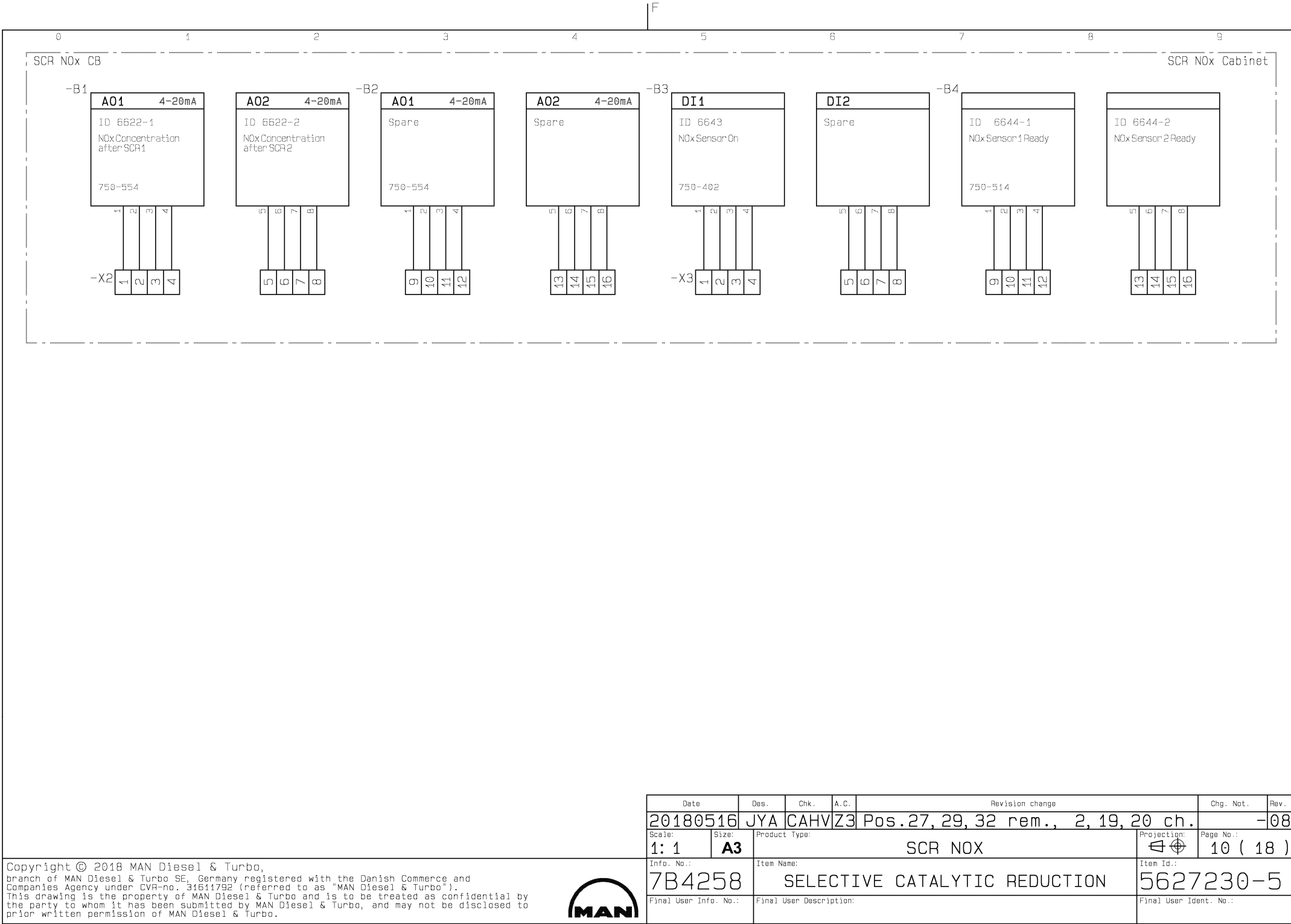
3 I/O CONNECTIONS

Page 10...10

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Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
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Final User Info. No.:			Final User Description:			Final User Ident. No.:



4 CABINET LAYOUT

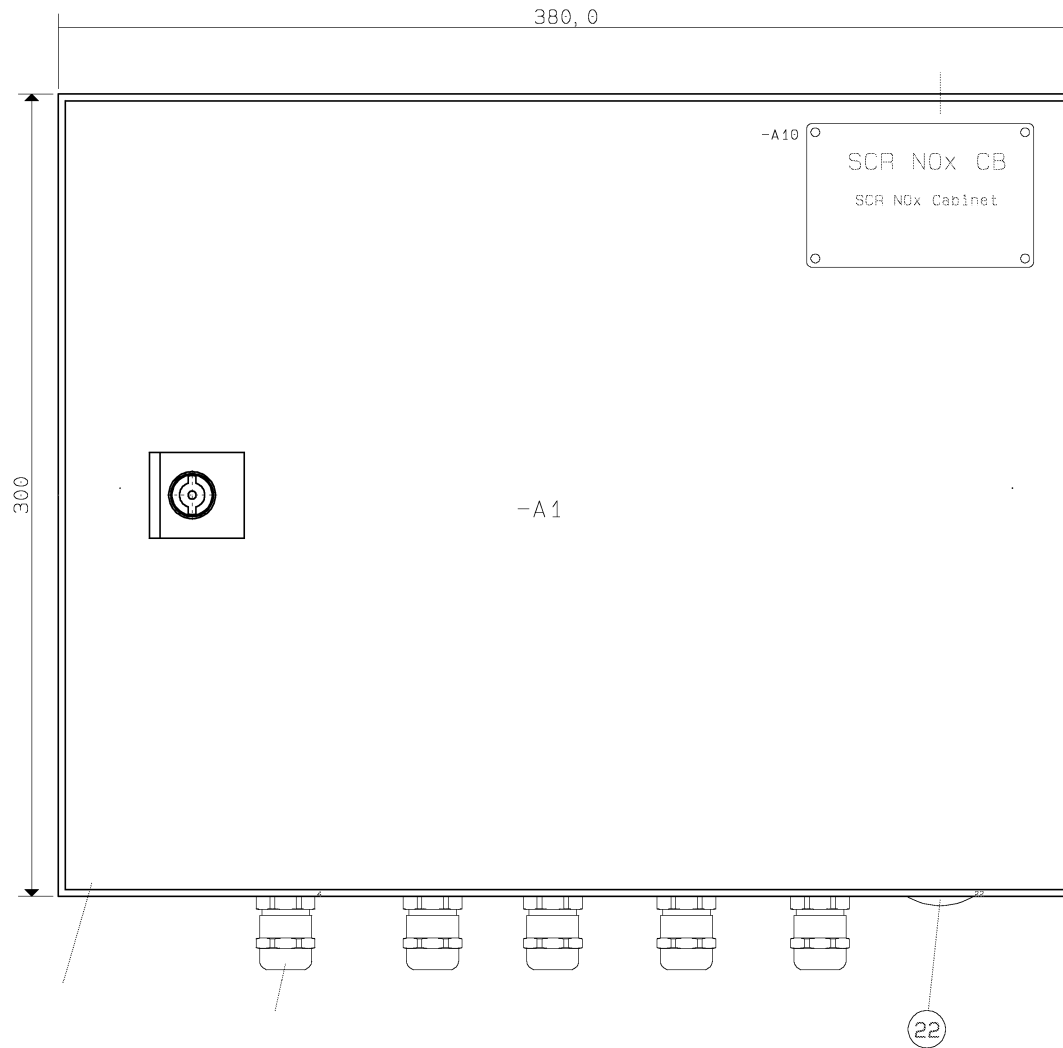
Page 12...13

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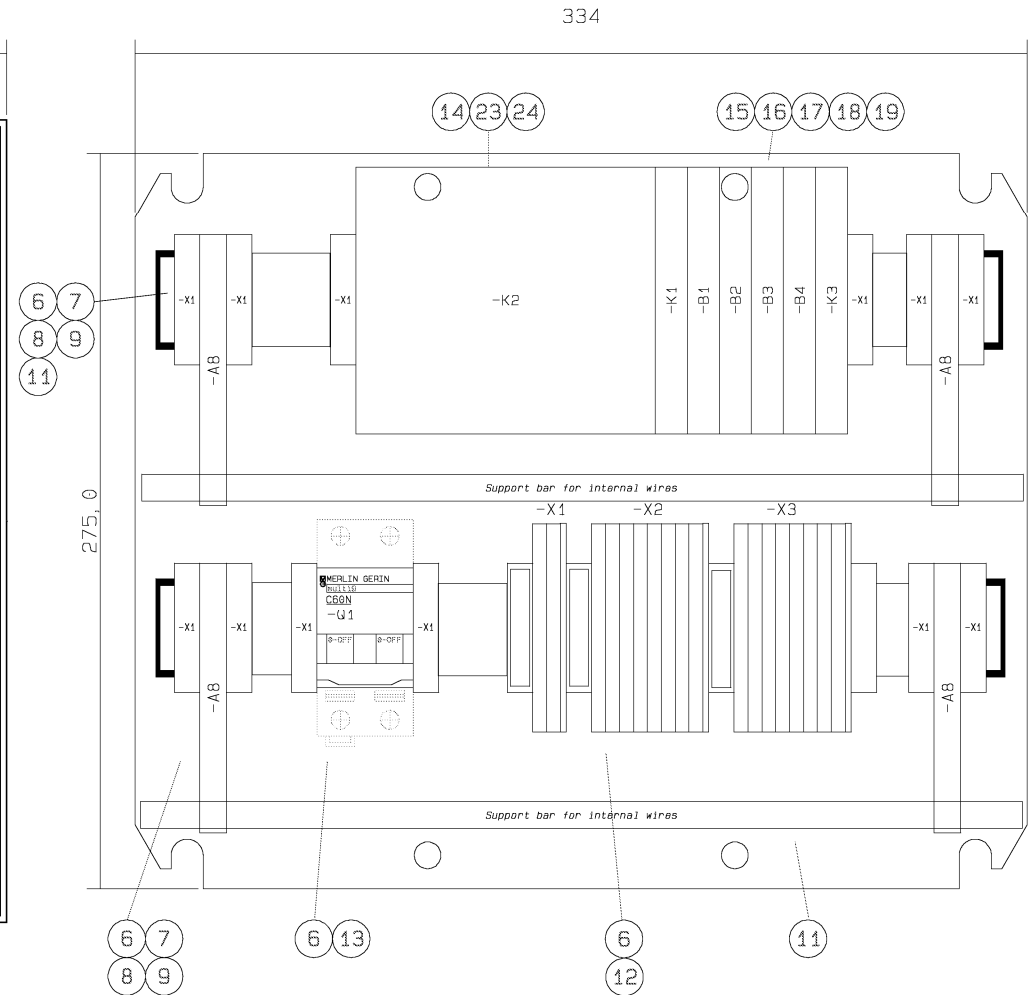
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Scale: 1: 1	Size: A3	Product Type: SCR NOX			Projection: 	Page No.: 11 (18)
Info. No.: 7B4258		Item Name: SELECTIVE CATALYTIC REDUCTION			Item Id.: 5627230-5	
Final User Info. No.:			Final User Description:			Final User Ident. No.:

SCR NOx Cabinet



Depth 155 mm

Mounting plate



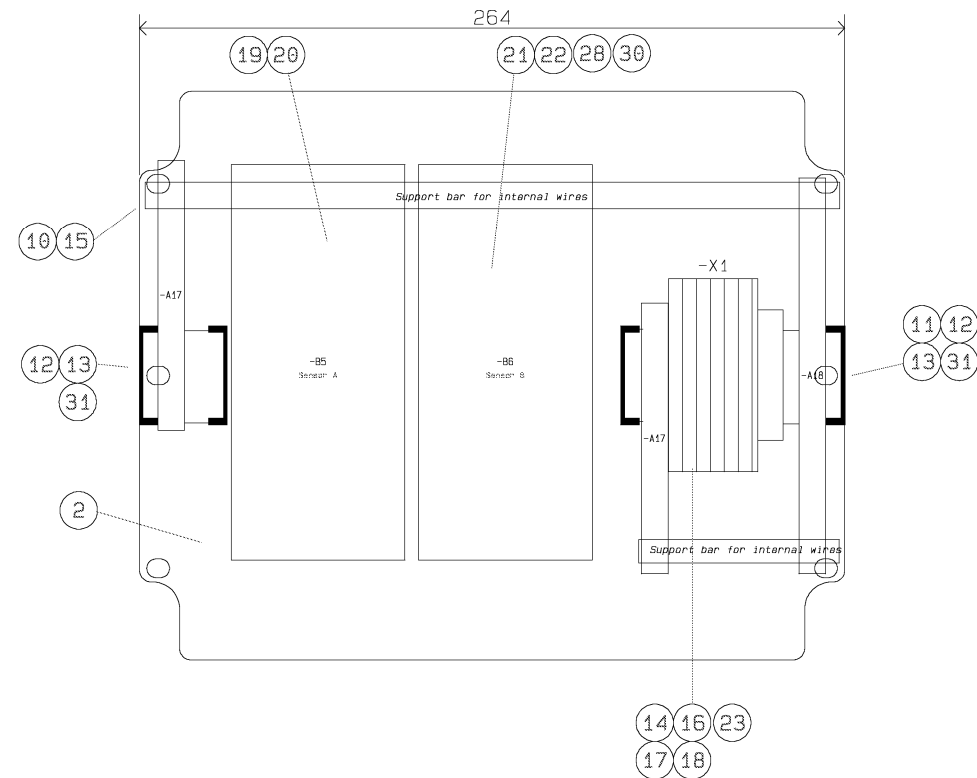
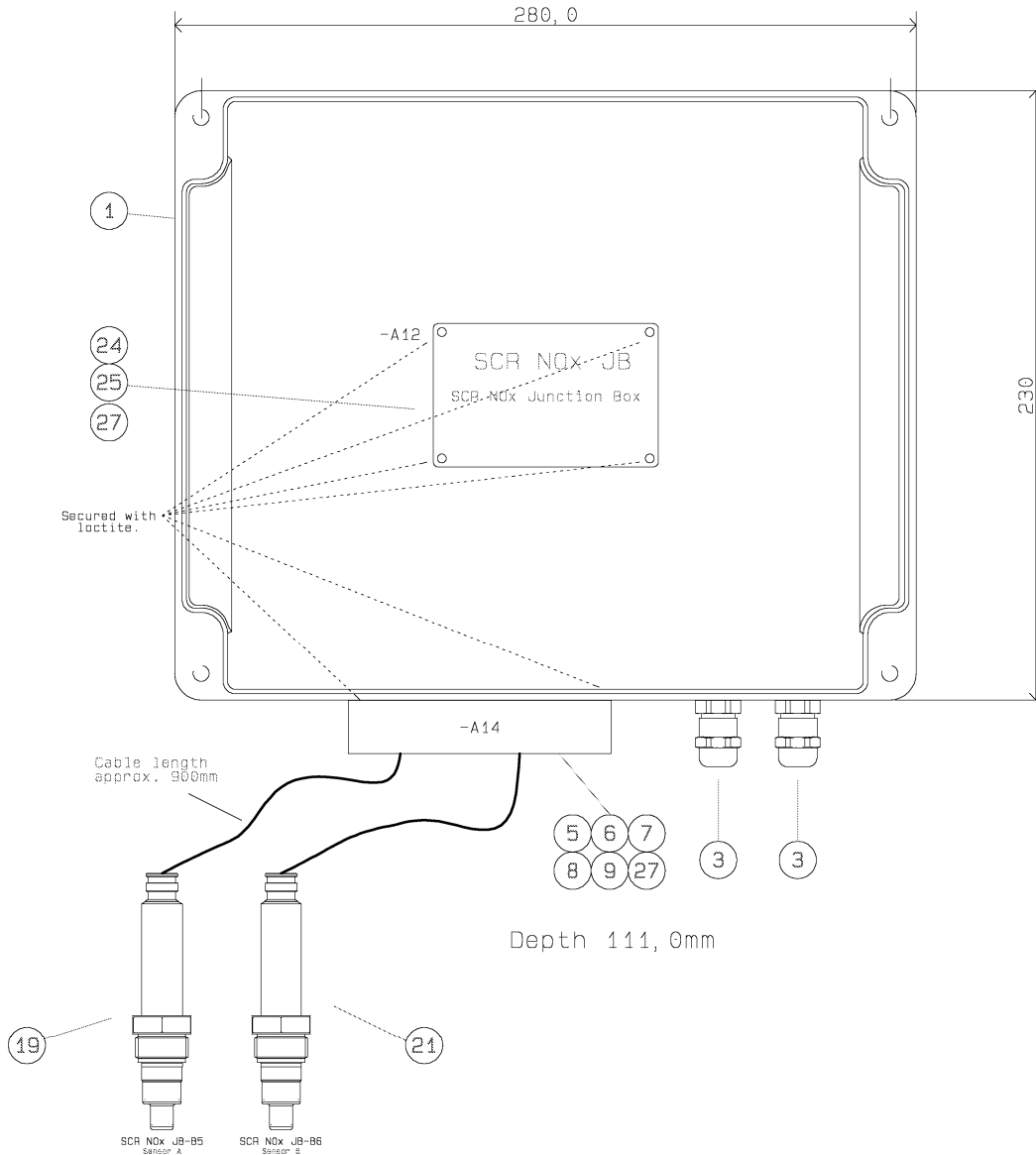
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Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
20180516	JYA	CAHVZ3	Pos.27, 29, 32 rem., 2, 19, 20 ch.				-08
Scale: 1: 2	Size: A3	Product Type: SCR NOX				Projection: 	Page No.: 12 (18)
Info. No.: 7B4258		Item Name: SELECTIVE CATALYTIC REDUCTION				Item Id.: 5627230-5	
Final User Info. No.:		Final User Description:				Final User Ident. No.:	

SCR NOx Junction Box

Mounting plate (with isolation plate)



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Date	Des.	Chk.	A.C.	Revision change	Chg. Not.	Rev.
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Final User Info. No.:		Final User Description:			Final User Ident. No.:	

5 CABLE LIST

Page 15...15

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Date		Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
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Cable Connection List

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6 COMPONENT LISTS

Page 17...18

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CAD Drawing - do not correct by hand - PCS Drawing

1006A3p2

F

Component List

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Component List

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Plan History 文件说明		Engine Type 机型	HP-SCR通用		
		Engine No 工程编号			
		Yard/Hull NO 船厂/船号			
		Classification 船级社			
WIRING OF SCR AUX. SYSTEM CONTROL CABINET SCR辅助系统接线					
				5	
				4	
				3	
20180623	邱斌斌	宁军	根据厂家认可图更改CSD07617		2
20180122	邱斌斌	宁军	封面信息通用更改CSD07217		1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	邱斌斌 20171228		Drawing NO 图号	4H-20508	
Check 校对	宁军 20171228				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 22
Verify 审定			Reference 设计参考图号		
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					

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BV1801II型控制箱

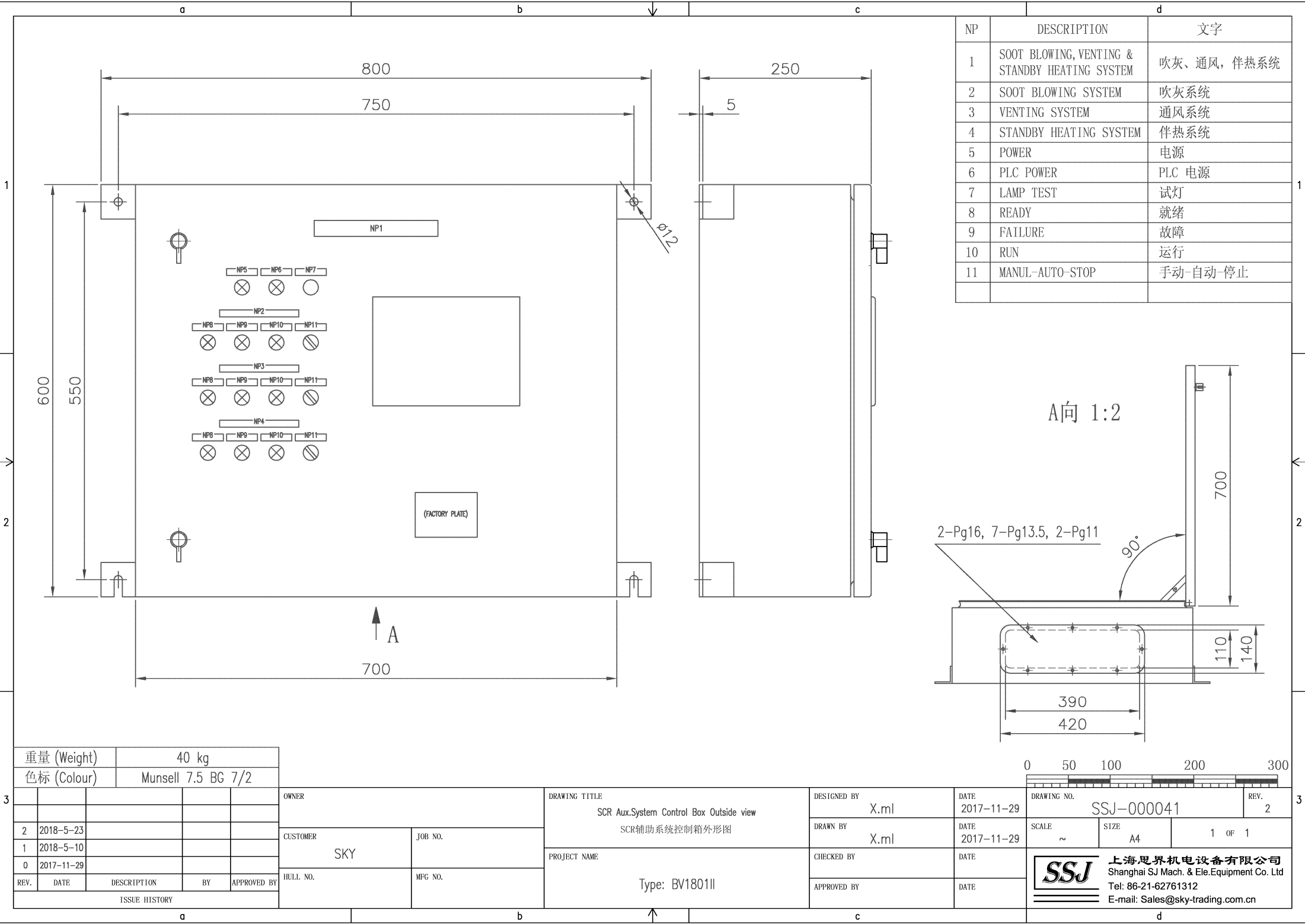
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											APPROVED BY		DATE					
ISSUE HISTORY																		

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BV1801III型控制箱图纸目录

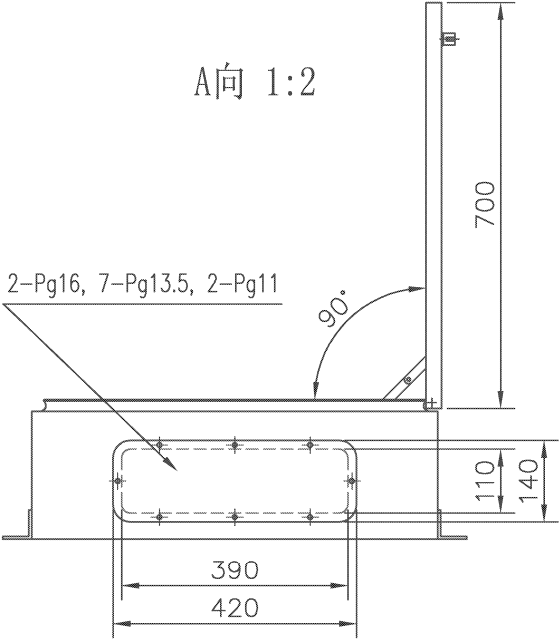
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2	SSJ-000041.0	SCR控制箱外形图	1
3	SSJ-000044.0	SCR控制箱内部布置图	3
4	SSJ-000042.1	SCR控制箱接线图	13
5	SSJ-000047.0	元件(备件)清单	2

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REV.		DATE		DESCRIPTION		BY			APPROVED BY		HULL NO.							MFG NO.		APPROVED BY		DATE		
ISSUE HISTORY																								



NP	DESCRIPTION	文字
1	SOOT BLOWING, VENTING & STANDBY HEATING SYSTEM	吹灰、通风，伴热系统
2	SOOT BLOWING SYSTEM	吹灰系统
3	VENTING SYSTEM	通风系统
4	STANDBY HEATING SYSTEM	伴热系统
5	POWER	电源
6	PLC POWER	PLC 电源
7	LAMP TEST	试灯
8	READY	就绪
9	FAILURE	故障
10	RUN	运行
11	MANUL-AUTO-STOP	手动-自动-停止

A向 1:2



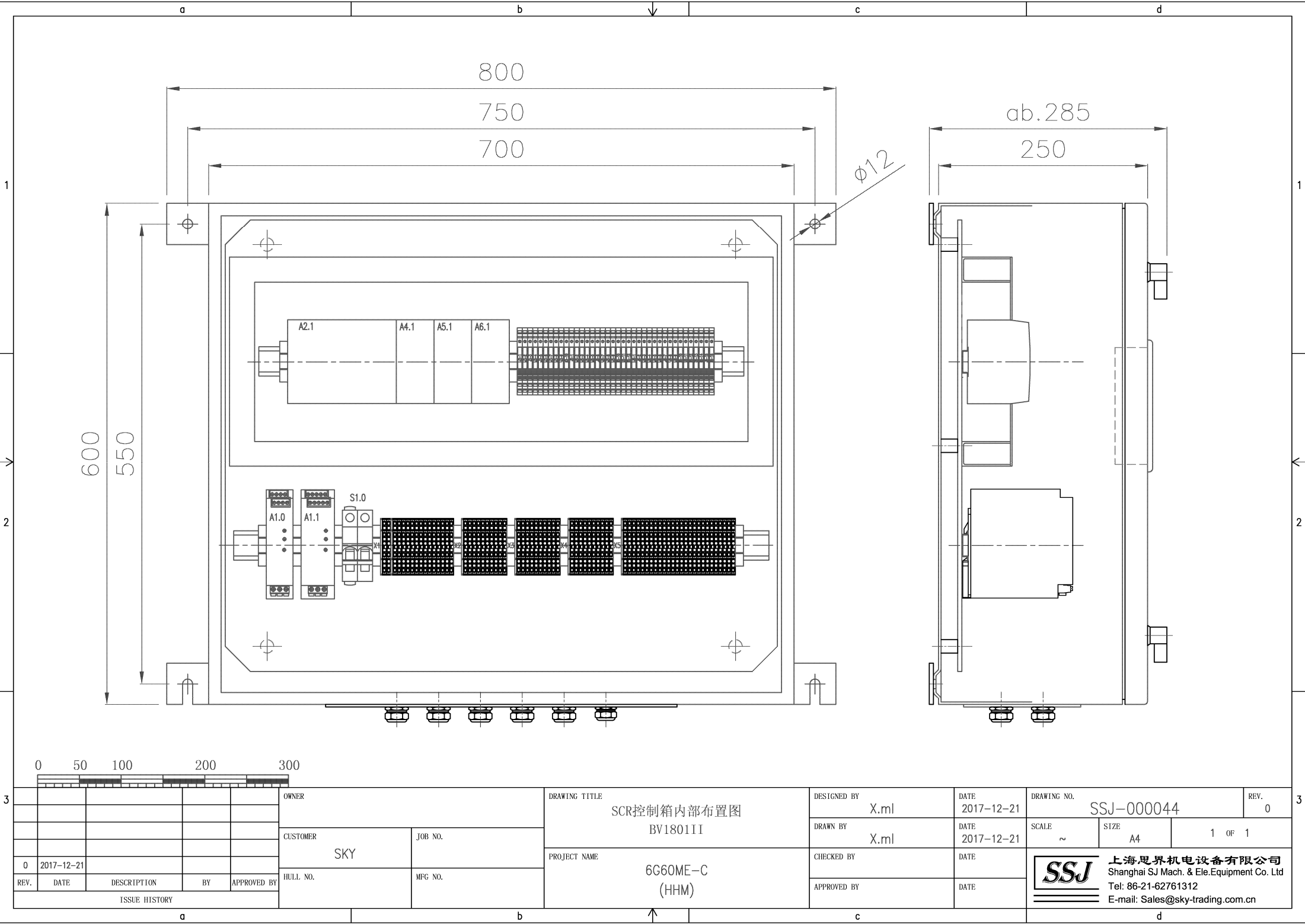
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SKY			
JOB NO.			
MFG NO.			

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Shanghai SJ Mach. & Ele.Equipment Co. Ltd
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E-mail: Sales@sky-trading.com.cn



REV.	DATE	DESCRIPTION	BY	APPROVED BY
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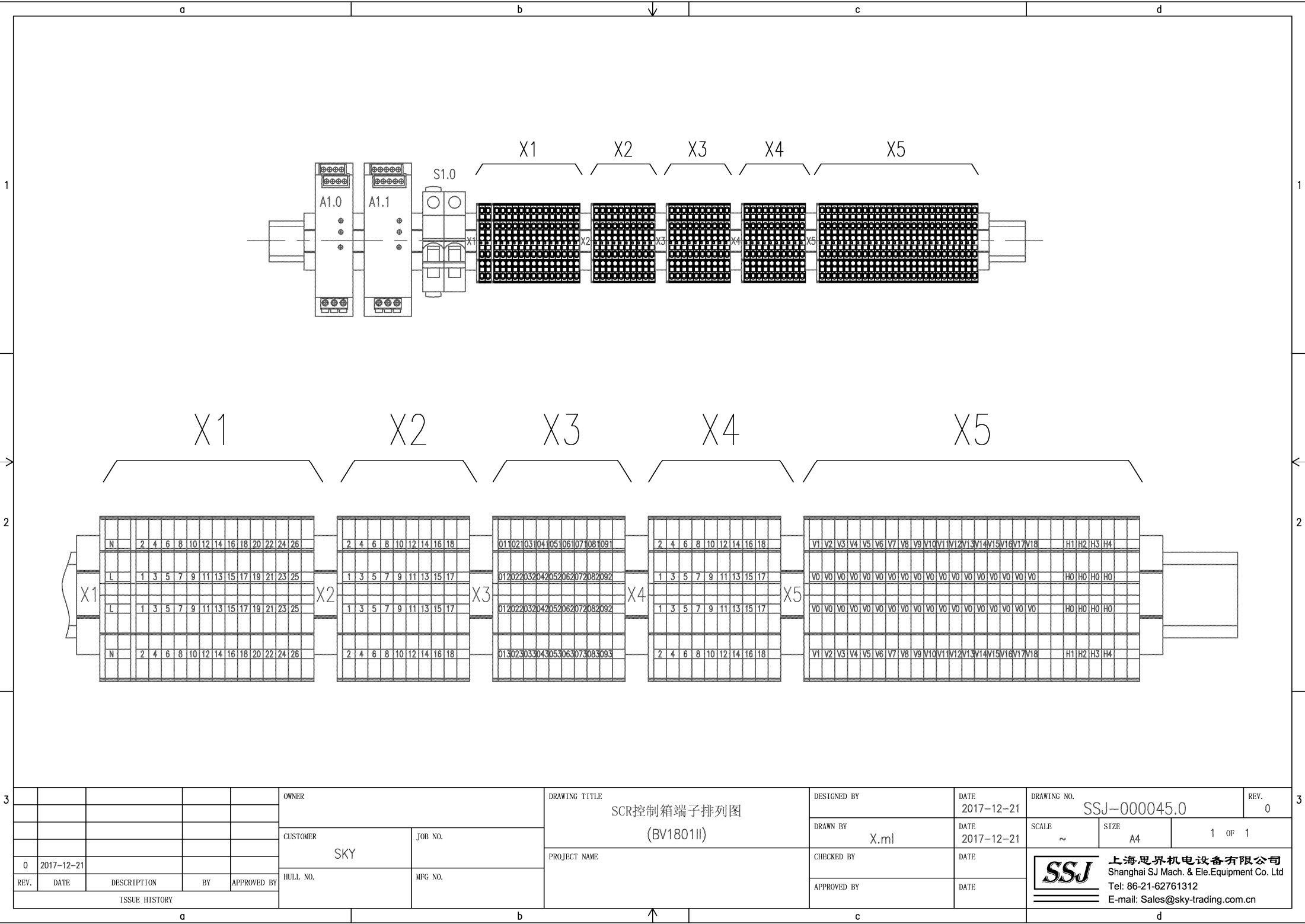
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BV180111
PROJECT NAME
6G60ME-C
(HHM)

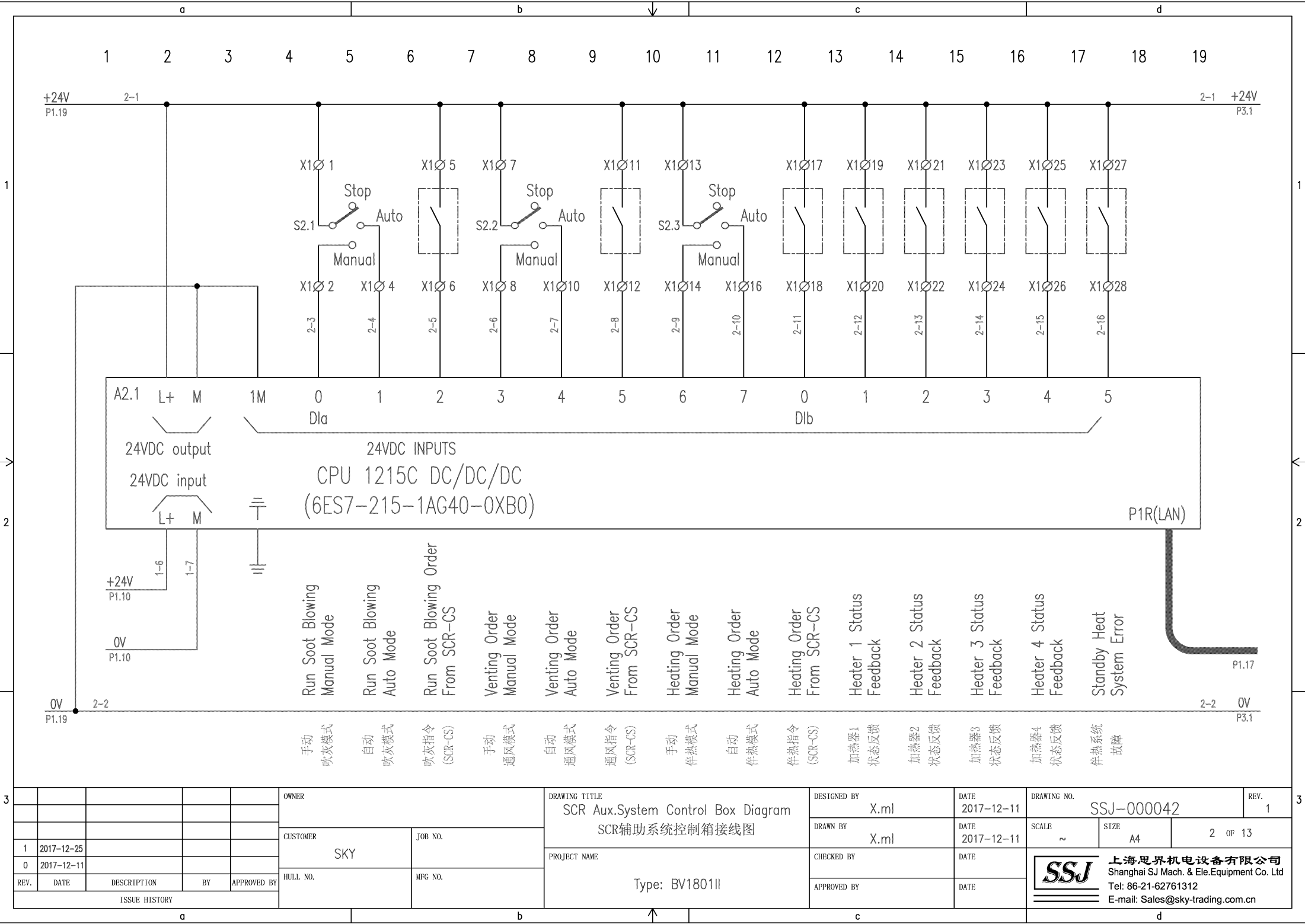
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SSJ		上海思界机电设备有限公司		
		Shanghai SJ Mach. & Ele.Equipment Co. Ltd		
		Tel: 86-21-62761312		
		E-mail: Sales@sky-trading.com.cn		

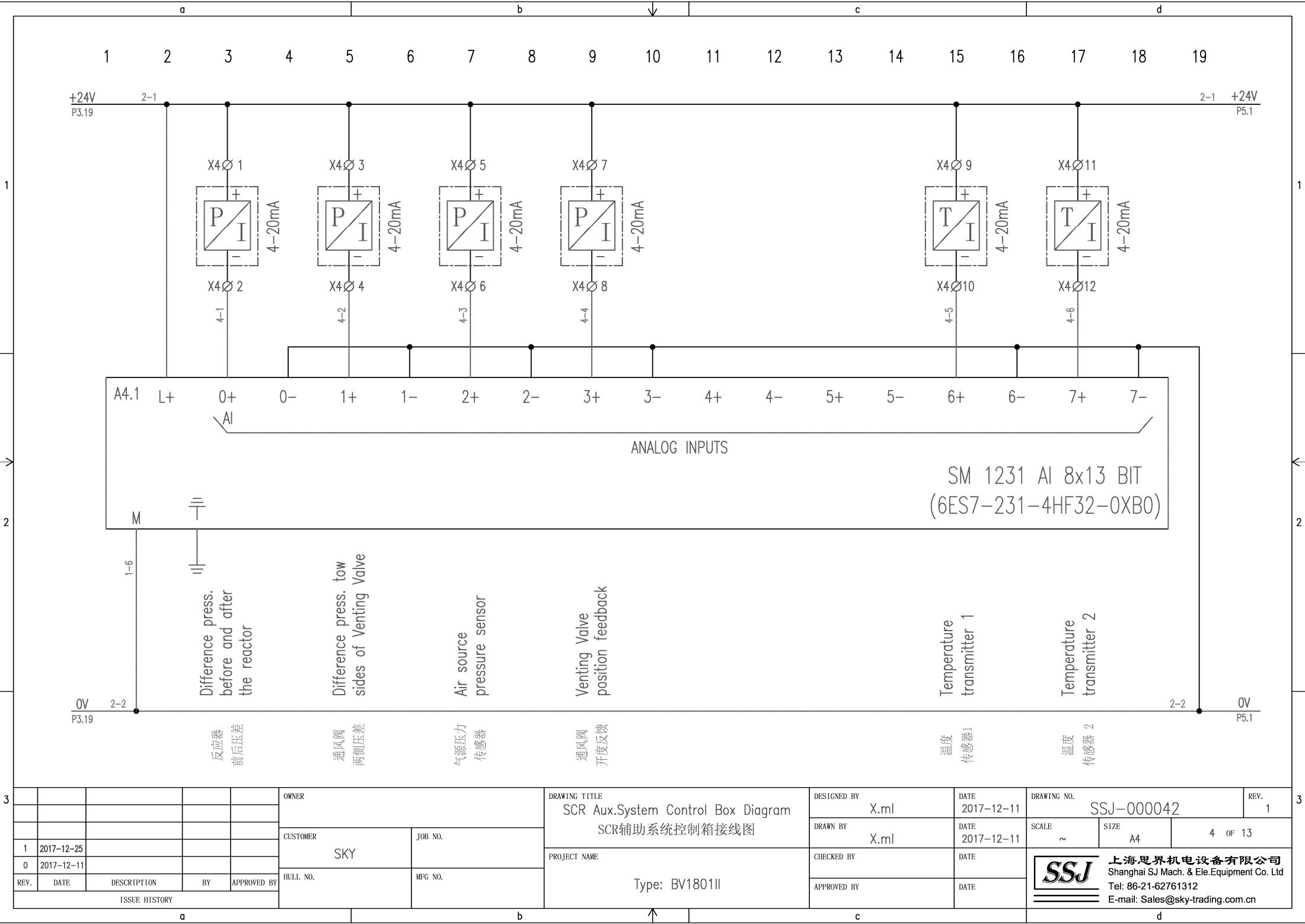


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0	2017-12-11						SCR辅助系统控制箱接线图		X.ml	2017-12-11	SCALE	SIZE	2 OF 13
REV.	DATE	DESCRIPTION	BY	APPROVED BY	HULL NO.		PROJECT NAME		CHECKED BY	DATE	SSJ 上海思界机电设备有限公司 Tel: 86-21-62761312 E-mail: Sales@sky-trading.com.cn		
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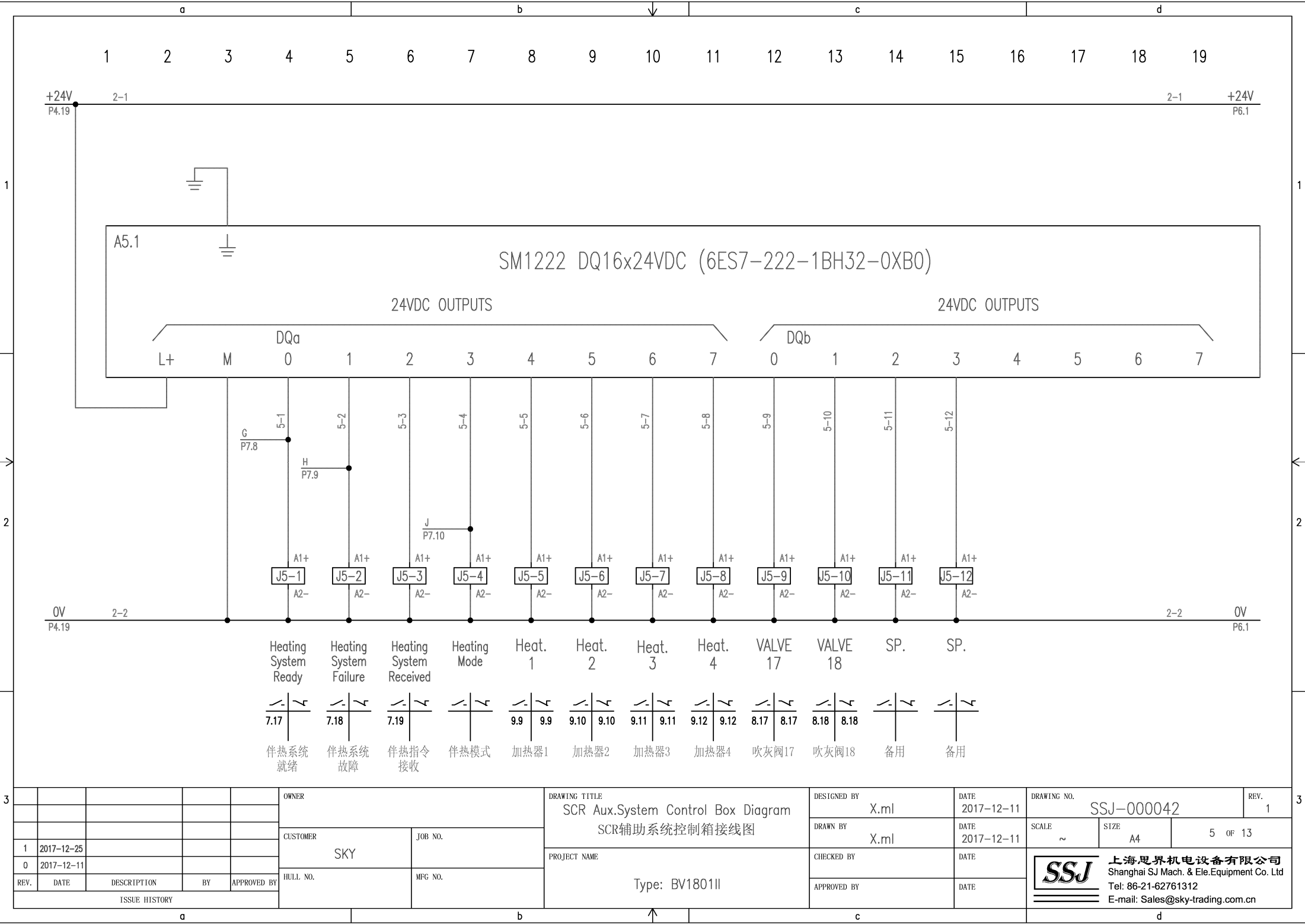
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SCR Aux.System Control Box Diagram	
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		上海思界机电设备有限公司	
		Shanghai SJ Mach. & Ele. Equipment Co. Ltd	
		Tel: 86-21-62761312	
		E-mail: Sales@sky-trading.com.cn	



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HULL NO.	
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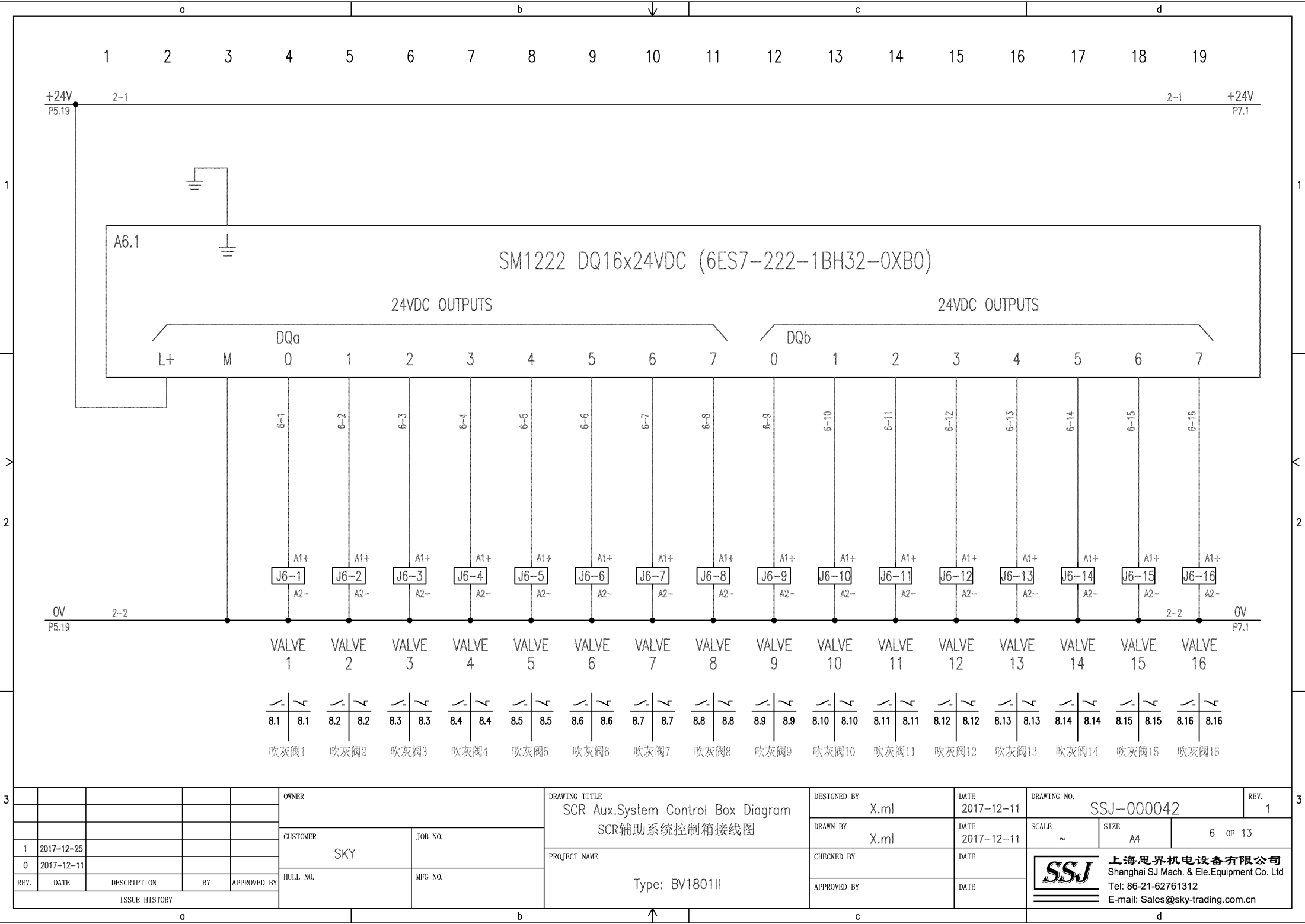
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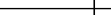
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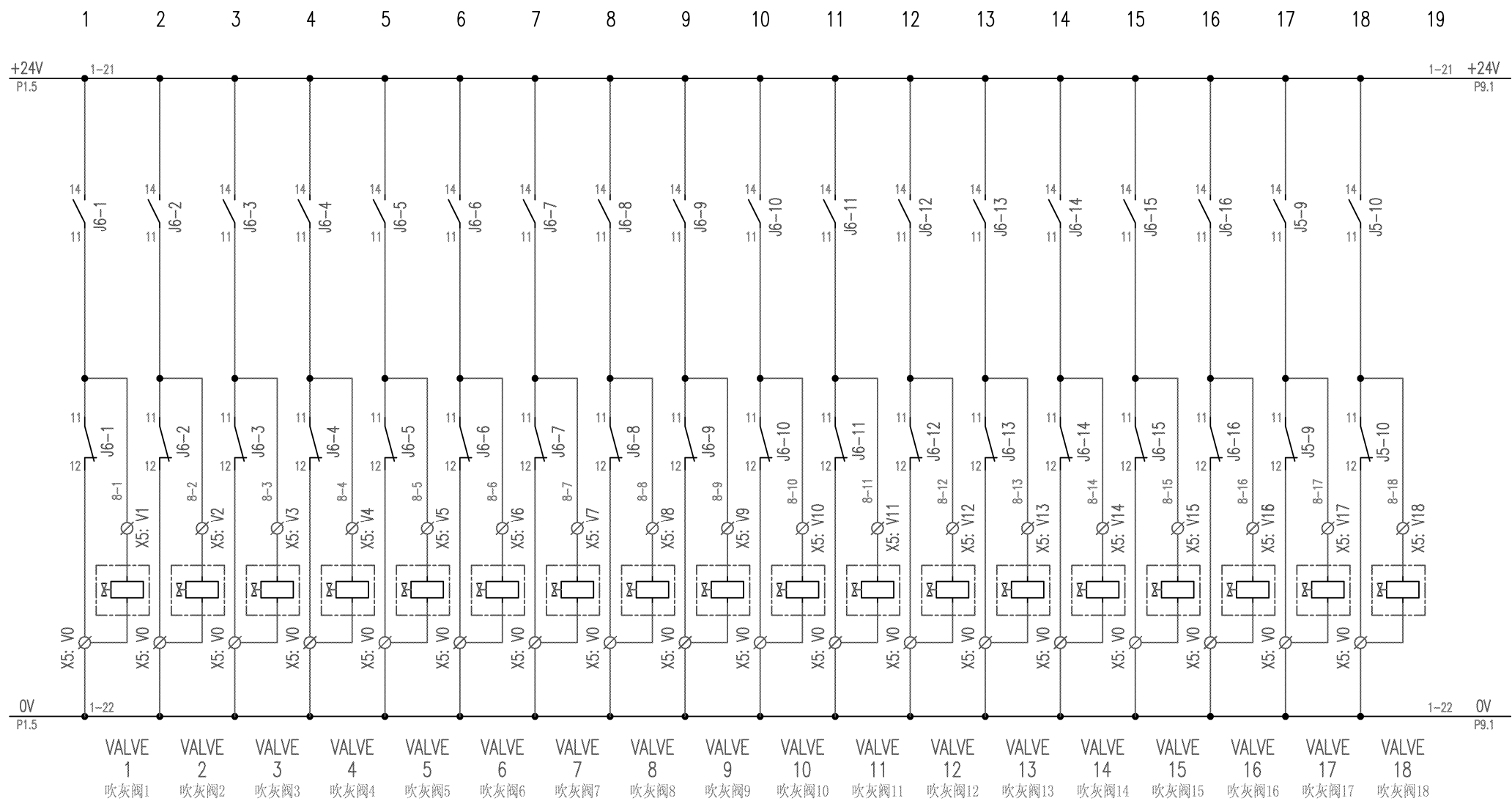
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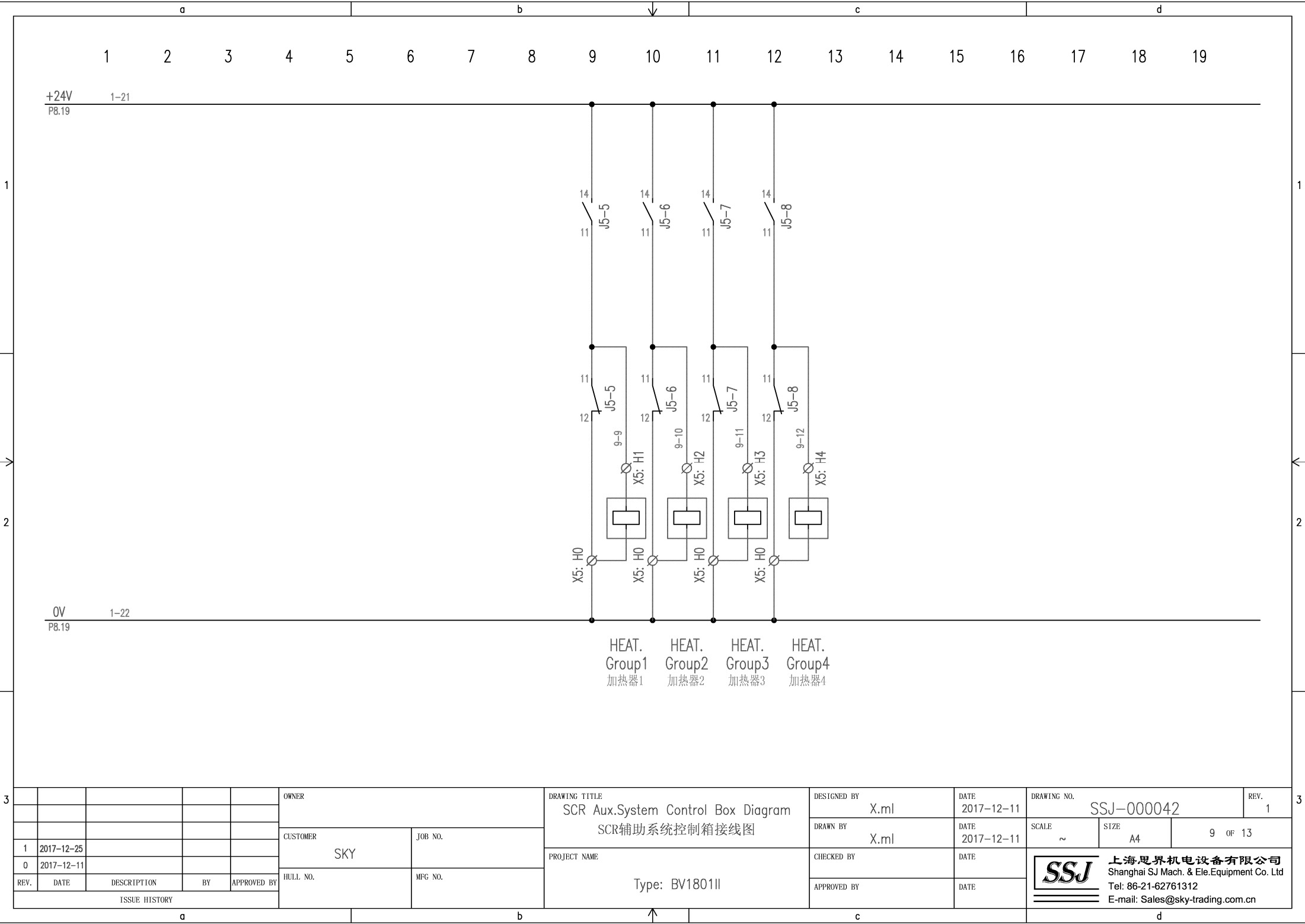
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E-mail: Sales@sky-trading.com.cn



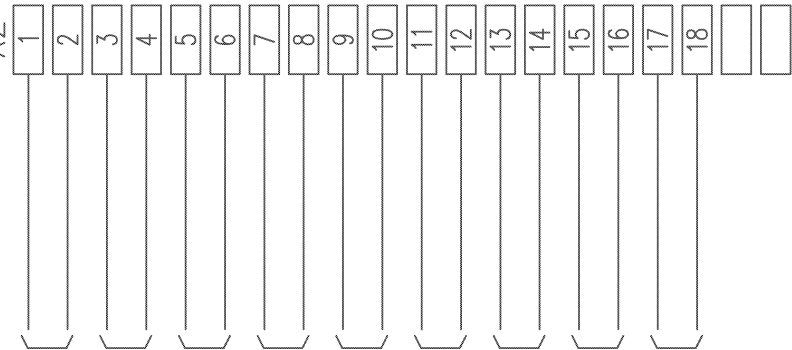
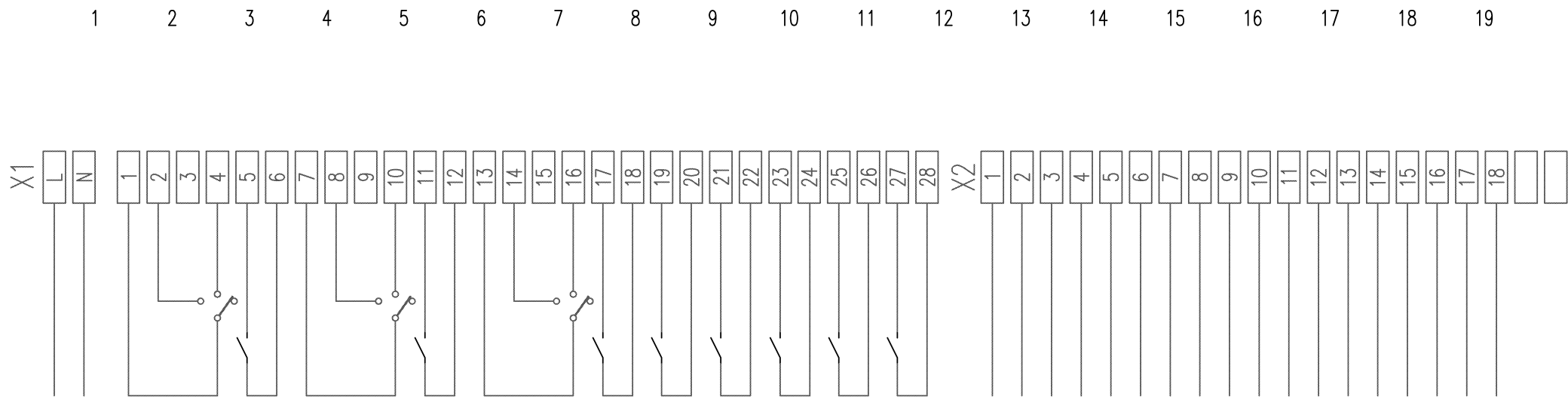
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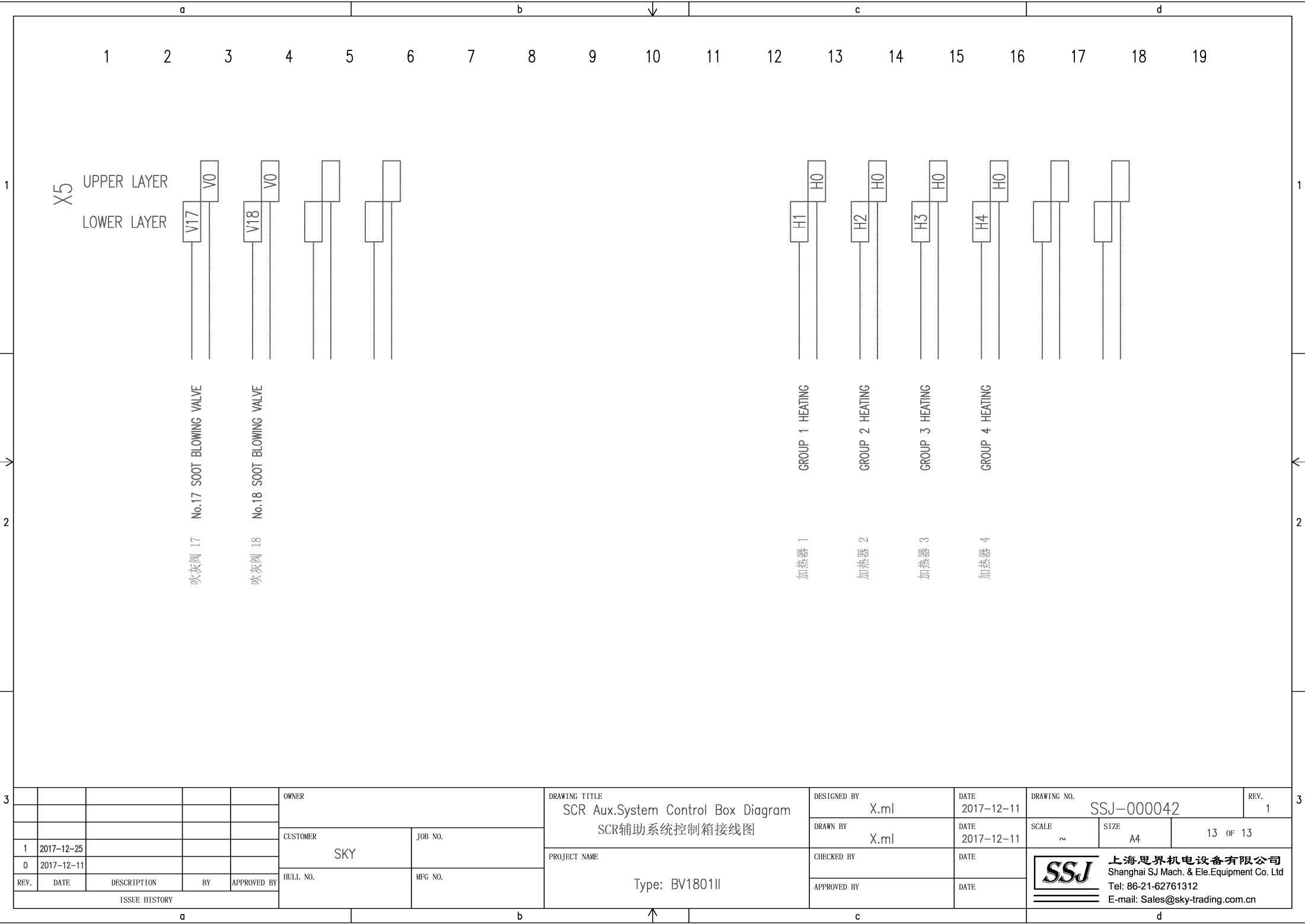
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a					b					c					d												



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REV. DATE DESCRIPTION BY APPROVED BY					HULL NO.		MFG NO.		(HHM)		APPROVED BY		DATE							
ISSUE HISTORY																				

Plan History 文件说明		Engine Type 机型	6G60ME-C9.5-HPSCR				
		Engine No 工程编号	CE0561Y				
		Yard/Hull NO 船厂/船号	江苏新时代造船有限公司 0311117~00311120				
		Classification 船级社	ABS				
SCR TERMINAL BOX ON M.E. CONNECTING DRAWING SCR接线箱接线图							
							5
							4
							3
20180419	邱斌斌	宁军	P7 ,3个温度传感器为自带电缆				2
20180206	邱斌斌	宁军	P7 ,传感器代号更正CSD07256				1
Data 日期	Correct 修改	Check 校对	Description 修改说明				Rev. 版本
Design 编制	邱斌斌 20171226		Drawing NO 图号	4H-20624			
Check 校对	宁军 20171226						
Examine 审核			Replaced 被替代图号		Total 总页数(含封面)	07	
Verify 审定			Reference 设计参考图号				
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司				
Approved 批准							

Info. No.:		Item Name: SCR接线箱接线图			Item Id.: 4H-20624	
Scale:	Size: A4				Page No.: 02 (07)	Projection:  CMD-MAN
Date	Des.	Chk.	A.C.	Revision change		Chg. Not. Rev.
20180419	邱斌斌	宁军	*	P7 ,3个温度传感器为自带电缆		CSD07418 02

SPECIFICATION AND DESCRIPTION

技术要求与说明

1. Position numbers,measuring values and description of the measuring medium refer to "Guidance values Automation"

位置编号，测量值及测量介质的说明请参考“运行参数表”
2. In the drawing, all the cable indicated by physical lines are arranged by the engine maker

图中以实线表示的电缆由主机制造厂安装。
3. The cable gland size of the shipyard side on the Main terminal box are decided by the shipyard

接线箱船厂进线侧的填料函尺寸由船厂确定。
4. In the drawing, the contact state indicated: free state i. e. without being affected by external force.

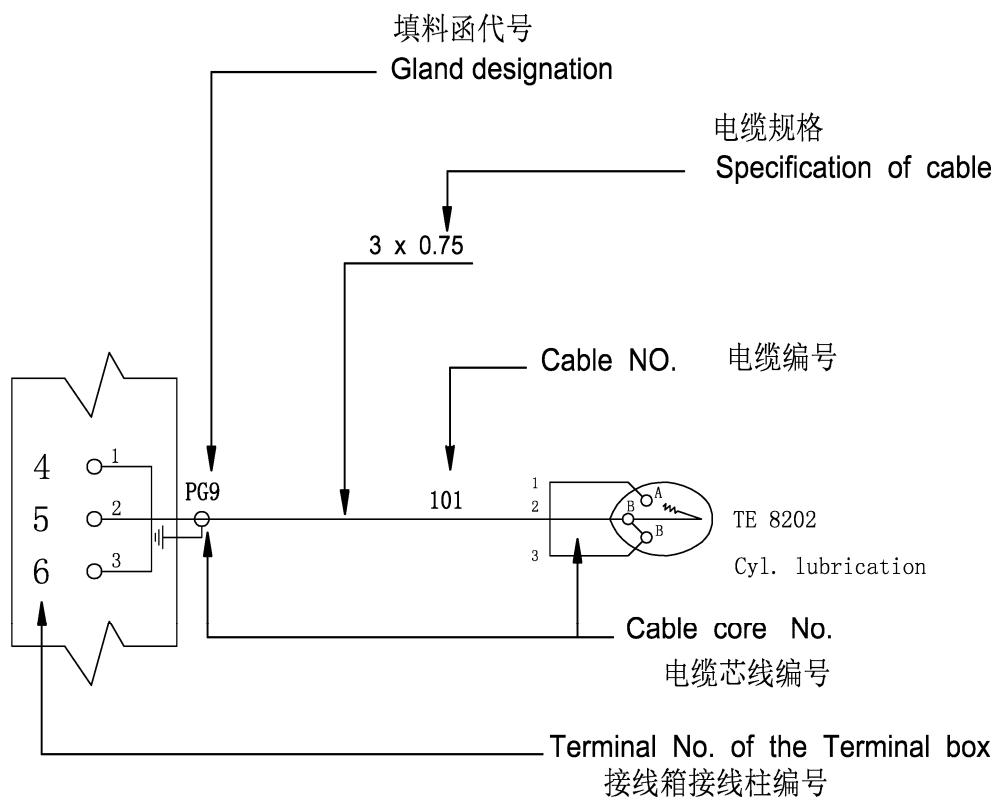
图中触点的状态：自由状态即不受外力的作用
5. The frame of electrical equipments and junction boxes should be earthed completely.

电气设备和接线箱外壳接地要可靠。

Info. No.:		Item Name: SCR接线箱接线图			Item Id.: 4H-20624		
Scale:	Size: A4	Page No.: 03 (07)			Projection: 	CMD-MAN	
Date	Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
20180419	邱斌斌	宁军	*	P7 ,3个温度传感器为自带电缆		CSD07418	02

6. Description of the junction box drawing

接线箱接线图说明



7. Description of cable gland

电缆填料函说明

Gland symbol 填料函代号	permit dia. of cable (mm) 电缆允许直径
PG9	4-8
PG11	5-10
PG13.5	6-12
PG16	10-14
PG21	13-18
PG29	17-25
PG36	24-32
PG42	31-38

Info. No.:		Item Name: SCR接线箱接线图			Item Id.: 4H-20624	
Scale:	Size: A4				Page No.: 04 (07)	Projection:  CMD-MAN
Date	Des.	Chk.	A.C.	Revision change		Chg. Not.
20180419	邱斌斌	宁军	*	P7 ,3个温度传感器为自带电缆		CSD07418 02

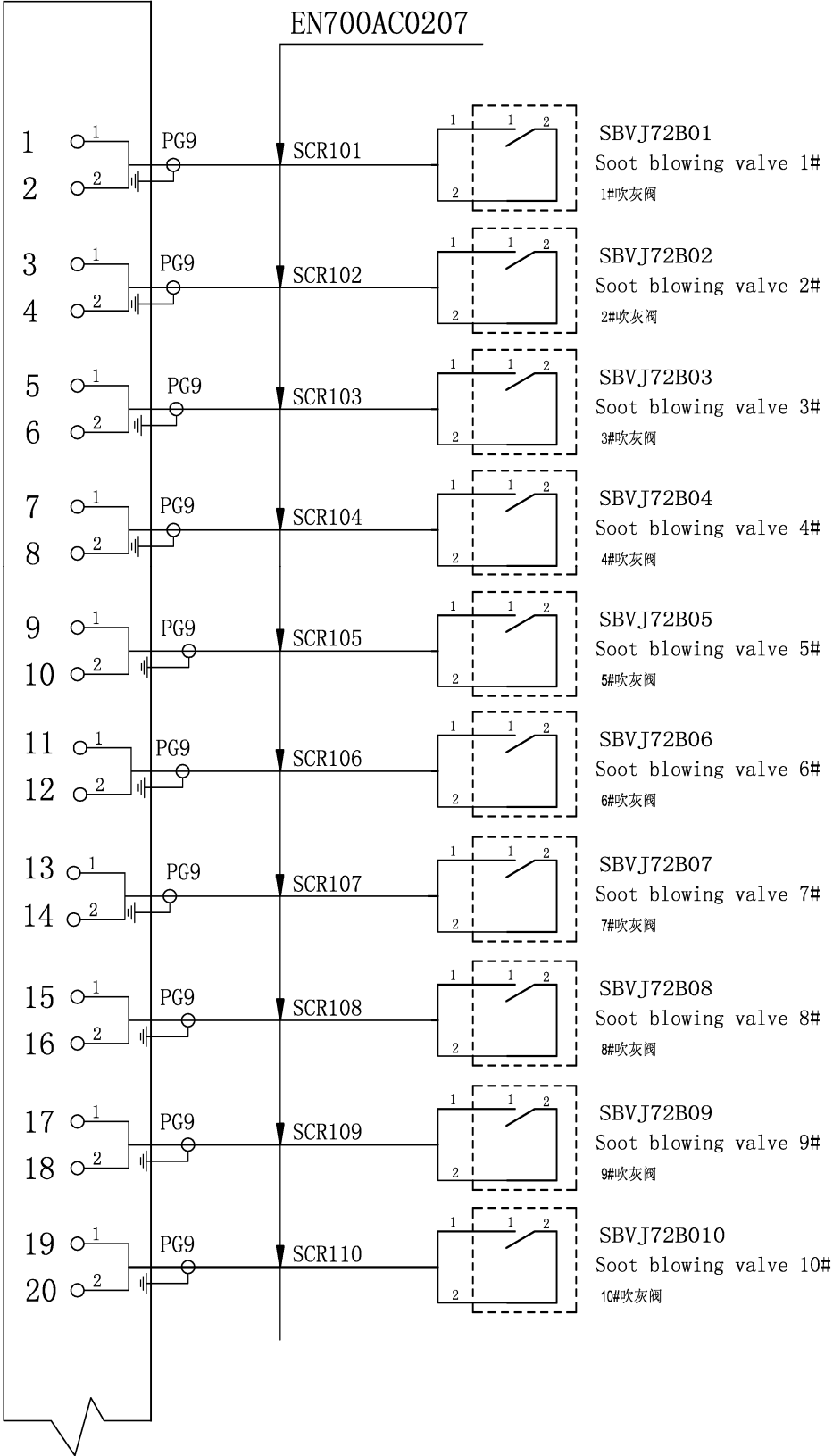
8. COMPONENT SYMBOL

元件代号

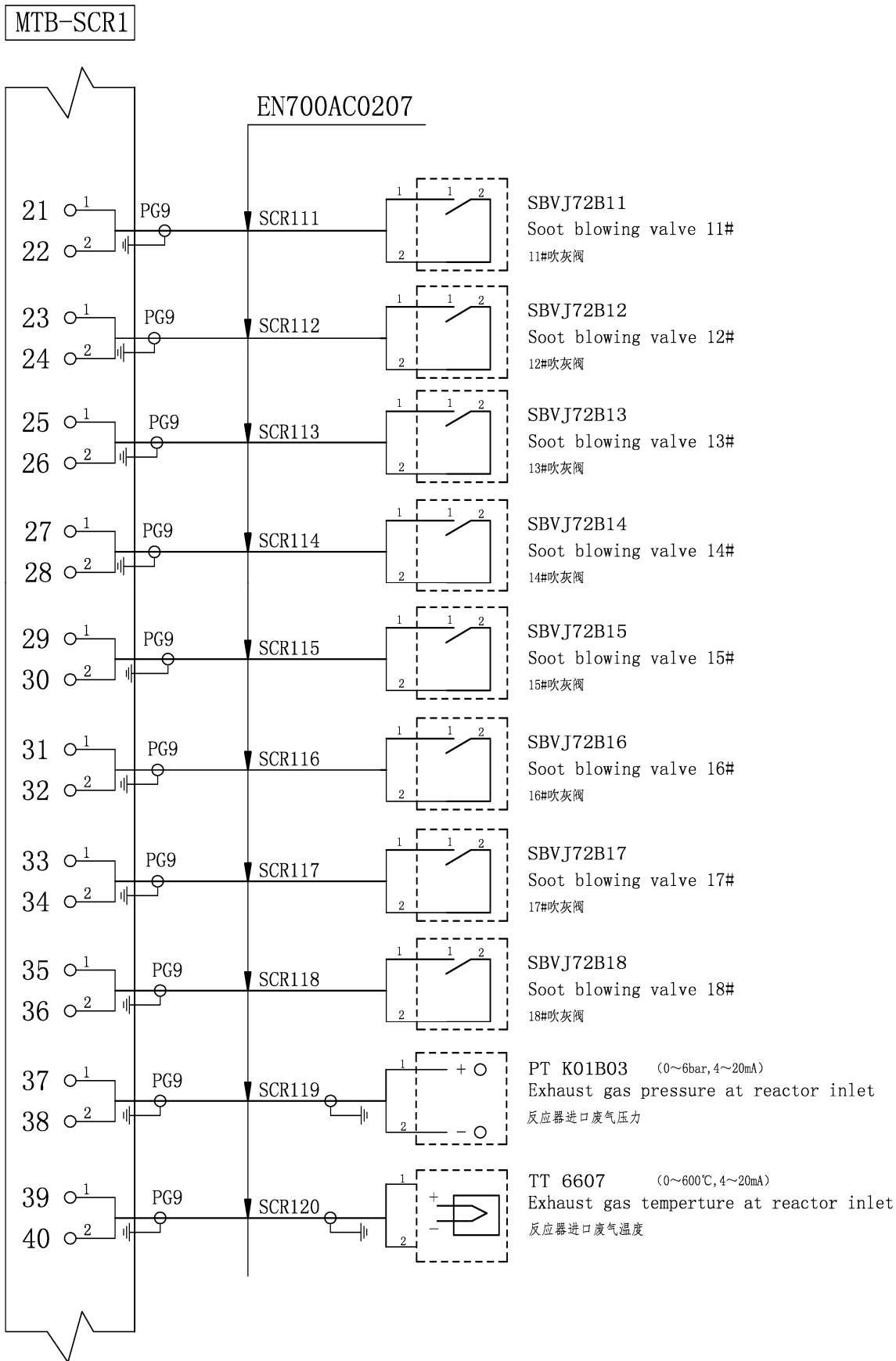
MTB:	Main terminal box	接线箱
TE:	Temperature element	温度传感器
TS:	Temperature Switch	温度开关
PS:	Pressure Switch	压力开关
PT:	Pressure Transmitter	压力传感器
LS:	Level Switch	液位开关
FS:	Flow Switch	流量开关
ZV:	Solenoid Valve	电磁阀
ZS:	Position Switch	位置开关
ZT:	Position Transmitter	位置传感器
TT:	Tempreture Transmitter	温度传感器
SBV:	Soot Blowing solid Valve	吹灰电磁阀
PDT:	Pressure difference Transmitter	压差传感器
PDS:	Pressure difference Switch	压差开关

Info. No.:		Item Name: SCR接线箱接线图			Item Id.: 4H-20624	
Scale:	Size: A4				Page No.: 05 (07)	Projection: ⊟⊕
Date 20180419		Des. 邱斌斌	Chk. 宁军	A.C. *	Revision change P7,3个温度传感器为自带电缆	Chg. Not. CSD07418
						Rev. 02

MTB-SCR1

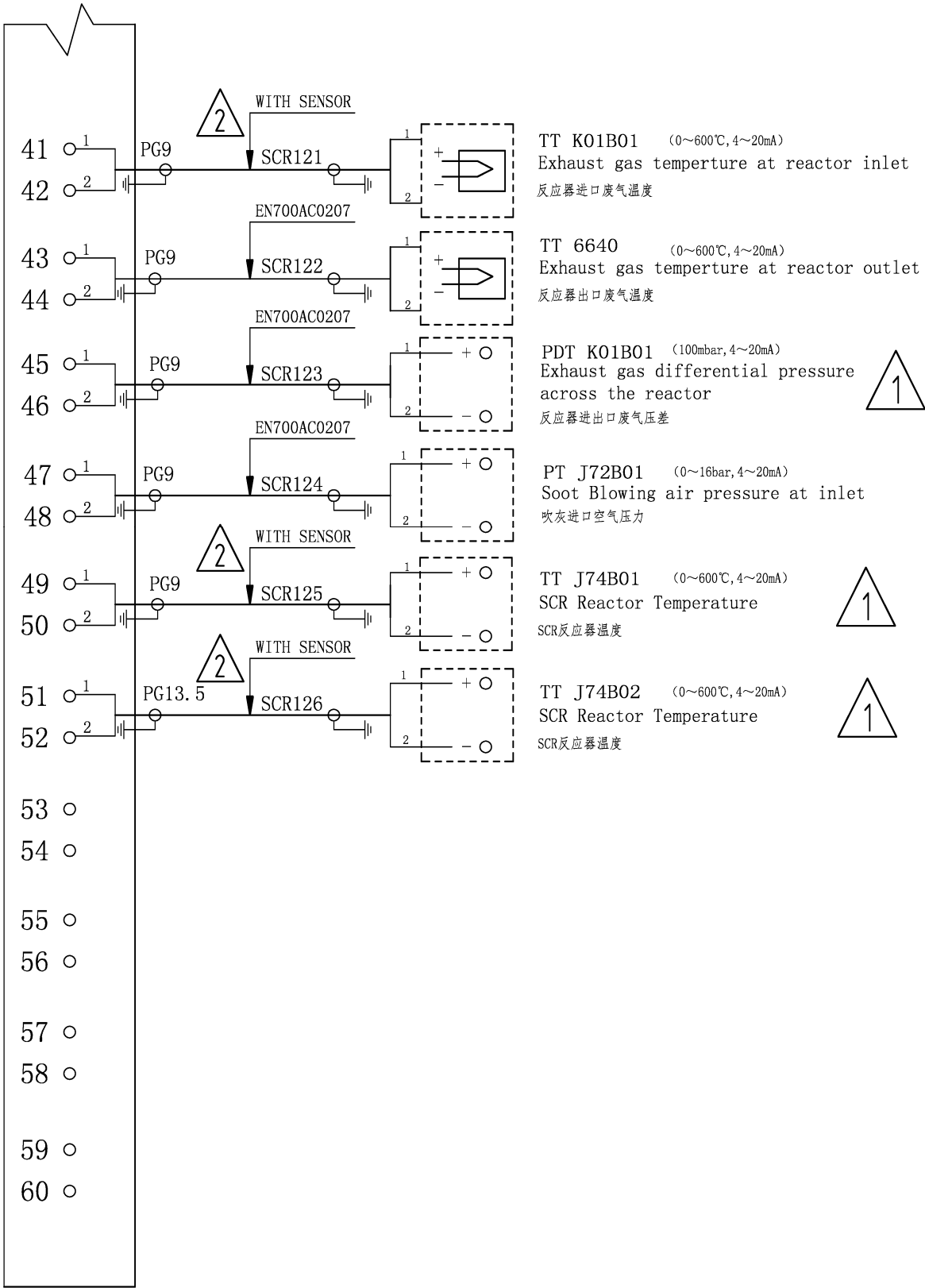


Info. No.:		Item Name: SCR接线箱接线图			Item Id.: 4H-20624	
Scale:	Size: A4	Page No.: 06 (07)			Projection: 	CMD-MAN
Date	Des.	Chk.	A.C.	Revision change		Chg. Not.
20180419	邱斌斌	宁军	*	P7,3个温度传感器为自带电缆		02

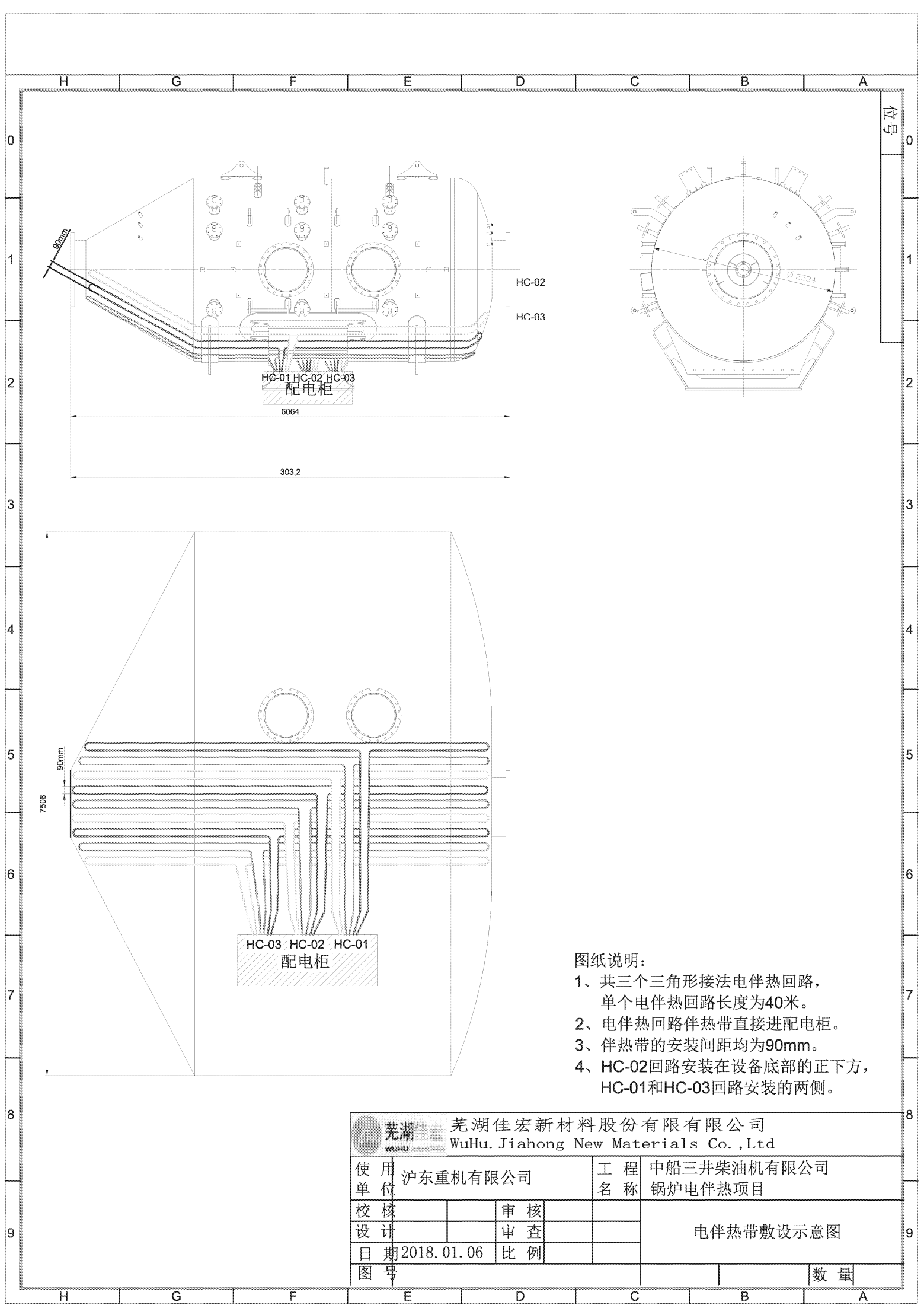


Info. No.:		Item Name: SCR接线箱接线图				Item Id.: 4H-20624		
Scale:	Size: A4				Page No.: 07 (07)	Projection: 	CMD-MAN	
Date		Des.	Chk.	A.C.	Revision change		Chg. Not.	Rev.
20180419		邱斌斌	宁军	*	P7 ,3个温度传感器为自带电缆		CSD07418	02

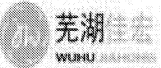
MTB-SCR1

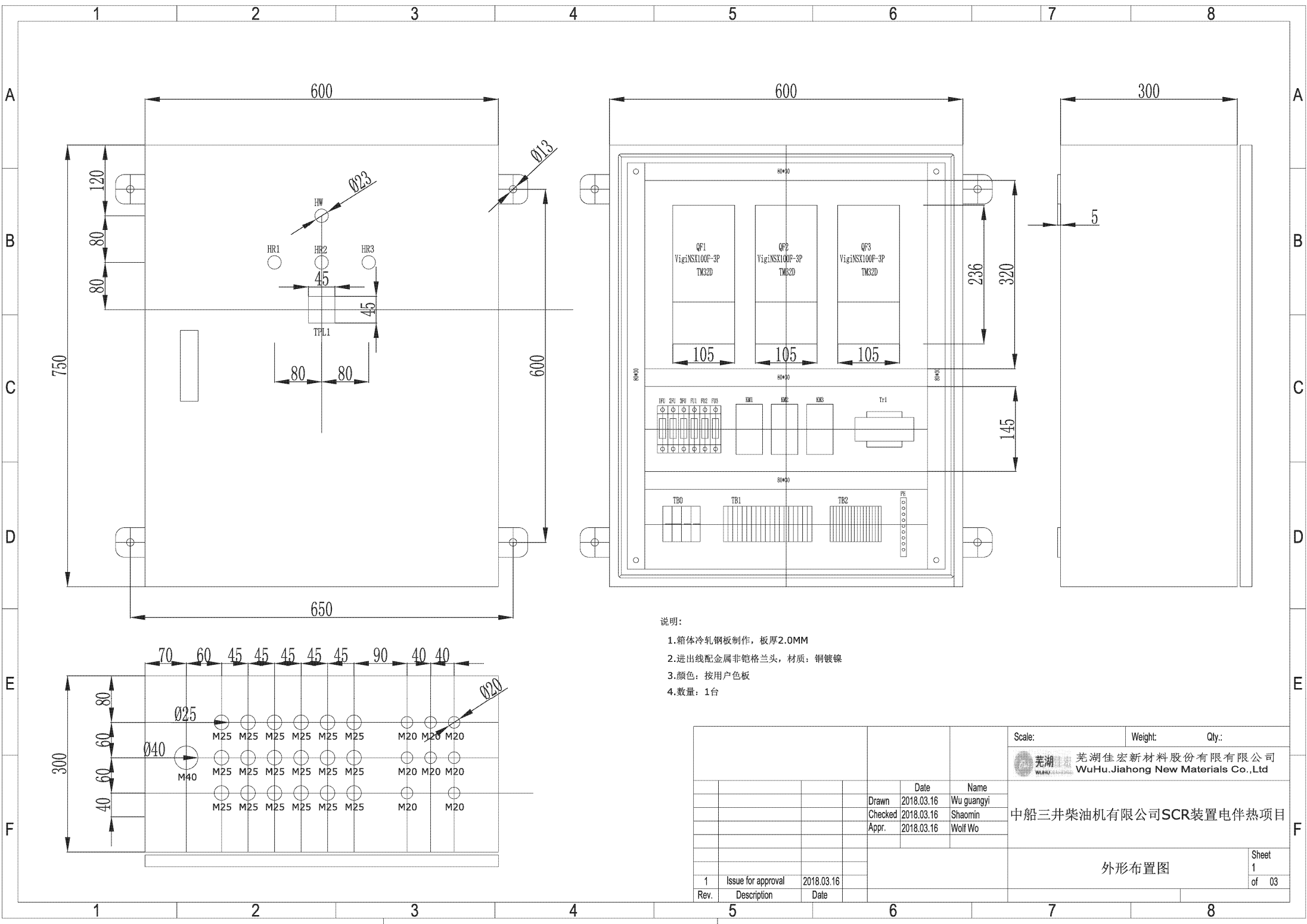


Plan History 文件说明		Engine Type 机型	HP-SCR通用		
		Engine No 工程编号			
		Yard/Hull NO 船厂/船号			
		Classification 船级社			
SCR STANDBY HEAT SYSTEM SCR伴热系统					
					5
					4
					3
20180621	邱斌斌	宁军	厂家认可图修改CSD07617		2
20180131	邱斌斌	宁军	厂家认可图修改CSD07526		1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	邱斌斌 20170108		Drawing NO 图号	4H-20528	
Check 校对	宁军 20170108				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 5
Verify 审定			Reference 设计参考图号		
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					



- 图纸说明:
- 1、共三个三角形接法电伴热回路，单个电伴热回路长度为40米。
 - 2、电伴热回路伴热带直接进配电柜。
 - 3、伴热带的安装间距均为90mm。
 - 4、HC-02回路安装在设备底部的正下方，HC-01和HC-03回路安装的两侧。

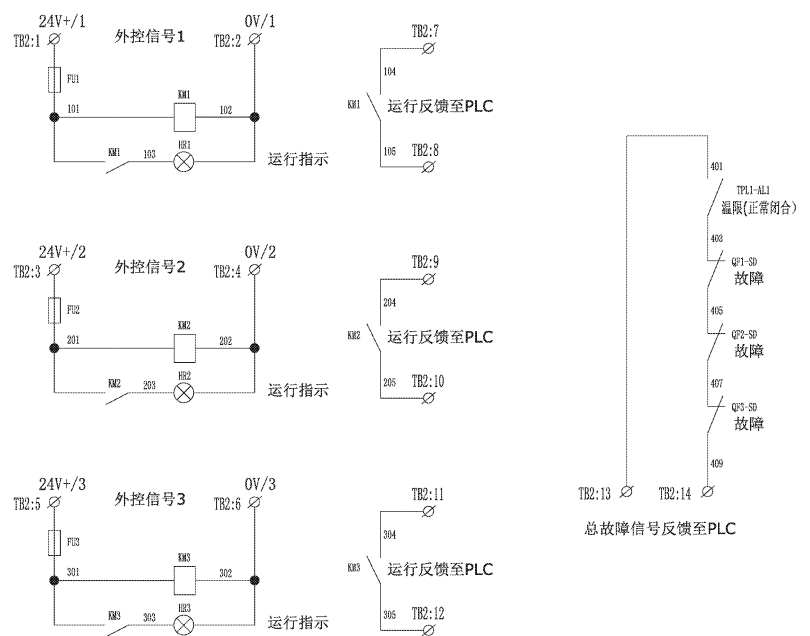
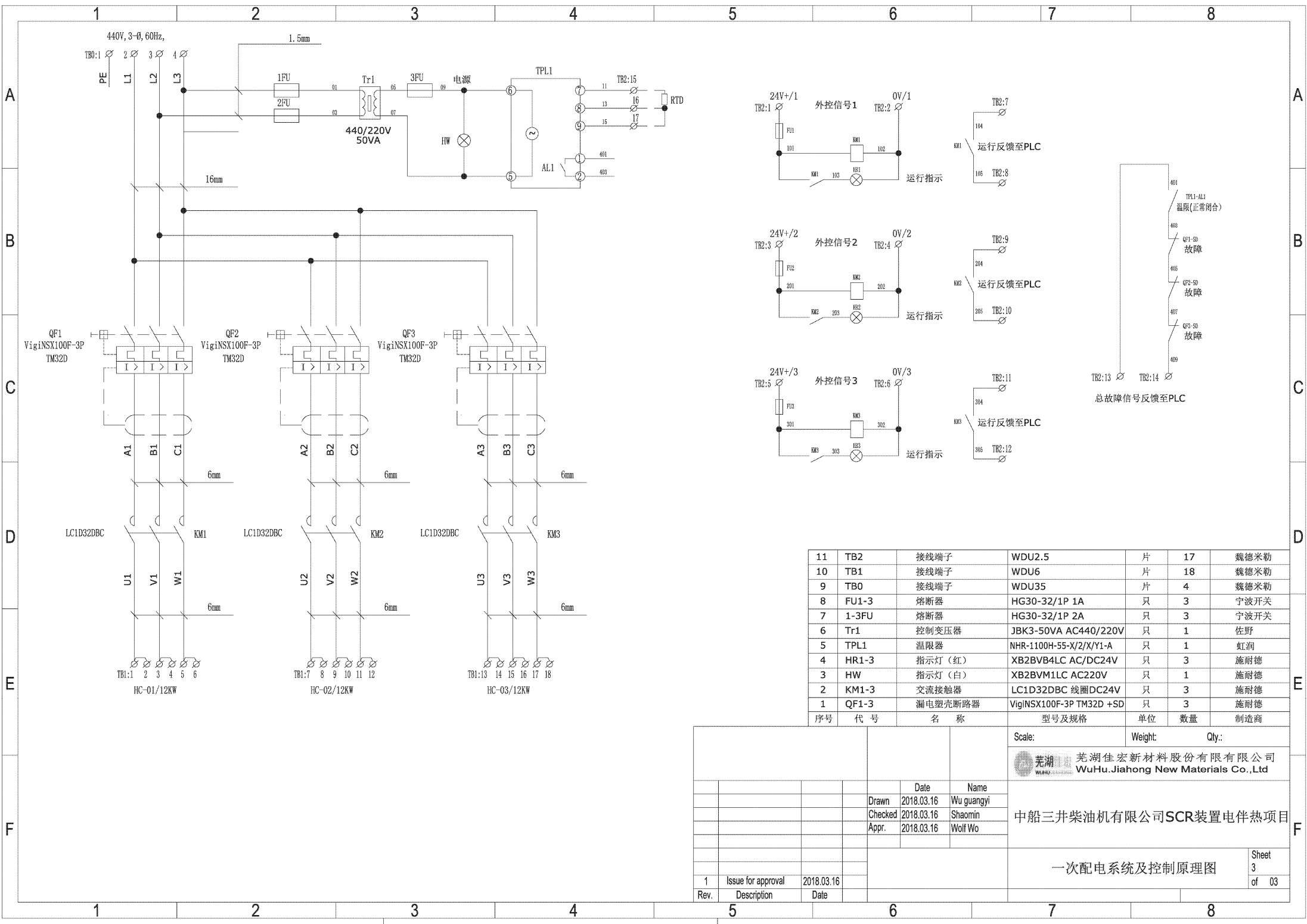
 芜湖佳宏新材料股份有限公司 WuHu. Jiahong New Materials Co., Ltd									
使用单位		沪东重机有限公司				工程名称		中船三井柴油机有限公司 锅炉电伴热项目	
校核				审核				电伴热带敷设示意图	
设计				审查					
日期		2018.01.06		比例					
图号								数量	



说明:

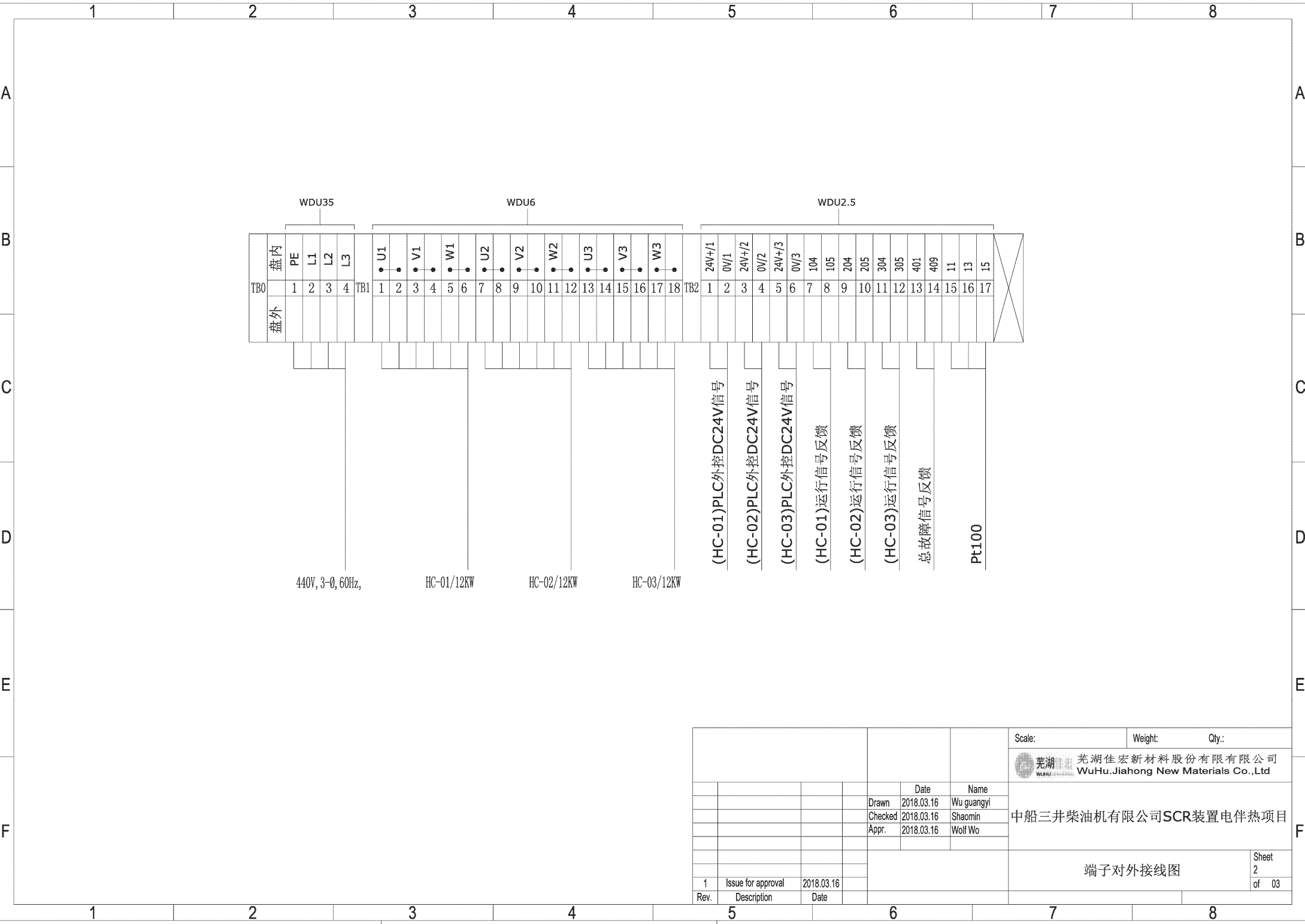
- 1.箱体冷轧钢板制作,板厚2.0MM
- 2.进出线配金属非铠格兰头,材质:铜镀镍
- 3.颜色:按用户色板
- 4.数量:1台

						Scale:		Weight:		Qty.:		
								芜湖佳宏新材料股份有限公司 WuHu.Jiahong New Materials Co.,Ltd				
					Date	Name						
				Drawn	2018.03.16	Wu guangyi						
				Checked	2018.03.16	Shaomin						
				Appr.	2018.03.16	Wolf Wo						
						中船三井柴油机有限公司SCR装置电伴热项目						
1	Issue for approval	2018.03.16				外形布置图						Sheet 1
Rev.	Description	Date										of 03

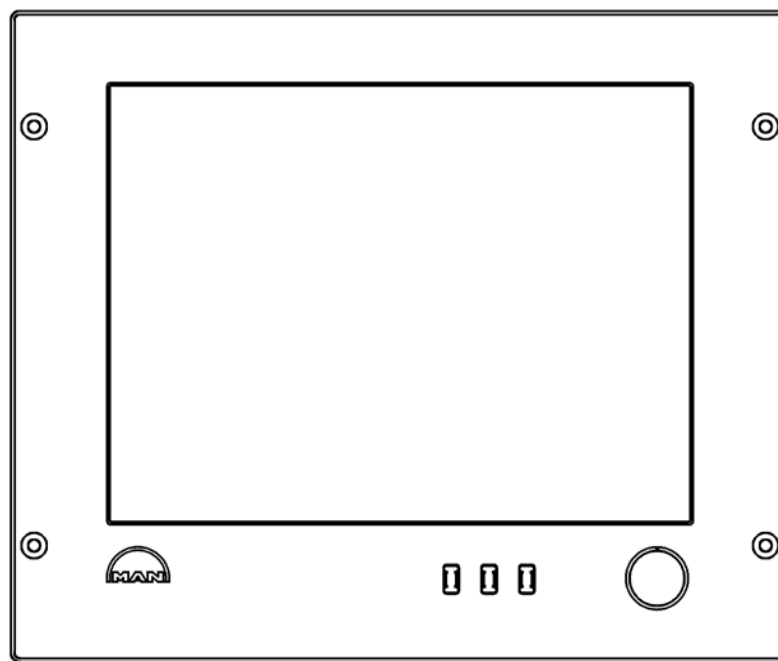
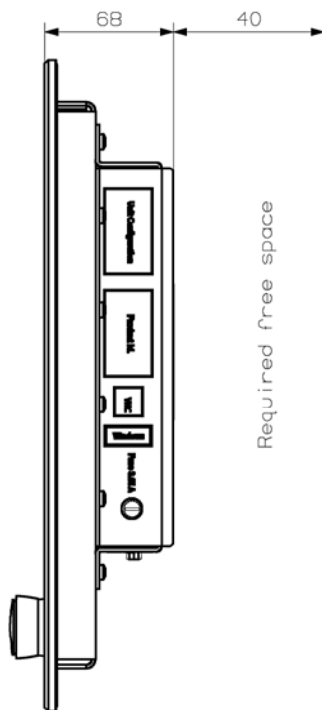


11	TB2	接线端子	WDU2.5	片	17	魏德米勒
10	TB1	接线端子	WDU6	片	18	魏德米勒
9	TB0	接线端子	WDU35	片	4	魏德米勒
8	FU1-3	熔断器	HG30-32/1P 1A	只	3	宁波开关
7	1-3FU	熔断器	HG30-32/1P 2A	只	3	宁波开关
6	Tr1	控制变压器	JBK3-50VA AC440/220V	只	1	佐野
5	TPL1	温限器	NHR-1100H-55-X/2/X/Y1-A	只	1	虹润
4	HR1-3	指示灯 (红)	XB2BVB4LC AC/DC24V	只	3	施耐德
3	HW	指示灯 (白)	XB2BVM1LC AC220V	只	1	施耐德
2	KM1-3	交流接触器	LC1D32DBC 线圈DC24V	只	3	施耐德
1	QF1-3	漏电塑壳断路器	VigiNSX100F-3P TM32D +SD	只	3	施耐德
序号	代号	名称	型号及规格	单位	数量	制造商

Scale:			Weight:		Qty.:	
Date			Name			
Drawn 2018.03.16			Wu guangyi			
Checked 2018.03.16			Shaomin			
Appr. 2018.03.16			Wolf Wo			
中船三井柴油机有限公司SCR装置电伴热项目						
一次配电系统及控制原理图						
Sheet 3 of 03						



						Scale:		Weight:		Qty.:	
						 芜湖佳宏新材料股份有限公司 WuHu.Jiahong New Materials Co.,Ltd					
					Date	Name		中船三井柴油机有限公司SCR装置电伴热项目			
				Drawn	2018.03.16	Wu guangyi					
				Checked	2018.03.16	Shaomin					
				Appr.	2018.03.16	Wolf Wo					
								端子对外接线图			
1	Issue for approval	2018.03.16						Sheet 2			
Rev.	Description	Date						of 03			



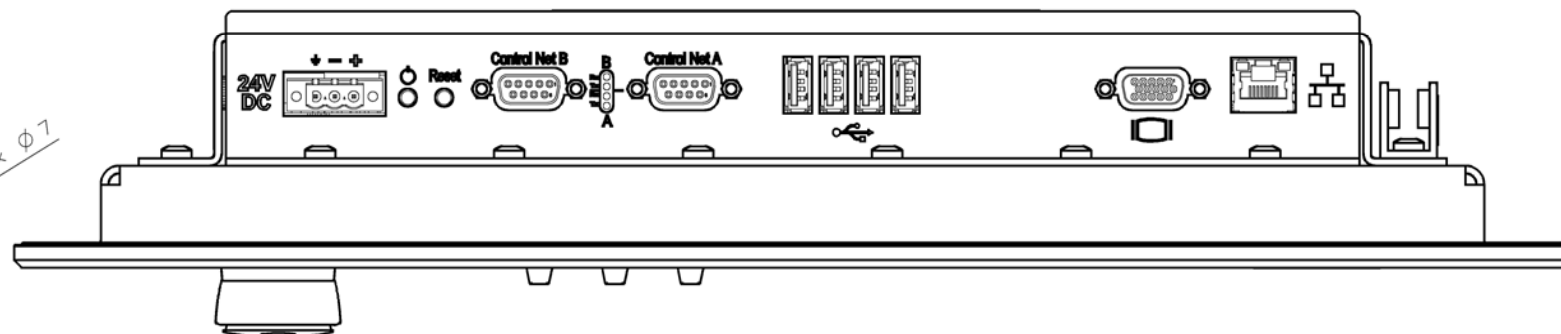
125 Make: 1421
455 Type: EC-MOP complete
15" display with touch

Specifications:
Processor: Intel Atom D2550
Chipset: NM10
Harddisk: Flash drive 64GB (SSD)
RAM: 4 GB
USB: 7 x USB 2.0 (3 on front)
Ethernet: 1 x GB Ethernet controller
ArcNet: Integrated 2 channel ARCNET controller
External graphics: 1 x VGA + 1 x DVI-D
Internal display: 15 inch TFT fully dimmable

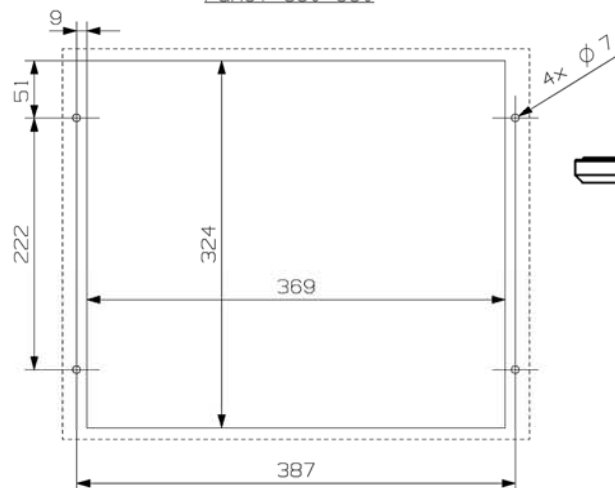
Power supply: 24 VDC -25% / + 30% (18-31.2 VDC)
Polarity protected
Fuse: 3.15 A
Power consumption: 25 W typical

Included:
Manual
USB stick with recovery image
PS2 to USB adapter
Mounting screws
Power connector
Arcnet connectors

Connections



Panel cut-out



Date	Des.	Chk.	APPD.	A.C.	Revision change	CSD No.	Rev.
20170811	邱斌斌	宁军			根据 1883468 - 1.3 升级		03
20160531	侯杰	宁军			根据 1883468 - 1.2 升级		02
20160107	侯杰	宁军			根据 1883468 - 1.1 转化		01
Basic Standards (MBO 501)					similar Drawing No.1		
EN801M-02 Welding							
EN21F-m Tolerances							
Material / Blank:					Final User Material:		Mass (kg):
Scale:	Size:	Product Type:			Page No.1	Projection:	
	A2	EC-MOP			(		
Info. No.1	Item Name:			MAIN OPERATION PANEL		Item Id.1	1883468-1
Final User Info. No.1	Final User Description:			电脑		Final User Ident. No.1	3H-22059
621H							

2016
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do not connect to power - US Drawing



安庆船用电器有限责任公司

ANQING MARINE ELECTRIC DEVICE CO., LTD

ERCS POWER SUPPLY

减排控制系统不间断电源

5654261-3.2

Type: AD-UPS400-1

型号: AD-UPS400-1



ADD: 3.9 Square Kilometer Industrial Park In AnQing
Economic and Technical Development Zone.

地址: 安徽省安庆市经济技术开发区3.9平方工业园三城寺路

Tel 电话: +86-556-5315485

Fax 传真: +86-556-5311583

Postal 邮编: 246005

E-mail: aq485jyb@163.com

D/E NO. (机型): 6G50ME-C9.5-HPSCR

Hull NO. (船号):

Shipyard:

船 厂:

D/E Maker:

柴油机制造商:

Class 船级社:

Designed 设 计	陈义依	2018-4-3						
Checked 校 对	徐文涛	2018-4-3						
Confirmed 审 核	陈义依	2018-4-3						
Approved 批 准	陈义依	2018-4-3	ReV. 标记	Modif. 修改原因	Qty 数量	Name 姓 名	Date 日期	
Drg. No. 图 号		AD5654261-3.2						
					Page 第 1 页	Total 共 12 页		

1		2		3		4		5		6		7		8	
NO. 序号		DRG. 图 号		NAME 名 称		PAGE 页 码		REMARK 备 注							
A	1	AD5654261-3. 2		COVER 封面		1									
	2	AD5654261-3. 2-10		Contents 目录		2									
	3	AD5654261-3. 2-20		ERCS Power supply outline diagram ERCS 电源外形图		3									
B	4	AD5654261-3. 2-30		ERCS UPS PRINCIPLE DIAGRAM ERCS UPS原理图		4									
	5	AD5654261-3. 2-31		ERCS UPS PRINCIPLE DIAGRAM ERCS UPS 原理图		5									
	6	AD5654261-3. 2-32		ERCS UPS PRINCIPLE DIAGRAM ERCS UPS 原理图		6									
	7	AD5654261-3. 2-33		ERCS UPS PRINCIPLE DIAGRAM ERCS UPS 原理图		7									
C	8	AD5654261-3. 2-34		External Interface Diagram 外部接线图		8									
	9	AD5654261-3. 2-40		Chinese Elements List 1 中文元件清单1		9									
	10	AD5654261-3. 2-41		Chinese Elements List 2 中文元件清单2		10									
	11	AD5654261-3. 2-42		English Elements List 1 英文元件清单1		11									
D	12	AD5654261-3. 2-43		English Elements List 2 英文元件清单2		12									
E															
F															

Rev. 标记		Modif. 修改原因		Qty. 数量		Name 姓名		Date 日期		Power Supply For ERCS				Contents						=		PAGE 2	
DESIGNED 设计		陈文永		CONFIRMED 审核		陈文永		2017-3-28		ERCS UPS电源		安庆船用电器有限责任公司		目录						+		第 2 页	
CHECKED 校对		陈文永		APPROVED 批准		陈文永		2017-3-28				ANQING MARINE ELECTRIC DEVICE CO., LTD				Drg. No. 图 号		AD5654261-3. 2-10				TOTAL: 12	
																						共 12 页	

1		2		3		4		5		6		7		8	
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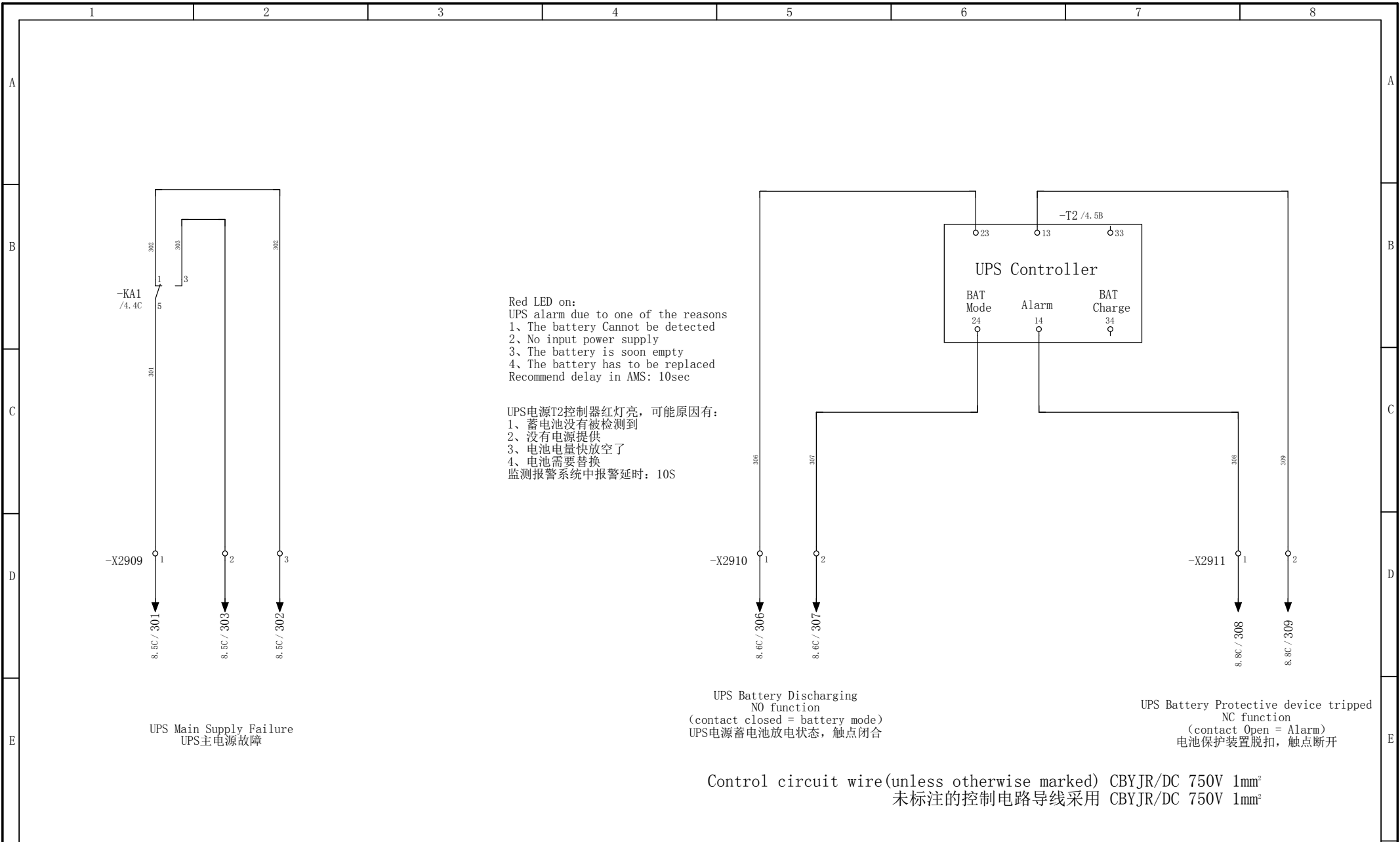
1		2		3		4		5		6		7		8	
NO.		Mark		Name		Desc. &Spec									
1				Nameplate 铭牌		-ERCS Emission reduction control system									
2		P1		Ammter "Output Current" 输出电流表		F96-DCB CL1.5 DC0-20A									
3		P2		Voltmeter "Output Voltage" 输出电压表		F96-DCB CL1.5 DC0-50V									
4		H1		Indicating Light "24VDC ON" 24VDC接通指示灯		XB4BVB3C BL 绿色									
5		H3		Indicating Light "230AC ON" 230VAC接通指示灯		XB4BVB3C BL 绿色									
6		QS1		"MAIN SWITCH" 主开关		P1-25/EA/SVB/HI11									
7		M1		Fan and Filter 风扇和过滤器		FU-9803C									
8		M1-1		Inlet Foltter 进风过滤器		FU-9803A									
9		FP		FACTORY PLATE 厂牌											
10		T1		Power supply unit AC-DC 整流电源 AC-DC		QUINT-PS/1AC/24DC/20									
11		T2		Uninterruptible power supply 不间断电源		QUINT-UPS/24DC/24DC/20									
12		T101-T107		DC-DC Converter DC-DC 转换器		QUINT-PS/24DC/24DC/10									
13		QF1-QF3		Minitype Breaker 小型断路器		5SY6210-2 B10									
14		QF101-QF107		Minitype Breaker 小型断路器		5SY6216-2 B16									
15		KA1、KA3		Relay 中间继电器		LY2NJ									
16		KT2		Time Relay 时间继电器		H3Y-2									
17		X0		Terminal 接线端子		PT6-TWIN									
18		X1、X2		Terminal 接线端子		PT2.5-TWIN									
19		T3		Battery 蓄电池		UPS-BAT/VRLA/24DC/12AH									
20		R3		Current Divider 电流分配器		DC0-20A 20A/75mV									

BOTTOM VIEW	

W*H*D:600*1200*600 (mm)	
Base H:100 (mm)	

Rev. 标记		Modif. 修改原因		Qty. 数量		Name 姓名		Date 日期		Power Supply For ERCS ERCS UPS电源		 安庆船用电器有限责任公司 ANQING MARINE ELECTRIC DEVICE CO., LTD		ERCS Power supply outline diagram ERCS 电源外形图		Drg. No. 图 号		AD5654261-3. 2-20		= PAGE 3 + 第 3 页 TOTAL: 12 共 12 页	
DESIGNED 设计		陈文永		CONFIRMED 审核		江小虎		2018-4-3													
CHECKED 校对		徐文涛		APPROVED 批准		陈若心		2018-4-3													

1		2		3		4		5		6		7		8	
---	--	---	--	---	--	---	--	---	--	---	--	---	--	---	--



Red LED on:
UPS alarm due to one of the reasons
1、The battery Cannot be detected
2、No input power supply
3、The battery is soon empty
4、The battery has to be replaced
Recommend delay in AMS: 10sec

UPS电源T2控制器红灯亮，可能原因有：
1、蓄电池没有被检测到
2、没有电源提供
3、电池电量快放空了
4、电池需要替换
监测报警系统中报警延时：10S

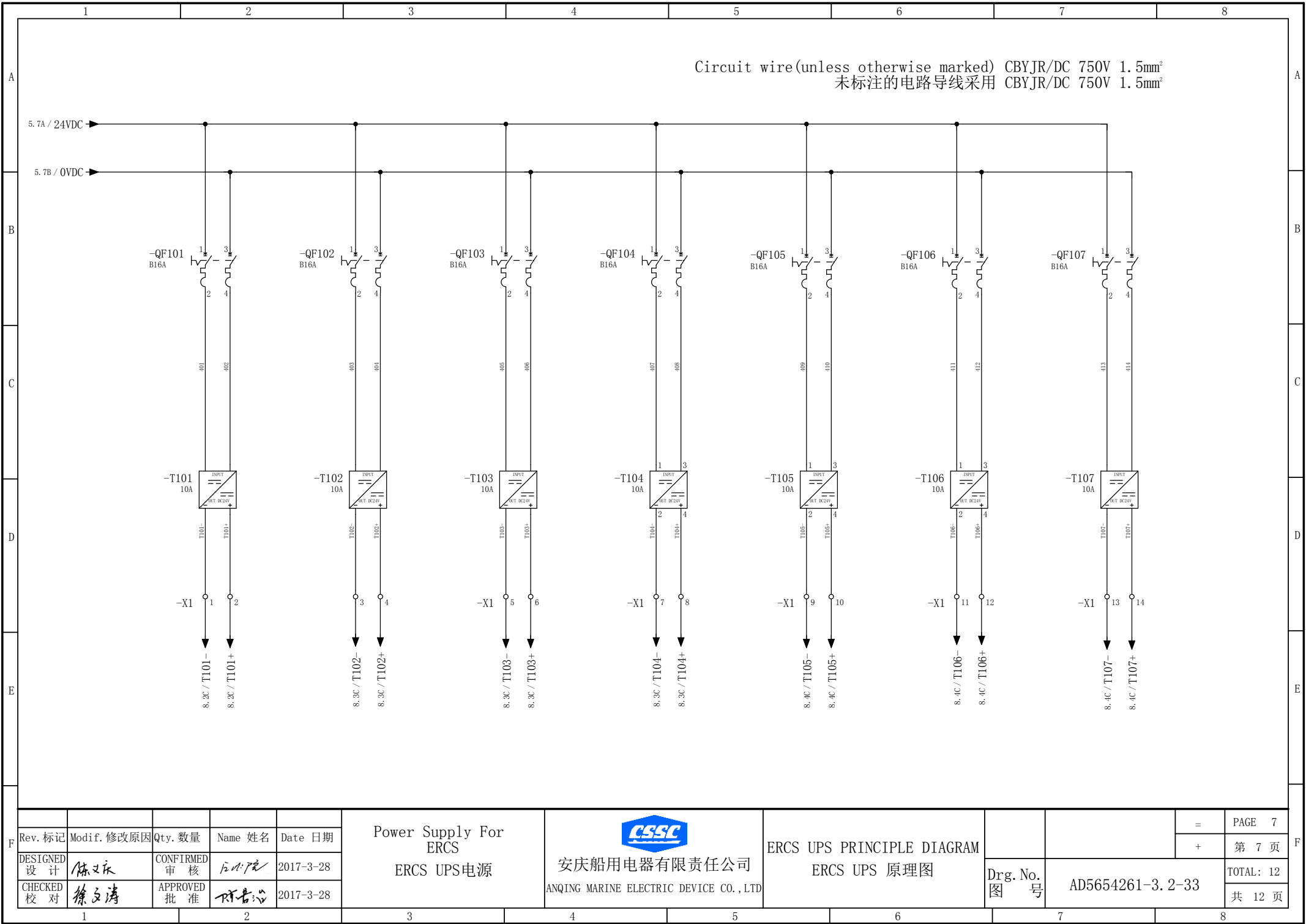
UPS Main Supply Failure
UPS主电源故障

UPS Battery Discharging
NO function
(contact closed = battery mode)
UPS电源蓄电池放电状态，触点闭合

UPS Battery Protective device tripped
NC function
(contact Open = Alarm)
电池保护装置脱扣，触点断开

Control circuit wire(unless otherwise marked) CBYJR/DC 750V 1mm²
未标注的控制电路导线采用 CBYJR/DC 750V 1mm²

						Power Supply For ERCS ERCS UPS电源	 安庆船用电器有限责任公司 ANQING MARINE ELECTRIC DEVICE CO., LTD	ERCS UPS PRINCIPLE DIAGRAM ERCS UPS 原理图			=	PAGE 6
Rev. 标记	Modif. 修改原因	Qty. 数量	Name 姓名	Date 日期						+	第 6 页	
DESIGNED 设计	陈义永	CONFIRMED 审核	江小虎	2017-3-29						TOTAL: 12		
CHECKED 校对	徐文涛	APPROVED 批准	陈若心	2017-3-29						共 12 页		



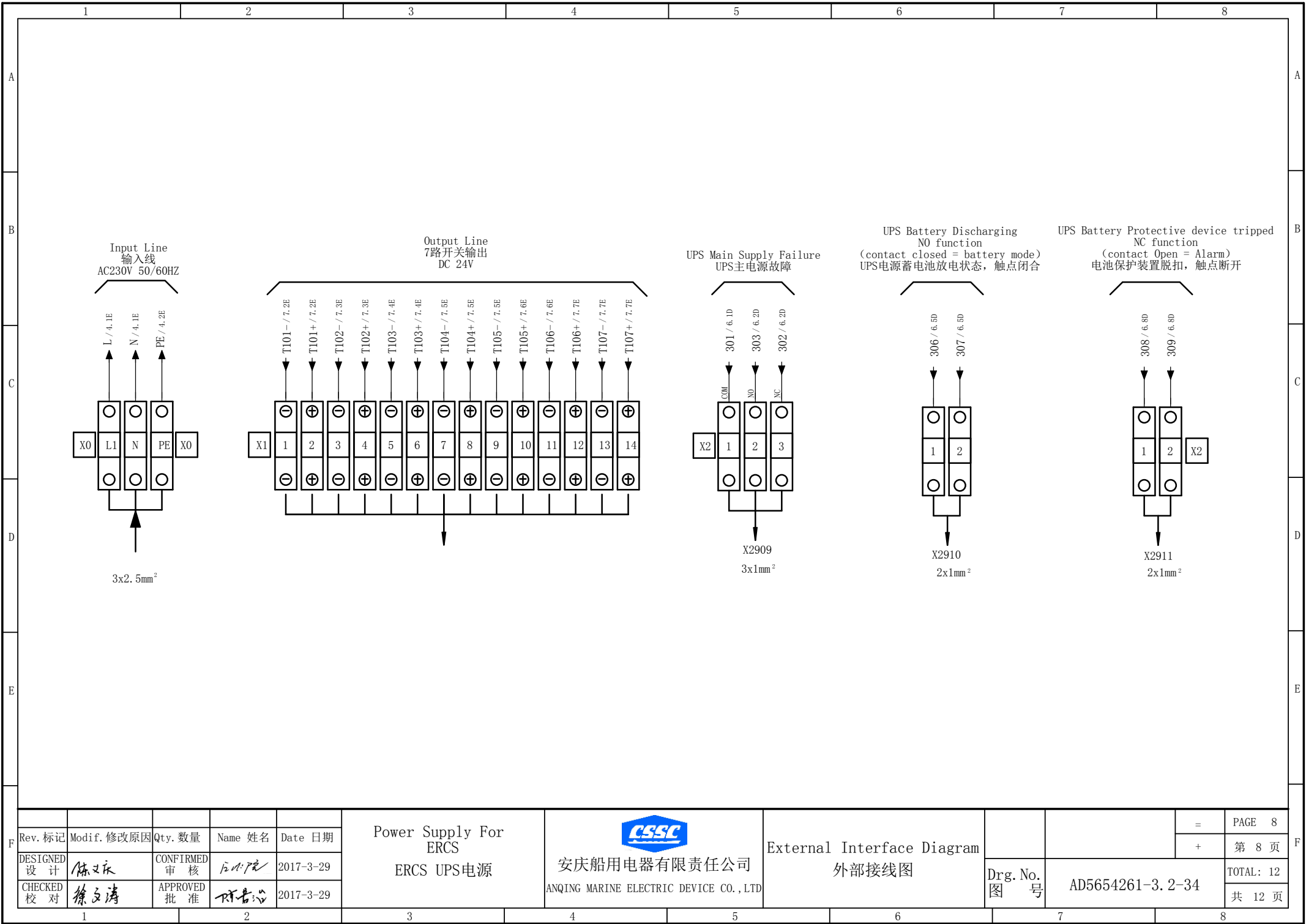
Rev. 标记	Modif. 修改原因	Qty. 数量	Name 姓名	Date 日期
DESIGNED 设计	陈文永	CONFIRMED 审核	陈文永	2017-3-28
CHECKED 校对	徐文清	APPROVED 批准	陈文永	2017-3-28

Power Supply For
ERCS
ERCS UPS电源



ERCS UPS PRINCIPLE DIAGRAM
ERCS UPS 原理图

		=	PAGE 7
		+	第 7 页
Drg. No. 图 号	AD5654261-3. 2-33	TOTAL: 12	
		共 12 页	



1		2		3		4		5		6		7		8										
序号		代号		名称		型 号 规 格		技术参数		备 注		数 量		制 造 商										
A	1	H1		指示灯		XB2BVB3LC		GRN 绿色		AC/DC24V 绿色		1		施耐德										
	2	H3		指示灯		XB2BVB3LC		GRN 绿色		AC/DC24V 绿色		1		施耐德										
	3	KA1		中间继电器		LY2NJ		DC24V		配PTF08A-E插座及固定卡		1		欧姆龙										
	4	KA3		中间继电器		LY2NJ		DC24V		配PTF08A-E插座及固定卡		1		欧姆龙										
B	5	KT2		时间继电器（通电）		H3Y-2		DC24V		1-10s		1		欧姆龙										
	6	KT2-1		时间继电器插座及固定配件		PYF08A				配 H3Y-2		1		欧姆龙										
	7	M1		通风过滤网组		FU-9803C		DC24/3. 6w		配过滤网组件		1		上海卡固										
	8	M1-1		过滤网组件		FU-9803A				外形尺寸：148. 5x148. 5		1		上海卡固										
C	9	P1		直流电流表		F96-DCB（AMMETER）20A		0-20A				1		上海怡泰仪表有限公司										
	10	P2		直流电压表		F96-DCB（VOLTMETER）		0-40VDC		1. 5级		1		上海怡泰仪表有限公司										
	11	QF1		小型断路器		5SY6210-2		B10A		2P B10A		1		西门子										
	12	QF2		小型断路器		5SY6210-2		B10A		2P B10A		1		西门子										
D	13	QF3		小型断路器		5SY6210-2		B10A		2P B10A		1		西门子										
	14	QF101		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
	15	QF101-1		汇流条（微型断路器用）		5ST3705				Cu 80A、2P、1m 配端盖5ST3750		1		西门子										
	16	QF102		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
E	17	QF103		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
	18	QF104		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
	19	QF105		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
	20	QF106		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
F	21	QF107		小型断路器		5SY6216-2		B16A		2P B16A		1		西门子										
	22	QS1		负荷开关		P1-25/EA/SVB/HI11		25A				1		穆勒电气有限公司										
	23	R1		分流器		0-100A/75mV		20A/75mV		配F96-DCB电流表		1		上海怡泰仪表有限公司										
	24	T1		开关电源		QUINT-PS/1AC/24DC/20		20A		AC-DC		1		菲尼克斯										
G	25	T2		UPS-IQ不间断电源		QUINT-UPS/24DC/24DC/20		20A				1		菲尼克斯										
	26	T3		蓄电池		QUINT-BAT/24DC/12AH		DC24V 12Ah				1		菲尼克斯										
	27	T101		QUINT DC/DC变换器		QUINT-PS/24DC/24DC/10		10A				1		菲尼克斯										
	28	T102		QUINT DC/DC变换器		QUINT-PS/24DC/24DC/10		10A				1		菲尼克斯										
H	29	T103		QUINT DC/DC变换器		QUINT-PS/24DC/24DC/10		10A				1		菲尼克斯										
	30	T104		QUINT DC/DC变换器		QUINT-PS/24DC/24DC/10		10A				1		菲尼克斯										
I	Rev. 标记		Modif. 修改原因		Qty. 数量		Name 姓名		Date 日期		Power Supply For ERCS ERCS UPS电源		 安庆船用电器有限责任公司 ANQING MARINE ELECTRIC DEVICE CO., LTD		Chinese Elements List 1 中文元件清单1						=		PAGE 9	
	DESIGNED 设计		陈文永		CONFIRMED 审核		陈文永		2018-4-3												+		第 9 页	
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A	1	H1	INDICATING LAMP		XB4BVB3C		GRN 绿色		DC24V GRN		1	Schneider										
	2	H3	INDICATING LAMP		XB4BVB3C		GRN 绿色		DC24V GRN		1	Schneider										
	3	KA1	RELAY		LY2NJ		DC24V		For Socket Of PTF08A-E and Fix		1	OMRON										
	4	KA3	RELAY		LY2NJ		DC24V		For Socket Of PTF08A-E and Fix		1	OMRON										
B	5	KT2	TIME RELAY		H3Y-2		DC24V		1-10s		1	OMRON										
	6	KT2-1	RELAY SOCKET		PYF08A				FOR H3Y-2		1	OMRON										
	7	M1	Propeller Fan		FU-9803C		DC24/3.6w		For Inlet Filter		1	KaGu										
	8	M1-1	Filter net		FU-9803A				Boundary Dimension: 148.5x148.5		1	KaGu										
C	9	P1	AMMETER DC		F96-DCB (AMMETER) 20A		0-20A		CL.1.5 For Current Divider		1	SHANGHAI YITAI I&M Ltd										
	10	P2	VOLTMETER DC		F96-DCB (VOLTMETER)		0-40VDC		CL.1.5		1	SHANGHAI YITAI I&M Ltd										
	11	QF1	MINITYPE BREAKER		5SY6210-2		B10A		2P B10A		1	SIEMEN										
	12	QF2	MINITYPE BREAKER		5SY6210-2		B10A		2P B10A		1	SIEMEN										
D	13	QF3	MINITYPE BREAKER		5SY6210-2		B10A		2P B10A		1	SIEMEN										
	14	QF101	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
	15	QF101-1	Bus-Bar (MINITYPE BREAKER)		5ST3705				Cu 80A、2P、1m For End Cap to 5ST3750		1	Schneider										
	16	QF102	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
E	17	QF103	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
	18	QF104	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
	19	QF105	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
	20	QF106	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
F	21	QF107	MINITYPE BREAKER		5SY6216-2		B16A		2P B16A		1	SIEMEN										
	22	QS1	Break Switch		P1-25/EA/SVB/HI11		25A				1	Moeller										
	23	T1	Switch Power Supply		QUINT-PS/1AC/24DC/20		20A		AC-DC		1	PHOENIX CONTACT										
	24	T2	UPS-IQ (UPS Power Manage)		QUINT-UPS/24DC/24DC/20		20A				1	PHOENIX CONTACT										
G	25	T3	Battery		QUINT-BAT/24DC/12AH		DC24V 12Ah				1	PHOENIX CONTACT										
	26	T101	QUINT DC/DC Converter		QUINT-PS/24DC/24DC/10		10A				1	PHOENIX CONTACT										
	27	T102	QUINT DC/DC Converter		QUINT-PS/24DC/24DC/10		10A				1	PHOENIX CONTACT										
	28	T103	QUINT DC/DC Converter		QUINT-PS/24DC/24DC/10		10A				1	PHOENIX CONTACT										
H	29	T104	QUINT DC/DC Converter		QUINT-PS/24DC/24DC/10		10A				1	PHOENIX CONTACT										
	30	T105	QUINT DC/DC Converter		QUINT-PS/24DC/24DC/10		10A				1	PHOENIX CONTACT										
	Rev. 标记		Modif. 修改原因		Qty. 数量		Name 姓名		Date 日期		Power Supply For ERCS ERCS UPS电源		 安庆船用电器有限责任公司 ANQING MARINE ELECTRIC DEVICE CO., LTD		English Elements List 1 英文元件清单1		Drg. No. 图 号		AD5654261-3.2-42		PAGE 11	
	DESIGNED 设计		陈文永		CONFIRMED 审核		江小虎		2017-3-29												第 11 页	
CHECKED 校对		徐文涛		APPROVED 批准		陈若心		2017-3-29		TOTAL: 12 共 12 页												
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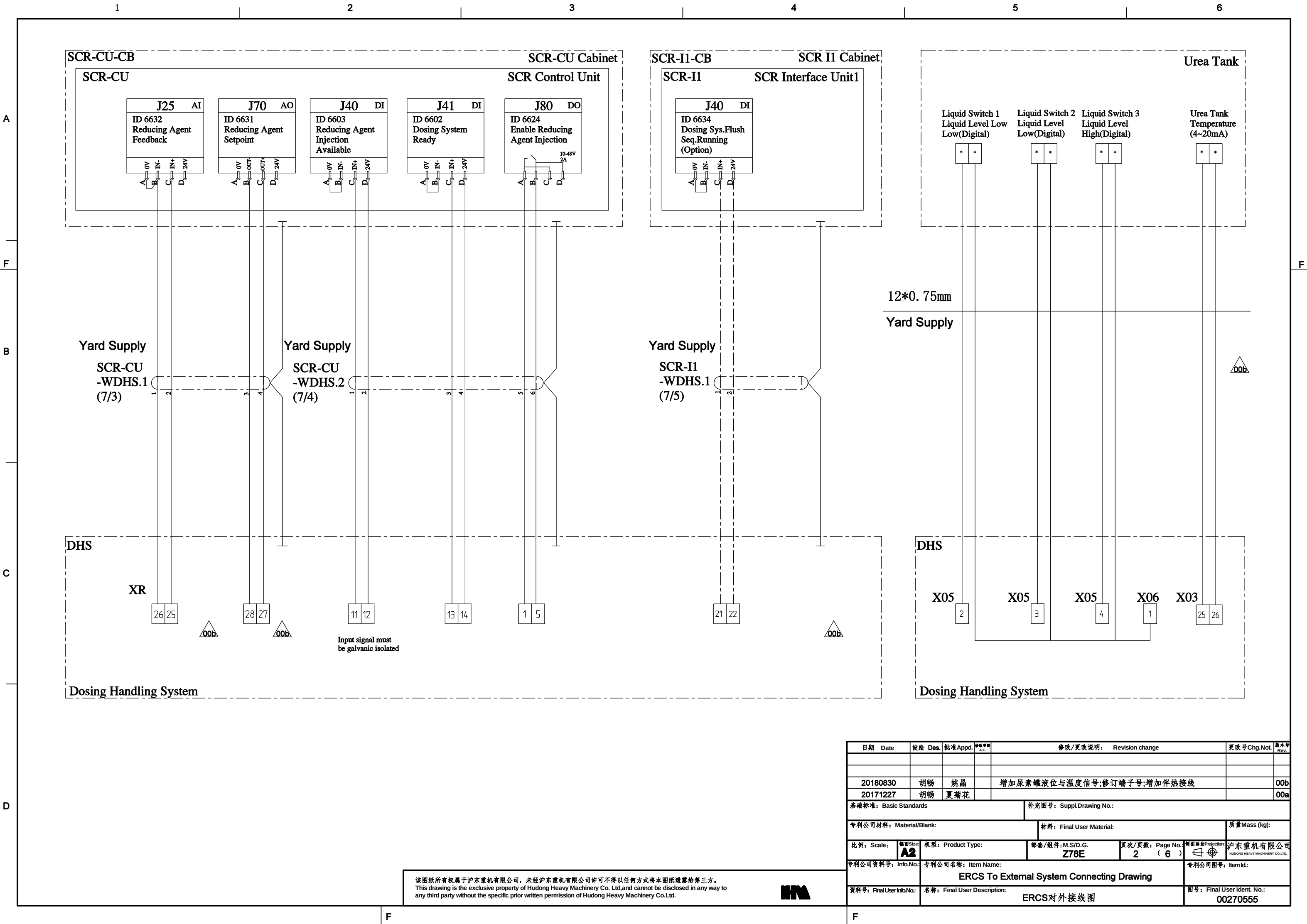
ERCS 对外接线图

ERCS To External System Connecting Drawing

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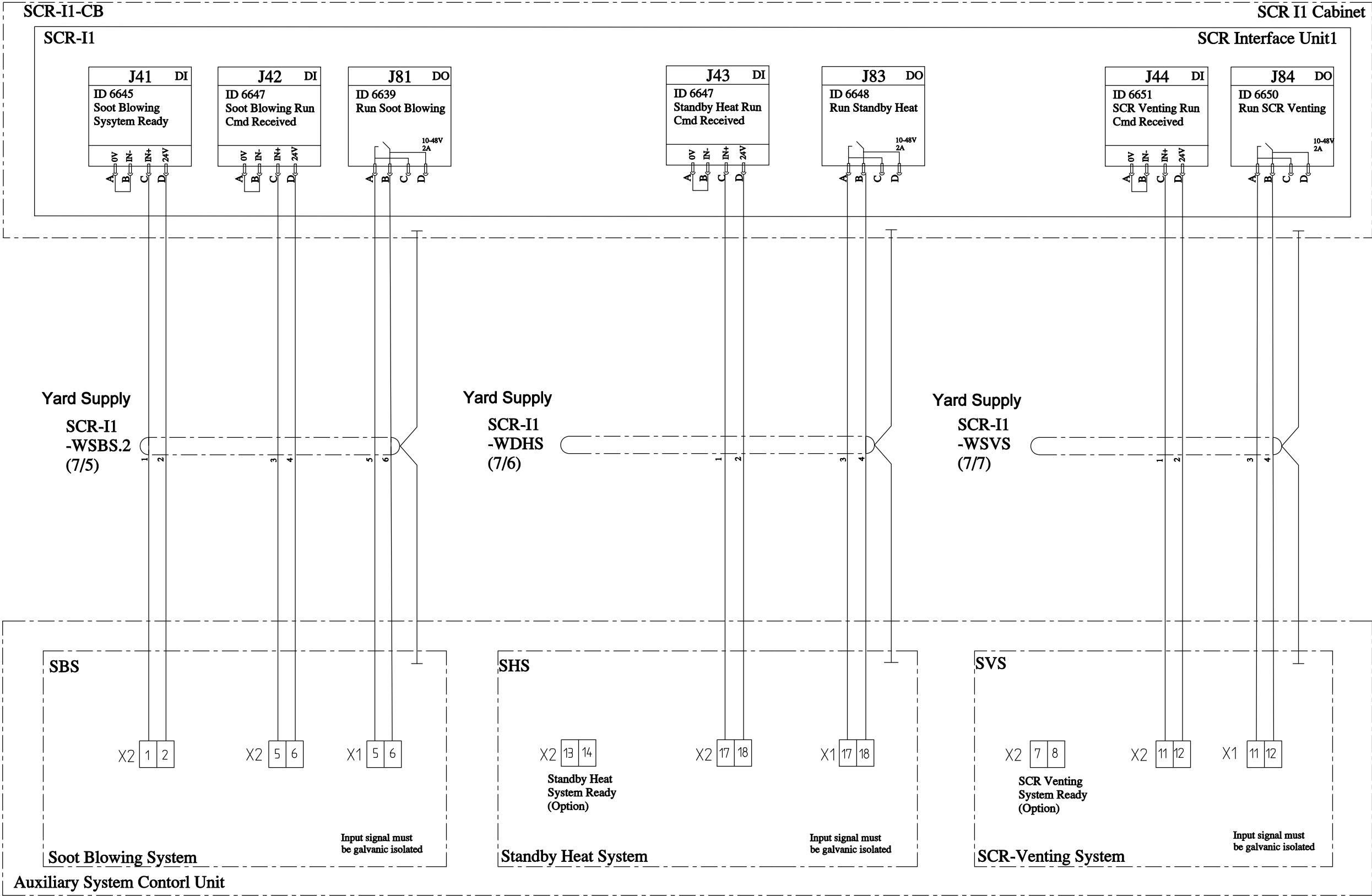
日期 Date	设计 Des.	批准 Appd.	修改/更改说明 Revision change	更改号 Chg.Not.	版本号 Rev.
20180830	胡畅	姚晶	增加尿素罐液位与温度信号;修订端子号;增加伴热接线		00b
20171227	胡畅	夏菊花			00a
基础标准: Basic Standards			补充图号: Suppl.Drawing No.:		
专利公司材料: Material/Blank:			材料: Final User Material:		质量Mass (kg):
比例: Scale:	幅面Size: A2	机型: Product Type:	部套/组件: M.S/D.G. Z78E	页次/页数: Page No. 1 (6)	制图标准Projection 沪东重机有限公司 HUDONG HEAVY MACHINERY CO.LTD.
专利公司资料号: Info.No.:	专利公司名称: Item Name: ERCS To External System Connecting Drawing			专利公司图号: Item Id.:	
资料号: Final User Info.No.:	名称: Final User Description: ERCS对外接线图			图号: Final User Ident. No.: 00270555	



日期 Date	设计 Des.	批准 Appd.	修改/更改说明: Revision change	更改号 Chg.Not.	版本号 Rev.
20180830	胡畅	姚晶	增加尿素罐液位与温度信号;修订端子号;增加伴热接线		00b
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专利公司资料号: Info.No.:		专利公司名称: Item Name: ERCS To External System Connecting Drawing			专利公司图号: Item Id.:
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20180830	胡畅	姚晶	增加尿素罐液位与温度信号;修订端子号;增加伴热接线		00b
20171227	胡畅	夏菊花			00a
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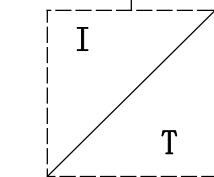
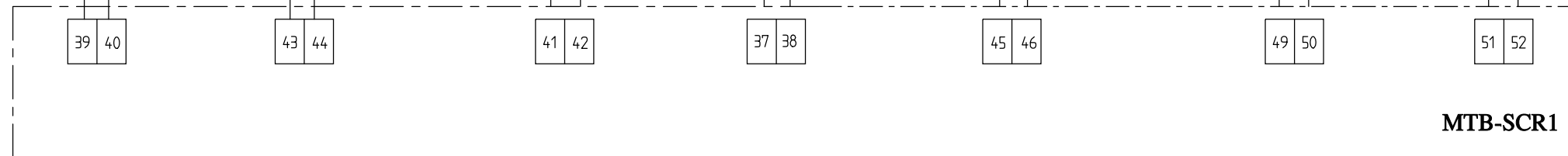
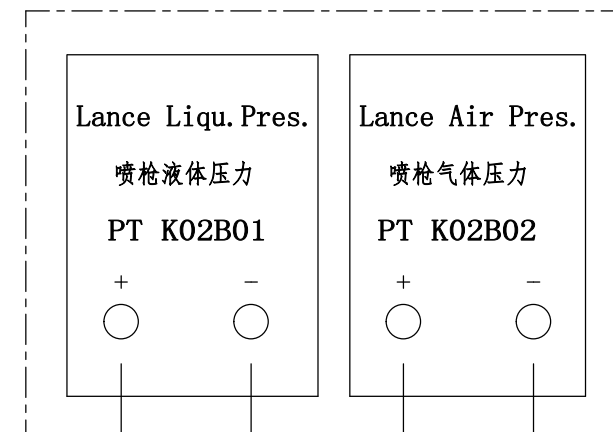
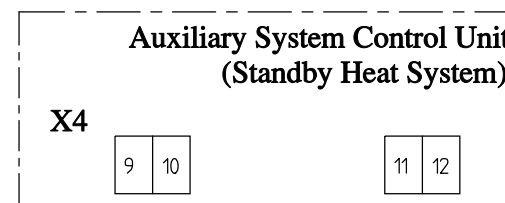
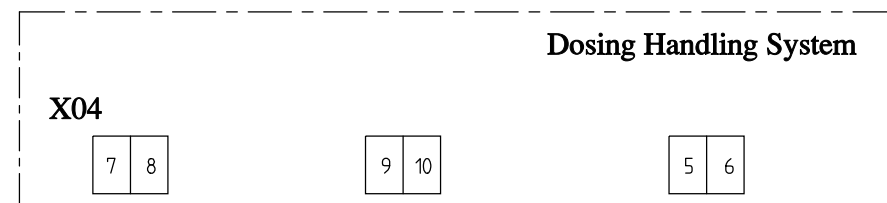
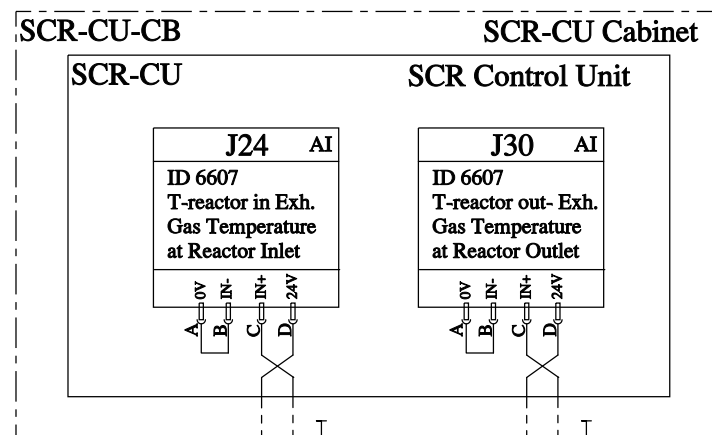
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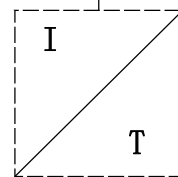
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Exh. gas temp. at reactor inlet

反应器进口废气温度

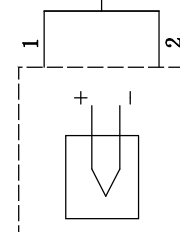
TT 6607



Exh. gas temp. at reactor outlet

反应器出口废气温度

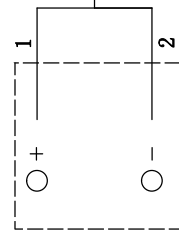
TT 6640



Exh. gas temp. at reactor inlet

反应器进口废气温度

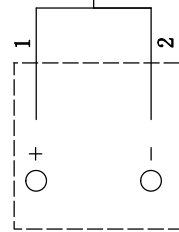
TT K01B01



Exh. gas press. at reactor inlet

反应器进口废气压力

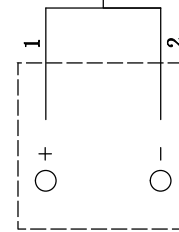
PT K01B03



Exh. gas diff. press. across the reactor

反应器进出口废气压差

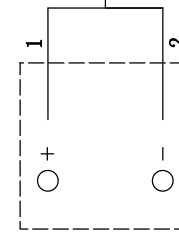
PDT K01B01



SCR Reactor Temperature

反应器温度

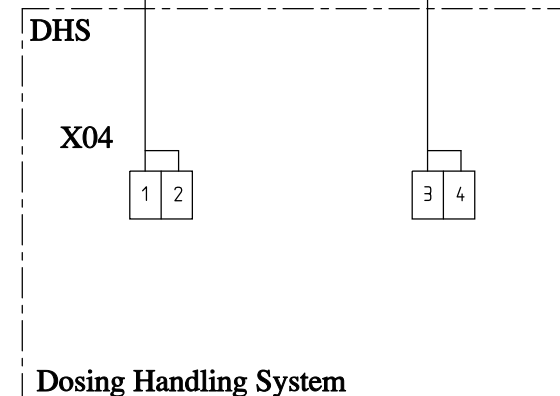
TT J74B01



SCR Reactor Temperature

反应器温度

TT J74B02



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HRA

日期 Date	设计 Des.	批准 Appd.	修改/更改说明: Revision change	更改号 Chg.No.	版本号 Rev.
20180830	胡畅	姚晶	增加尿素罐液位与温度信号;修订端子号;增加伴热接线		00b
20171227	胡畅	夏菊花			00a
基础标准: Basic Standards			补充图号: Suppl. Drawing No.:		
专利公司材料: Material/Blank:			材料: Final User Material:		质量 Mass (kg):
比例: Scale:	幅面 Size: A2	机型: Product Type:	部套/组件: M.S/D.G. Z78E	页次/页数: Page No. 4 (6)	制图/审核/投影: 沪东重机有限公司 HUdong HEAVY MACHINERY CO.LTD.
专利公司资料号: Info.No.:		专利公司名称: Item Name: ERCS To External System Connecting Drawing			专利公司图号: Item Id.:
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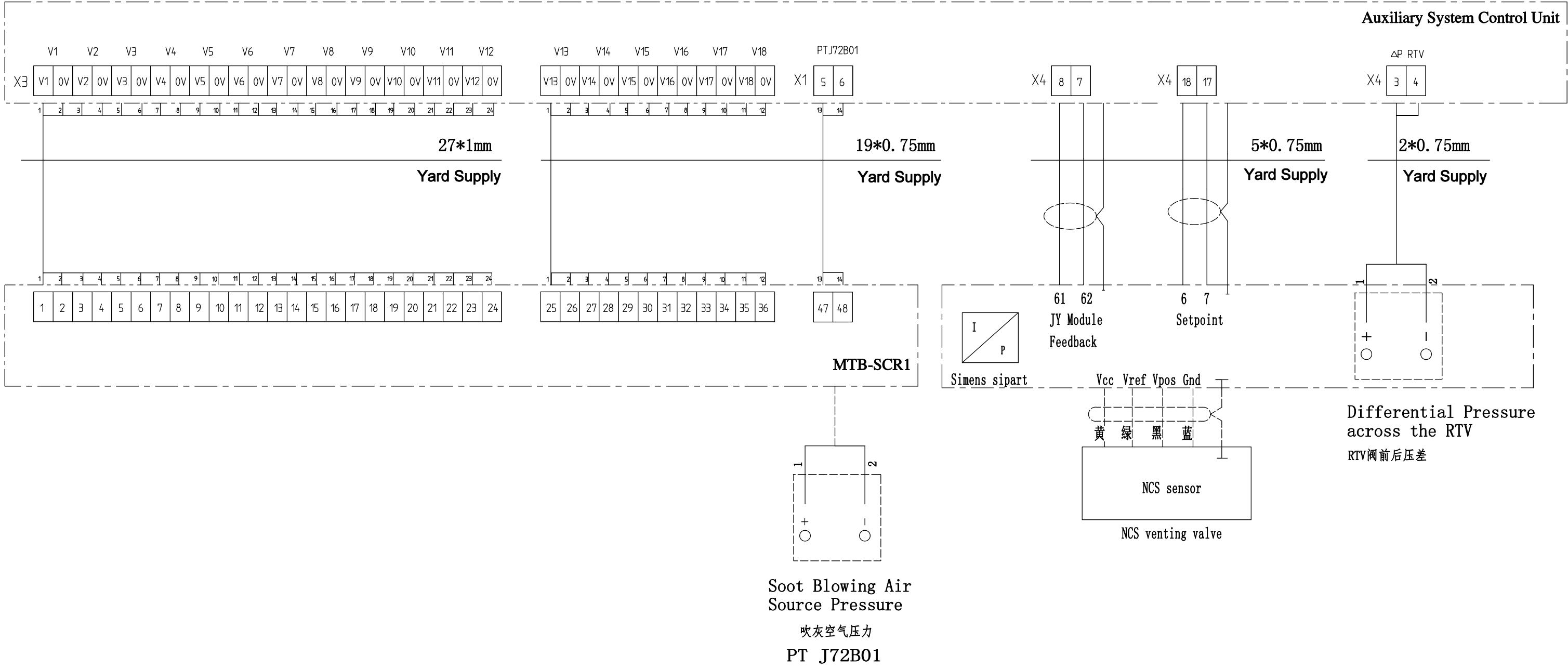
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F

B

C

D



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20171227	胡畅	夏菊花				00a
基础标准: Basic Standards			补充图号: Suppl. Drawing No.:			
专利公司材料: Material/Blank:			材料: Final User Material:			质量 Mass (kg):
比例: Scale:	幅面 Size: A2	机型: Product Type:	部套/组件: M.S/D.G. Z78E	页次/页数: Page No. 5 (6)	制图/审核: Projection	沪东重机有限公司 HUDONG HEAVY MACHINERY CO. LTD.
专利公司资料号: Info.No.:	专利公司名称: Item Name: ERCS To External System Connecting Drawing				专利公司图号: Item Id.:	
资料号: Final User Info.No.:	名称: Final User Description: ERCS对外接线图				图号: Final User Ident. No.: 00270555	

A

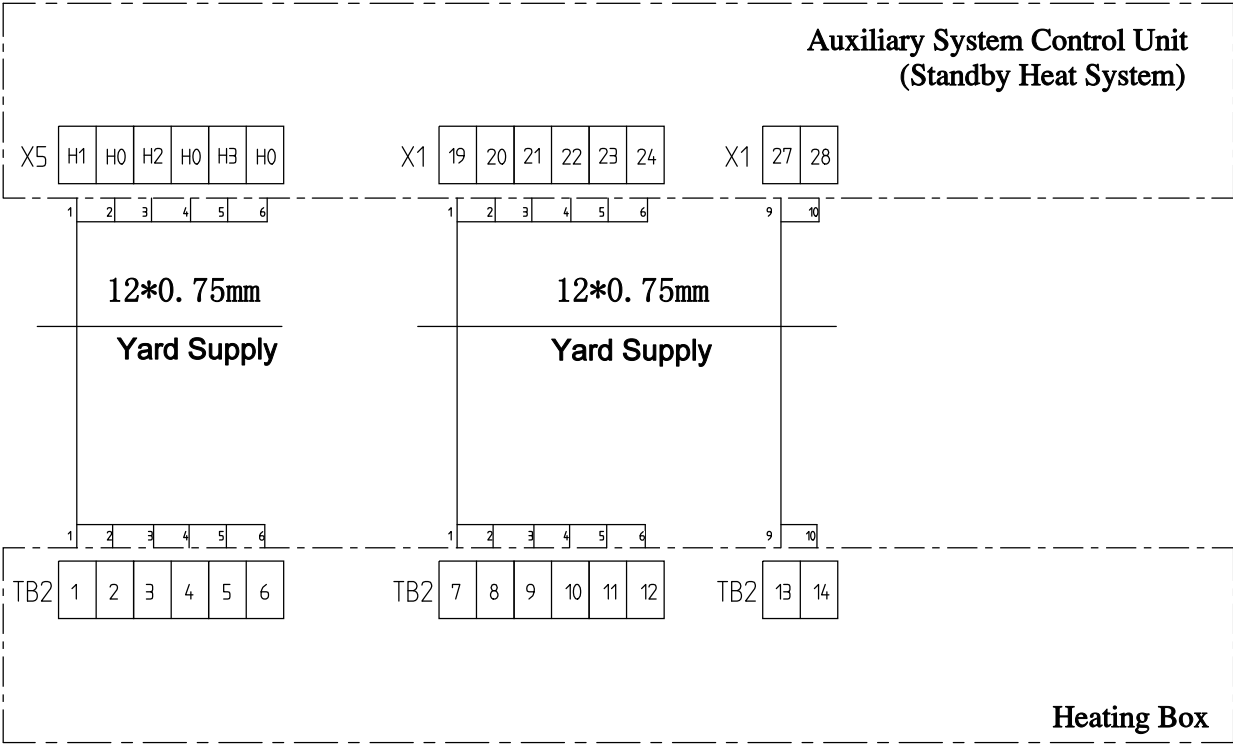
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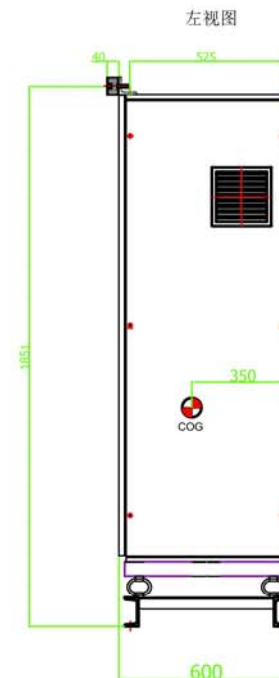
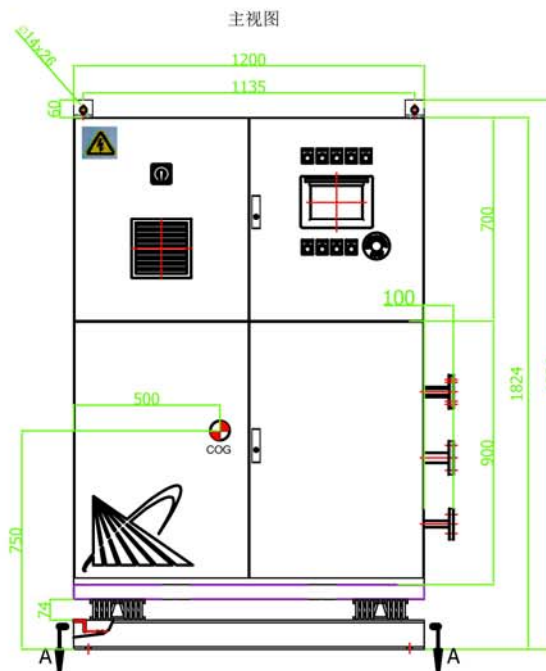
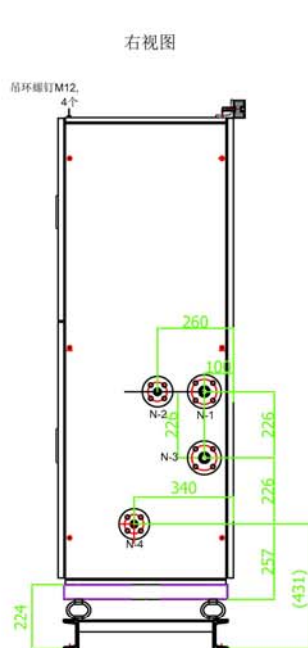
日期 Date	设计 Des.	批准 Appd.	审核 A.C.	修改/更改说明: Revision change	更改号 Chg.Not.	版本号 Rev.
20180830	胡畅	姚晶		增加尿素罐液位与温度信号;修订端子号;增加伴热接线		00b
20171227	胡畅	夏菊花				00a
基础标准: Basic Standards				补充图号: Suppl. Drawing No.:		
专利公司材料: Material/Blank:				材料: Final User Material:		质量 Mass (kg):
比例: Scale:	幅面 Size: A2	机型: Product Type:		部套/组件: M.S/D.G. Z78E	页次/页数: Page No. 6 (6)	制图/画法 Projection 沪东重机有限公司 HUDONG HEAVY MACHINERY CO. LTD.
专利公司资料号: Info.No.:		专利公司名称: Item Name: ERCS To External System Connecting Drawing				专利公司图号: Item Id.:
资料号: Final User Info.No.:		名称: Final User Description: ERCS对外接线图				图号: Final User Ident. No.: 00270555

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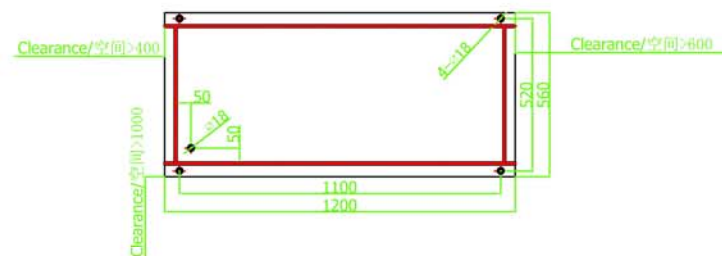
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文件说明 Document Remarks			机 型 Eng. Type		6G60 HP-SCR				
图纸目录: 1. SCR还原剂泵站 3H-27646.00 (SCR Reducing Agent Pump Station) 2. 混合器 3H-27804.00 (Static Mixing Assembly) 3. 喷枪 3H-27805.00 (The Injection lance) 4. 1/2"软管USS-IHAB-406B (Flexible Pipe 1/2") 5. 1"软管USS-IHAB-806B (Flexible Pipe 1") 6. SCR喷射系统接线图 (Wiring of SCR DHS)			台 份 Set No.		#44~#47				
			工程编号 Engine No.						
			船 厂 Shipyard		江苏新时代造船有限公司				
			船 号 Hull No.		311117-20				
			船级社 Classification Society		ABS				
			SCR尿素喷射系统 SCR Urea Injection System						
					00d				
					00c				
更新接线图					00b				
修 改 说 明 Corrected Description									
						00d			
						00c			
徐俊 20180827		侯春国 20180827				00b			
徐俊 20180312		侯春国 20180313				00a			
编 制 Compiled	校 对 Checked	审 核 Confirmed	审 定 Approved	会 签 Countersigned	批 准 Authorized	版本号 Rev.			
 沪 东 重 机 有 限 公 司 HUDONG HEAVY MACHINERY CO.,LTD.			文件编号 Document No.:				00278959		
			被替代文件编号 Replace No.				总 页 数 Total Pages	30	
			设计参考文件编号 Reference No.				页 数 Pages	1	

Plan History 文件说明		Engine Type 机型	通用		
		Engine No 工程编号	通用		
		Yard/Hull NO 船厂/船号	通用		
		Classification 船级社	通用		
SCR还原剂泵站					
					5
					4
					3
					2
					1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	耿直20171213		Drawing NO 图号	3H-27646	
Check 校对	朱向利20171213				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 2
Verify 审定			Reference 设计参考图号		
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					



A-A视图



Approved

subsupplier: Spraying Systems Co.

Teleph : 021-64828018

Fax : 021-64828019

Phone : 13916356559

E-mail : joe-zh@spray.com.cn

Website: www.spray.com.cn

Technical requirements

技术要求

1. Flow regulation range urea solution: 50-250L/h
尿素溶液流量控制范围 50-250L/h
2. Minimum pressure of inlet urea solution: 0 bar
入口尿素溶液最小压力 0 bar
3. Pump unit power requirements: 440V, 60Hz, 3Ph
泵组电源要求 440V, 60Hz, 3Ph
4. The pump group must have a standby pump
泵组必须备有备用泵

备注:

1. 设备使用环境温度: 5 - 40°C;
2. 起吊吊绳夹角建议60 - 90°;
3. 设备重量约300KG;

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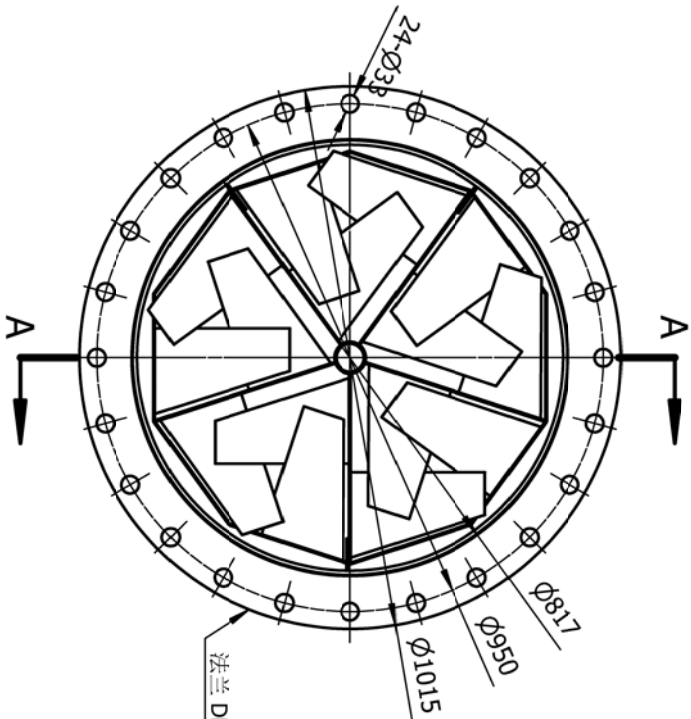
PROJECT No.

ECO No.

Port 接口	Nominal diameter 公称直径	Specification 连接标准	Connection 连接形式	Description 用途
N-1	DN25	法兰 DN25-PN16 PL FF I 316L GB/T9119	Flange 法兰	Air outlet 气出口
N-2	DN15	法兰 DN15-PN16 PL FF I 316L GB/T9119	Flange 法兰	Urea outlet 液体出口
N-3	DN25	法兰 DN25-PN16 PL FF I 316L GB/T9119	Flange 法兰	Air inlet 气进口
N-4	DN15	法兰 DN15-PN16 PL FF I 316L GB/T9119	Flange 法兰	Urea Intlet 液体进口

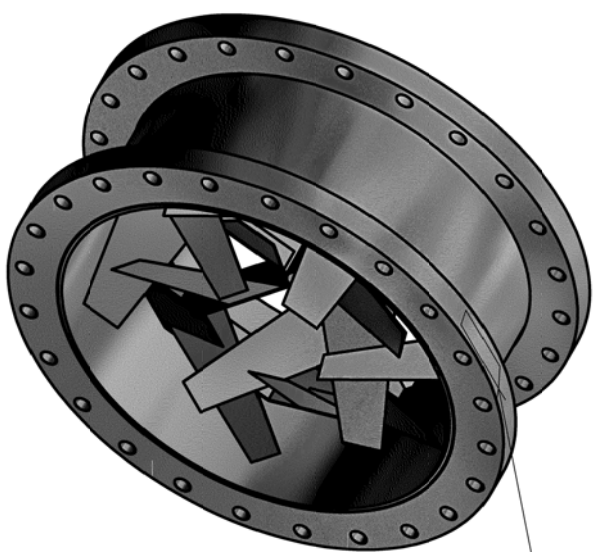
MATERIAL	DESCRIPTION
FINISH	SHIP ENGINE EXHAUST SCR UREA SPRAY
DO NOT SCALE DRAWING. WORK TO DIMENSIONS	
UNLESS OTHERWISE SPECIFIED: FIRST ANGLE	
ALL DIMENSIONS GIVEN IN MILLIMETERS.	
TOLERANCES	
WHOLE NUMBER	± 0.5
ONE PLACE DECIMALS	± 0.2
TWO PLACE DECIMALS	± 0.1
ANGULAR DECIMALS	± 3'
CONCENTRICITY	125 T.I.R.
SURFACE FINISH	125 OR BETTER
REMOVE ALL BURRS	
SCALE:	CHECKED BY: Laura
ENGINEER: Henry	APPROVED BY: William
DWG. NO.	USS-DA2-00
DATE: 2017/11/27	SHT. 1 OF 1 SIZE: A3

Plan History 文件说明		Engine Type 机型	通用		
		Engine No 工程编号	通用		
		Yard/Hull NO 船厂/船号	通用		
		Classification 船级社	通用		
STATIC MIXER ASSEMBLY 还原剂混合器					
					5
					4
					3
					2
					1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	耿直20171220		Drawing NO 图号	3H-27804	
Check 校对	杨恹峰20171220				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 2
Verify 审定			Reference 设计参考图号		
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					

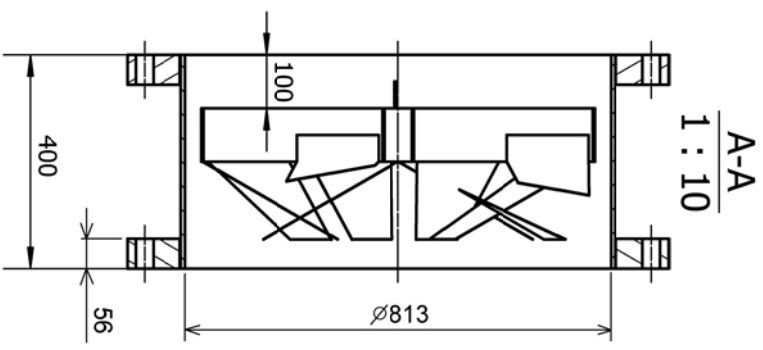


法兰 DN800 - PN10 PL FF I 316L GB/T9119

IMO钢印位置
IMO: 3H-27804
根据法兰厚度选择合适字高



适用环境:
最高耐温: 550℃
最高耐压: 10bar



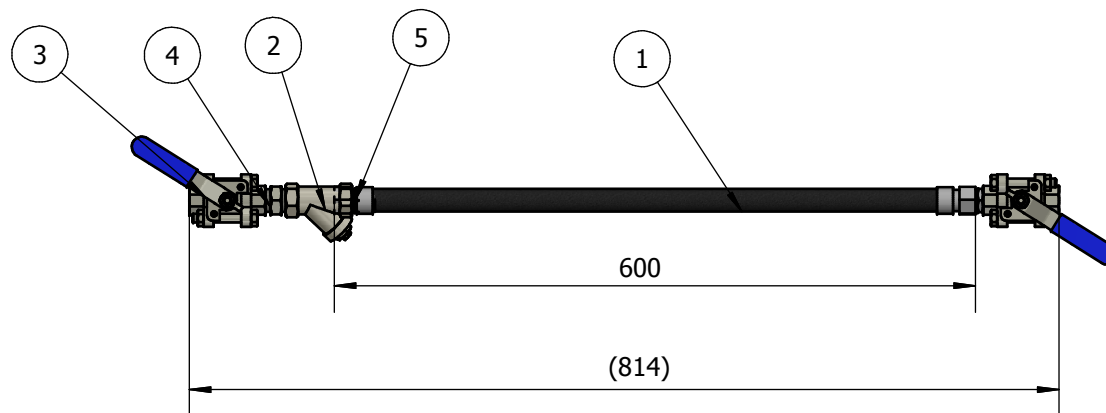
备注

混合器和管道内壁分别焊3个固定耳，用M12螺栓固定。

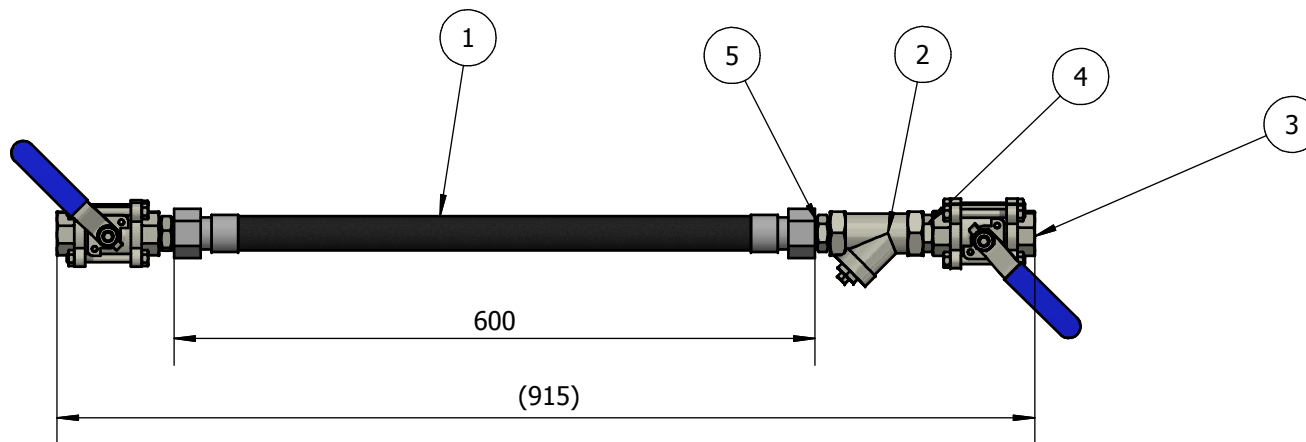
MATERIAL	Refer to parts	DRAWING NO.	STATIC MIXER ASSEMBLY USS-M008
FINISH	SEE PARTS	FOR ENGINE OFF GAS SCR	
DO NOT SCALE DRAWING. WORK TO DIMENSIONS. UNLESS OTHERWISE SPECIFIED: FIRST ANGULAR ALL DIMENSIONS GIVEN IN MILLIMETERS.			
TOLERANCES		SCALE: 1:10	
WHOLE NUMBER ± 0.5	ASSEMBLY DRILL, PLUNCH & COMMERCIAL STOCK SIZES NOT INCLUDED IN THE TOLERANCES.	CHECKED BY: Henry	
ONE PLACE DECIMALS ± 0.2		ENGINEER: William	
TWO PLACE DECIMALS ± 0.1		APPROVED BY: Bill	
ANGULAR DIMENSIONS ± 3°		DWG NO. USS-M008-00	
CONCENTRICITY ± 0.125 T.I.R.		DATE: 2017/8/31	
SURFACE FINISH 12.5 OR BETTER	REMOVE ALL BURRS	SHEET 1 OF 1	
		SIZE: A3	

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Plan History 文件说明		Engine Type 机型	通用		
		Engine No 工程编号	通用		
		Yard/Hull NO 船厂/船号	通用		
		Classification 船级社	通用		
SCR还原剂喷枪					
					5
					4
					3
					2
					1
Data 日期	Correct 修改	Check 校对	Description 修改说明		Rev. 版本
Design 编制	耿直20171220		Drawing NO 图号	3H-27805	
Check 校对	杨恹峰20171220				
Examine 审核			Replaced 被替代图号		Total 总页数(含封面) 2
Verify 审定			Reference 设计参考图号		
Countersign 会签			CSSC-MES Diesel Co.,Ltd 上海中船三井造船柴油机有限公司		
Approved 批准					



ITM	QTY	NUMBER	DESCRIPTION	MATL	DESC
1	1	FT00RUX015X03KK	橡胶软管, 1/2"(DN15), PN25, 长度0.6m, 接头304SS, BSPPF, 带钢丝加强, 提供船级社型式认可证书		Injector Hose Assembly (1/2")
2	1	VA00XC5011P2X2H	Y型单向阀, C501, 1/2", BSPT 内螺纹, 弹簧式, 软密封, 304SS		
3	2	VAXXAASDABTDTD1	球阀, 1/2", BSPT 内螺纹, 三片式, 带锁定手柄, 304SS		
4	1	PLXXTFSDAATDTD0	六角外丝, 1/2", BSPT, 304SS		
5	2	PL00TFSDX12XXXX	六角外丝转换接头, 1/2", G/BSPT, 304SS		
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				DO NOT SCALE DRAWING. WORK TO DIMENSIONS UNLESS OTHERWISE SPECIFIED: FIRST ANGLE ALL DIMENSIONS GIVEN IN MILLIMETERS.	
				TOLERANCES	 Spraying Systems Co.® (Shanghai) Co.No.21,Shulin Rd, Songjiang Industry Zone 201611
				WHOLE NUMBER ± 0.5 ONE PLACE DECIMALS ± 0.2 TWO PLACE DECIMALS ± 0.1 ANGULAR DECIMALS ± 3° CONCENTRICITY .125 T.I.R. SURFACE FINISH 3.2/ OR BETTER	ASSEMBLY, DRILL, PUNCH, & COMMERCIAL STOCK SIZES NOT INCLUDED IN THE TOLERANCES. REMOVE ALL BURRS
				SIZE: A3 SCALE: 1:5 ENGINEER: Craig	CHECKED BY: Henry APPROVED BY: William DWG. No. USS-IHAB-406B DATE: 2018/4/12 SHT.1 OF 1 REV: A



ITM	QTY	NUMBER	DESCRIPTION	MATL	DESC
1	1	FT00RUX025X02KK	橡胶软管, 1"(DN25), PN25, 长度0.6m, 接头304SS, BSPPF, 带钢丝加强, 提供船级社型式认可证书		Injector Hose Assembly (1")
2	1	VA00XC5011P1X2H	Y型单向阀, C501, 1", BSPT 内螺纹, 弹簧式, 软密封, 304SS		
3	2	VAXXAASDABTFTF1	球阀, 1", BSPT内螺纹, 三片式, 带锁定手柄, 304SS		
4	1	PLXTFSDAATFTF0	六角外丝, 1", BSPT, 304SS		
5	2	PL00TFSDAADFTF0	六角外丝转换接头, 1", G/BSPT, 304SS		
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				TOLERANCES WHOLE NUMBER ± 0.5 ONE PLACE DECIMALS ± 0.2 TWO PLACE DECIMALS ± 0.1 ANGULAR DECIMALS ± 3° CONCENTRICITY .125 T.I.R. SURFACE FINISH 32/ OR BETTER	ASSEMBLY, DRILL, PUNCH, & COMMERCIAL STOCK SIZES NOT INCLUDED IN THE TOLERANCES. REMOVE ALL BURRS
				PROJECT No. ECO No.	SIZE: A3 SCALE: 1:5 CHECKED BY: Henry ENGINEER: Craig APPROVED BY: William DWG. No. USS-IHAB-806B DATE: 2018/4/12 SHT.1 OF 1 REV: A



Spraying Systems (China) Co., Ltd.

6G60ME-C9.5-HPSCR 44#

Project Name Urea DHS
Project Number A2K18SH007
Customer Name HUDONG HEAVY MACHINE
Customer Address SHANGHAI
Customer Phone

Manufacturer Songjiang Factory
Manufactured Date APR.,2018

Spraying Systems (China) Co.,Ltd.

Address: No.21,Shulin Rd,Songjiang Industry Zone,Shanghai,China 201611

Phone: +86 21 67600882

Fax: +86 21 67600550

Designed Time: 2018/8/24

Revised Time: 3/28/2018

E.C.O. #		CHANGES				
NO.	E.C.O.	WAS	DATE	REQ.	BY	

DeNoX
PJ-C8A1347-203
0.37KW/PUMP

TITLE
PD-C8A1347-203-EG11-001

AutoJet
TECHNOLOGIES

DRAWN BY:
LAURA

CHECKED BY:
STEPHEN

APPROVED BY:
BILL

DATE: 8/24/2018

PROJECT No
A2K18SH007

VER. R1

SHT. 1 OF 21

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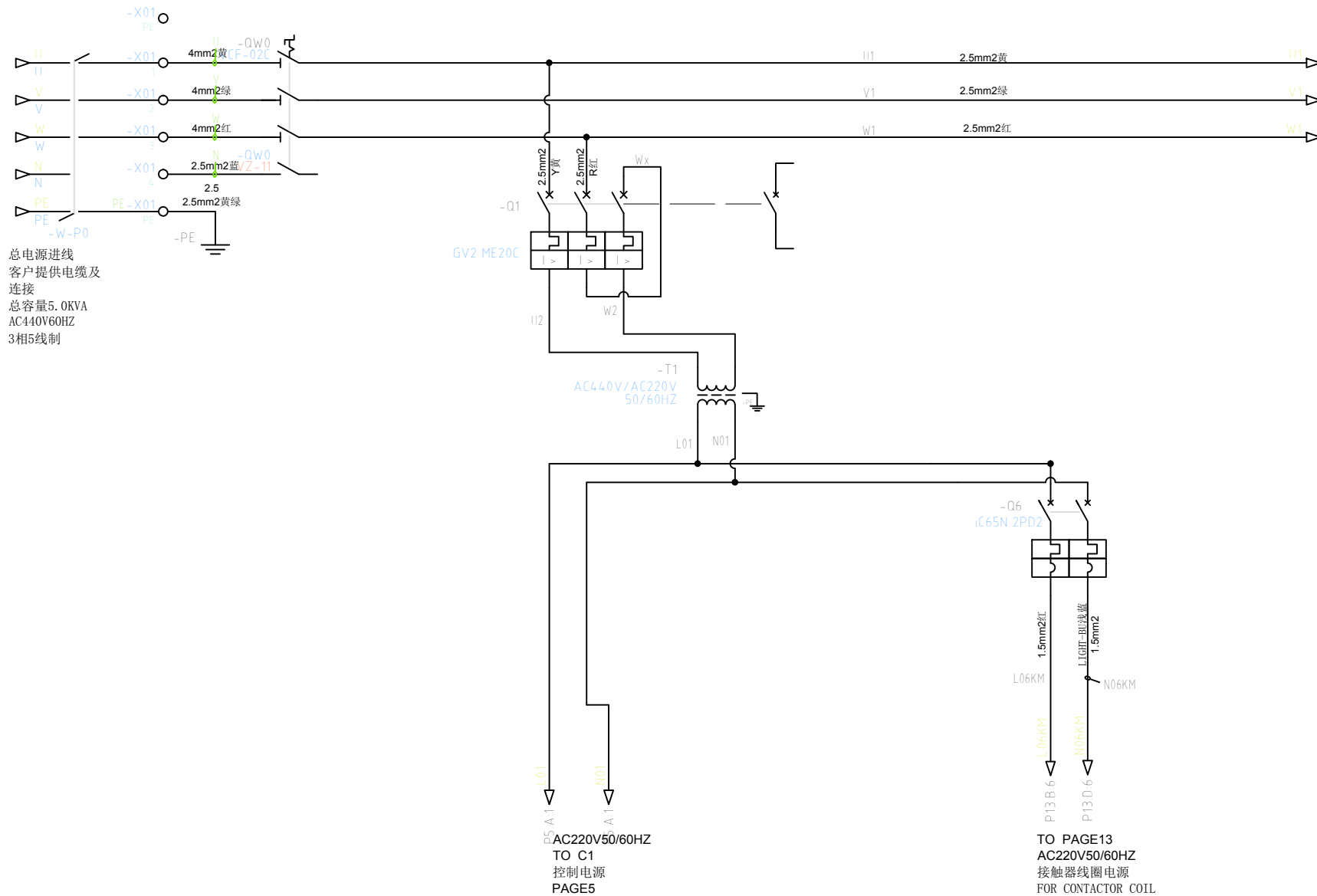
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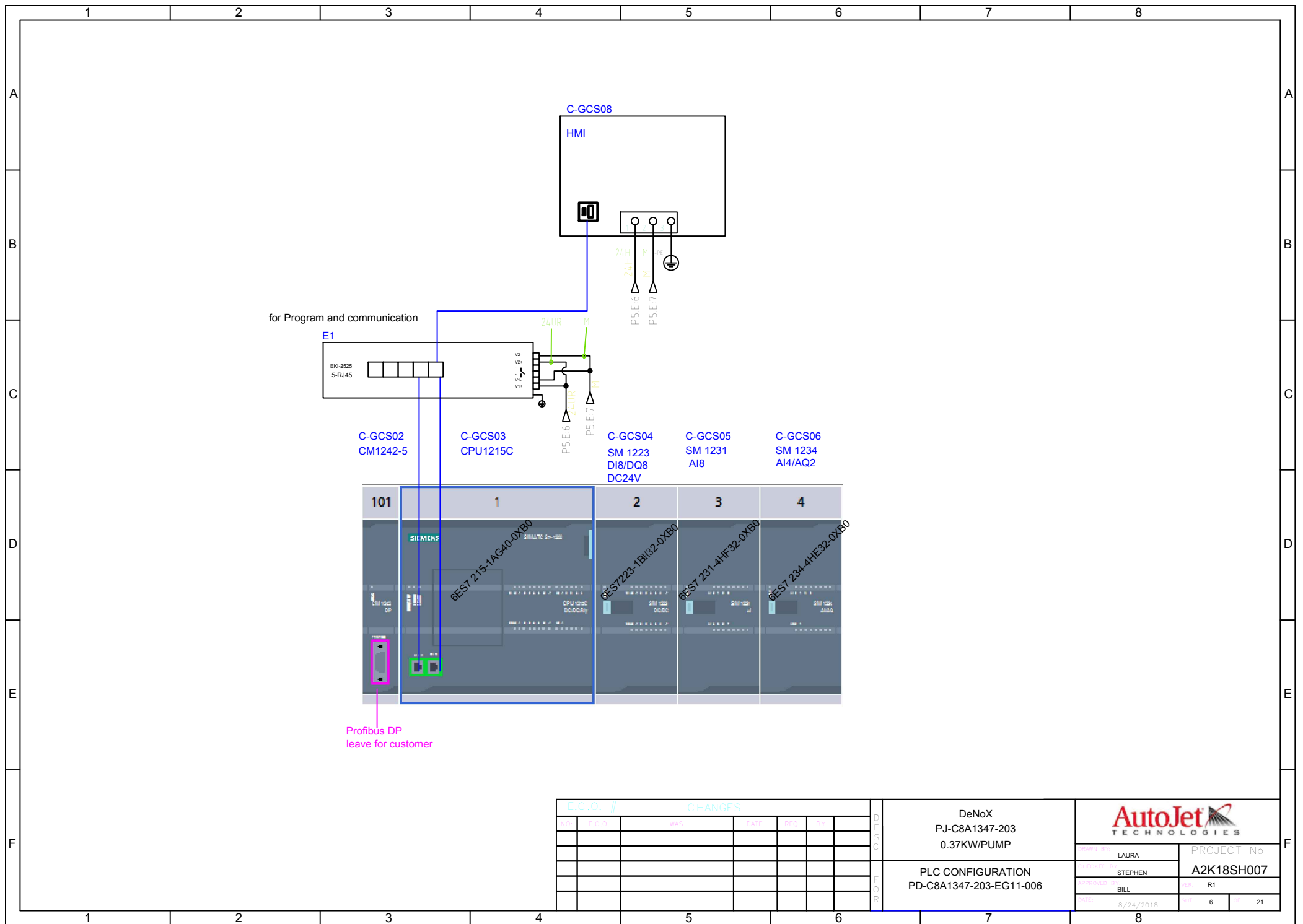
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PJ-C8A1347-203
0.37KW/PUMP

POWER DISTRIBUTION 1
PD-C8A1347-203-EG11-004

AutoJet
TECHNOLOGIES

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APPROVED BY: BILL			
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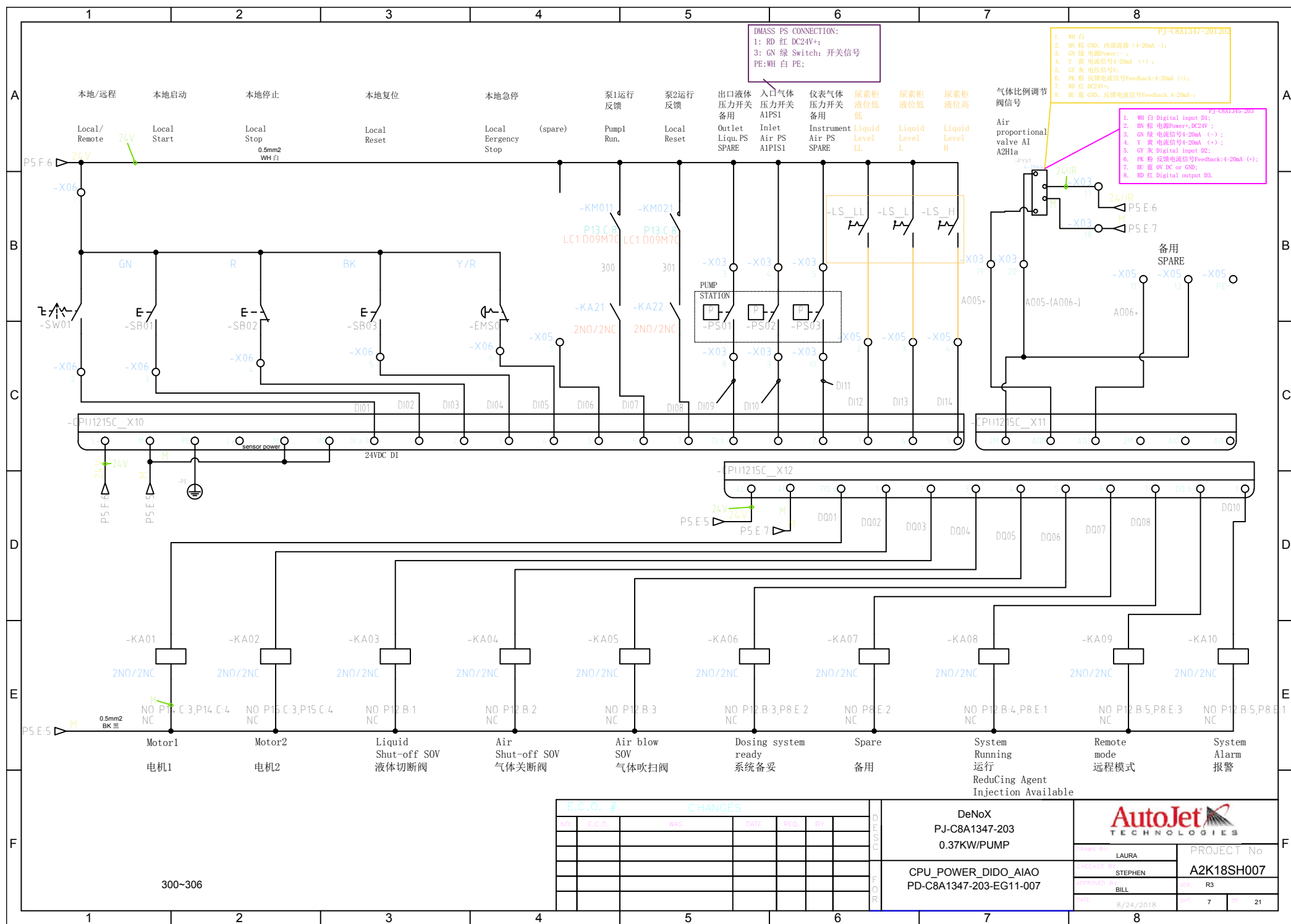
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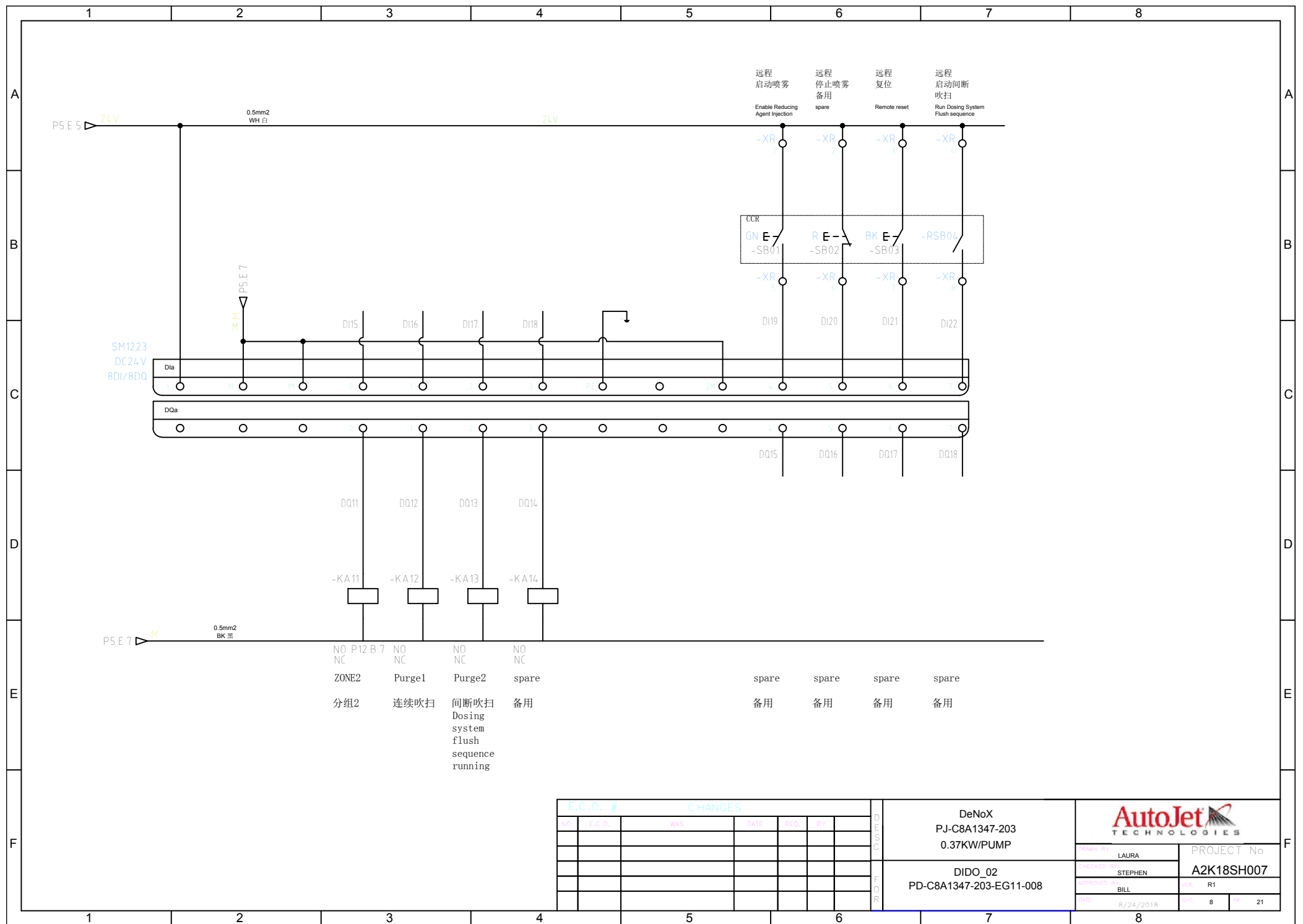
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TECHNOLOGIES

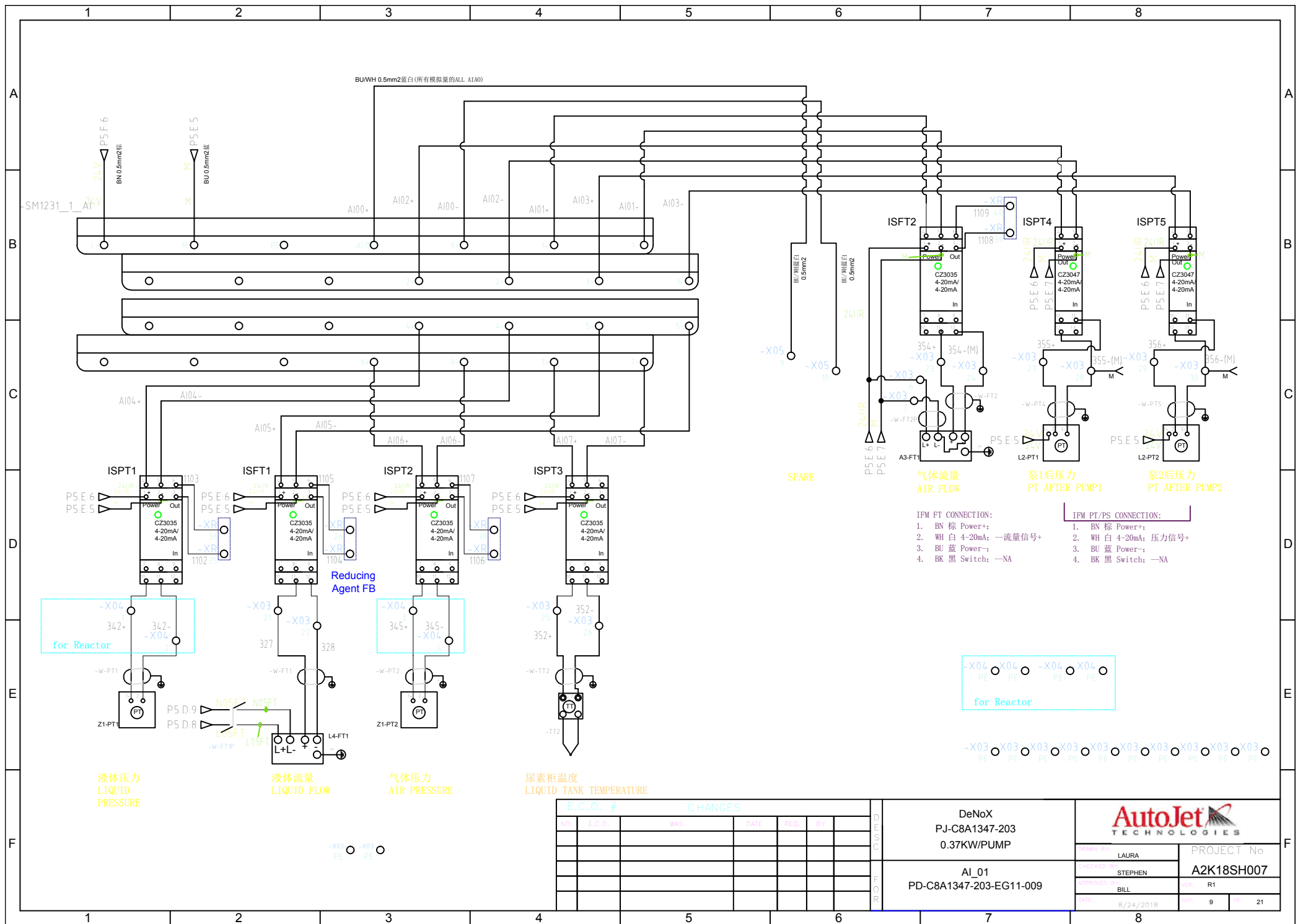
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APPROVED BY:
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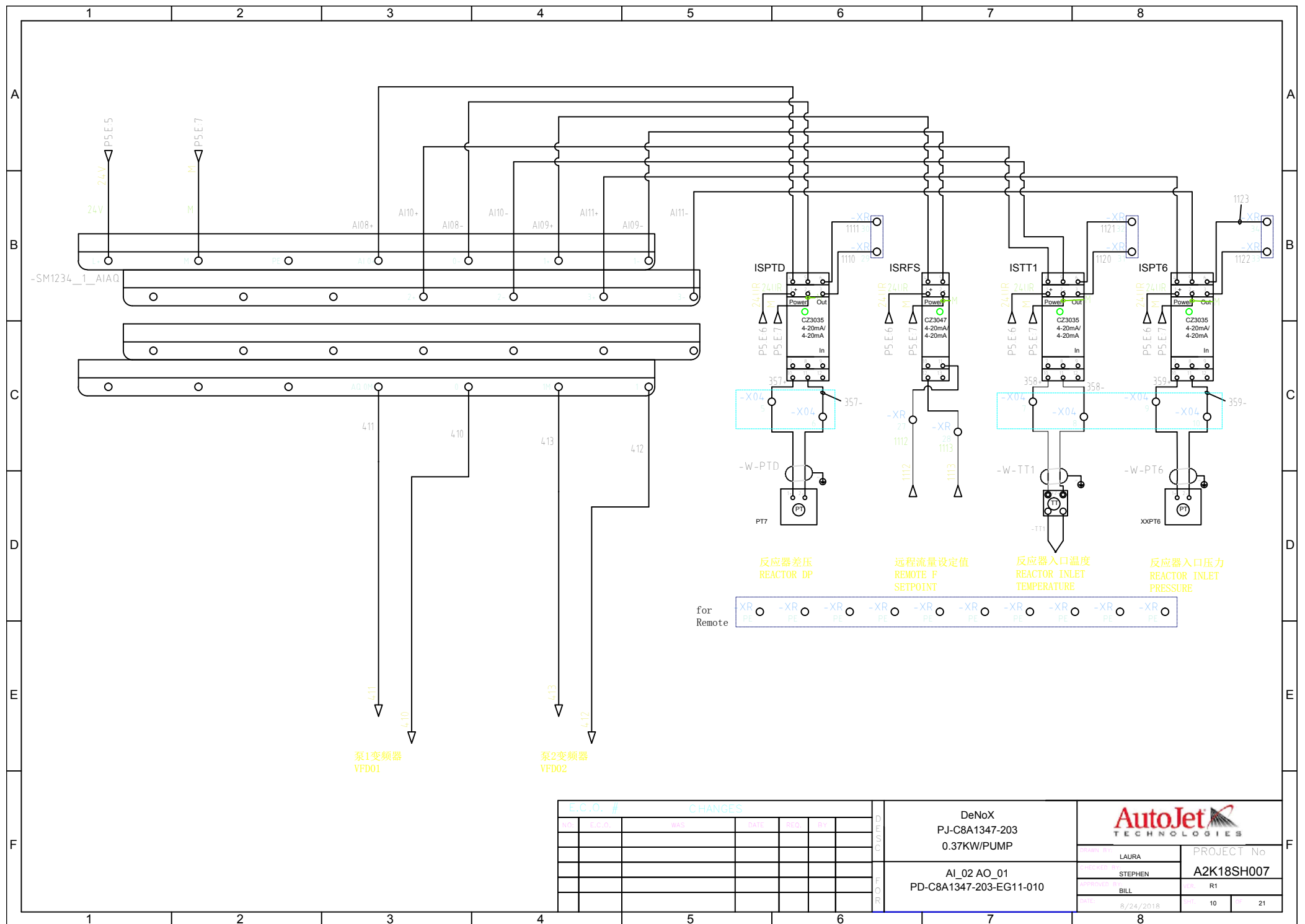
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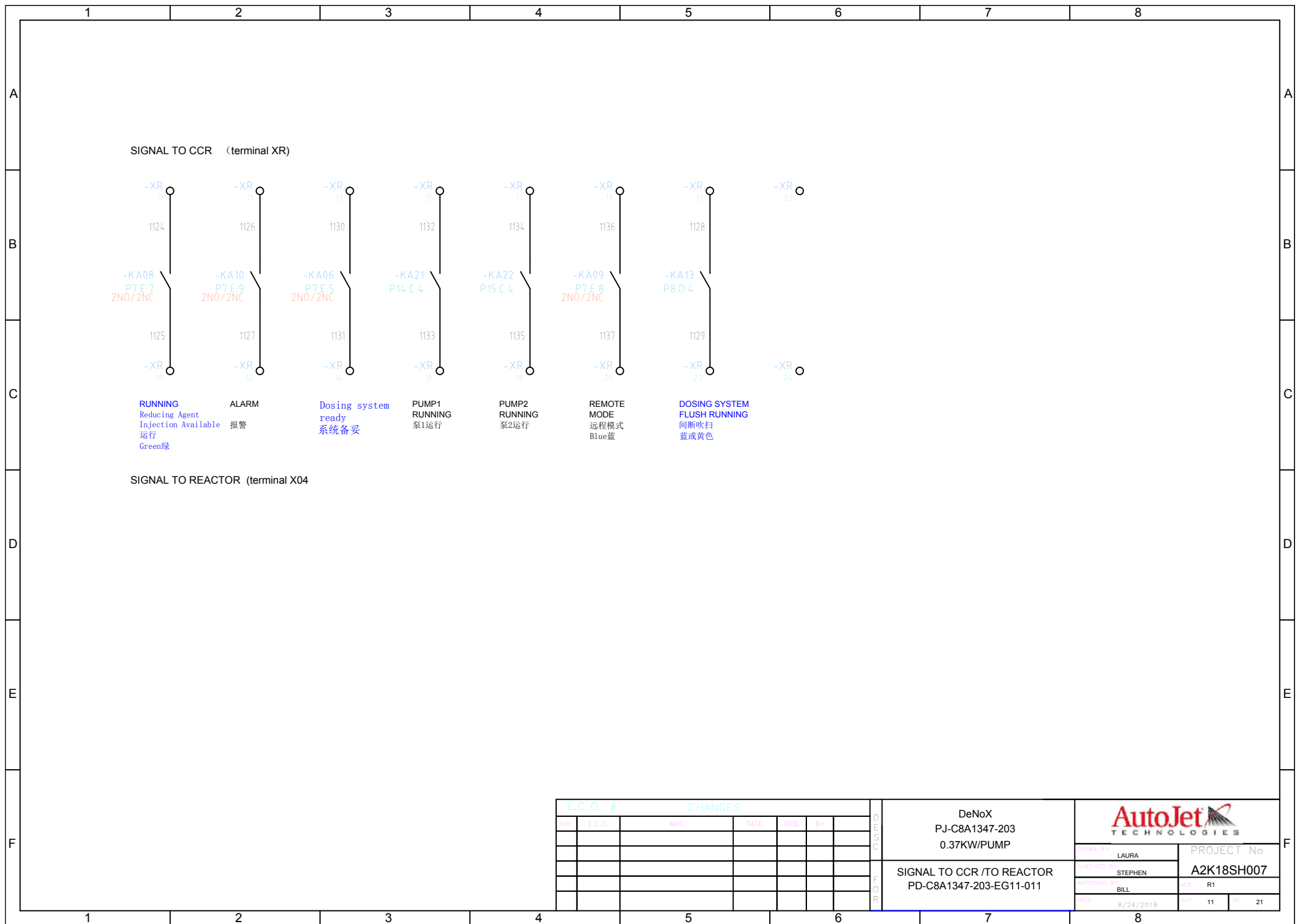
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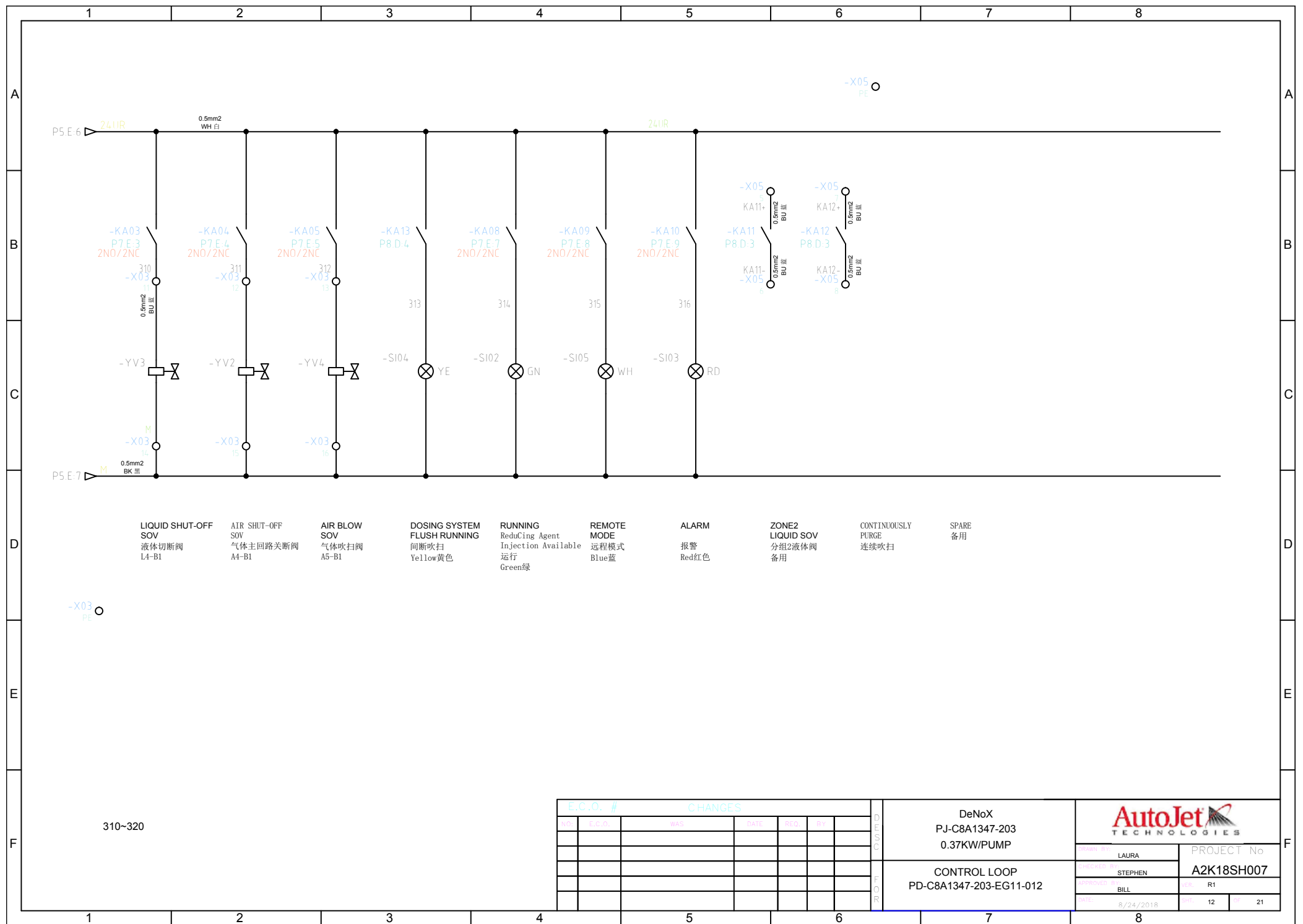






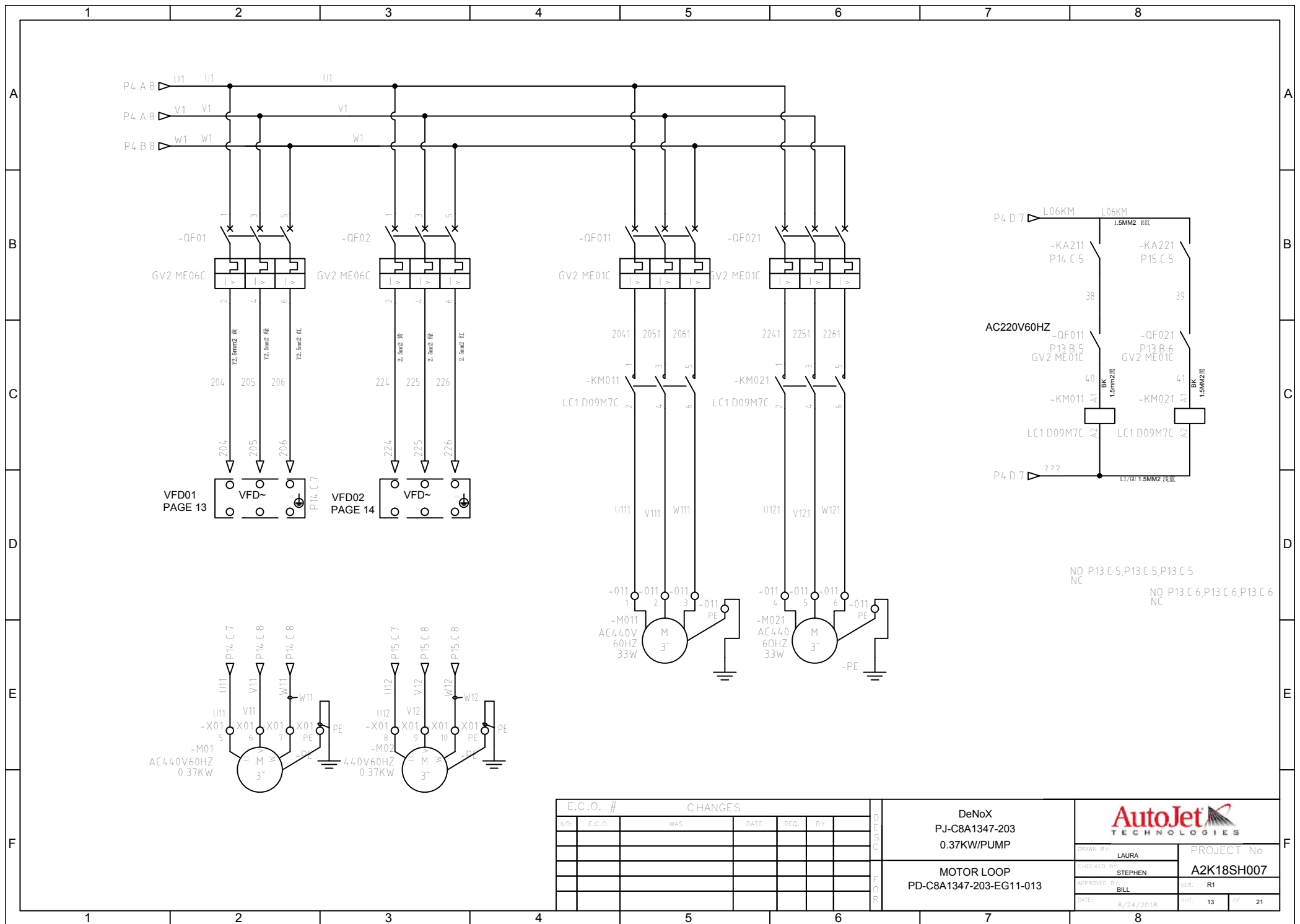
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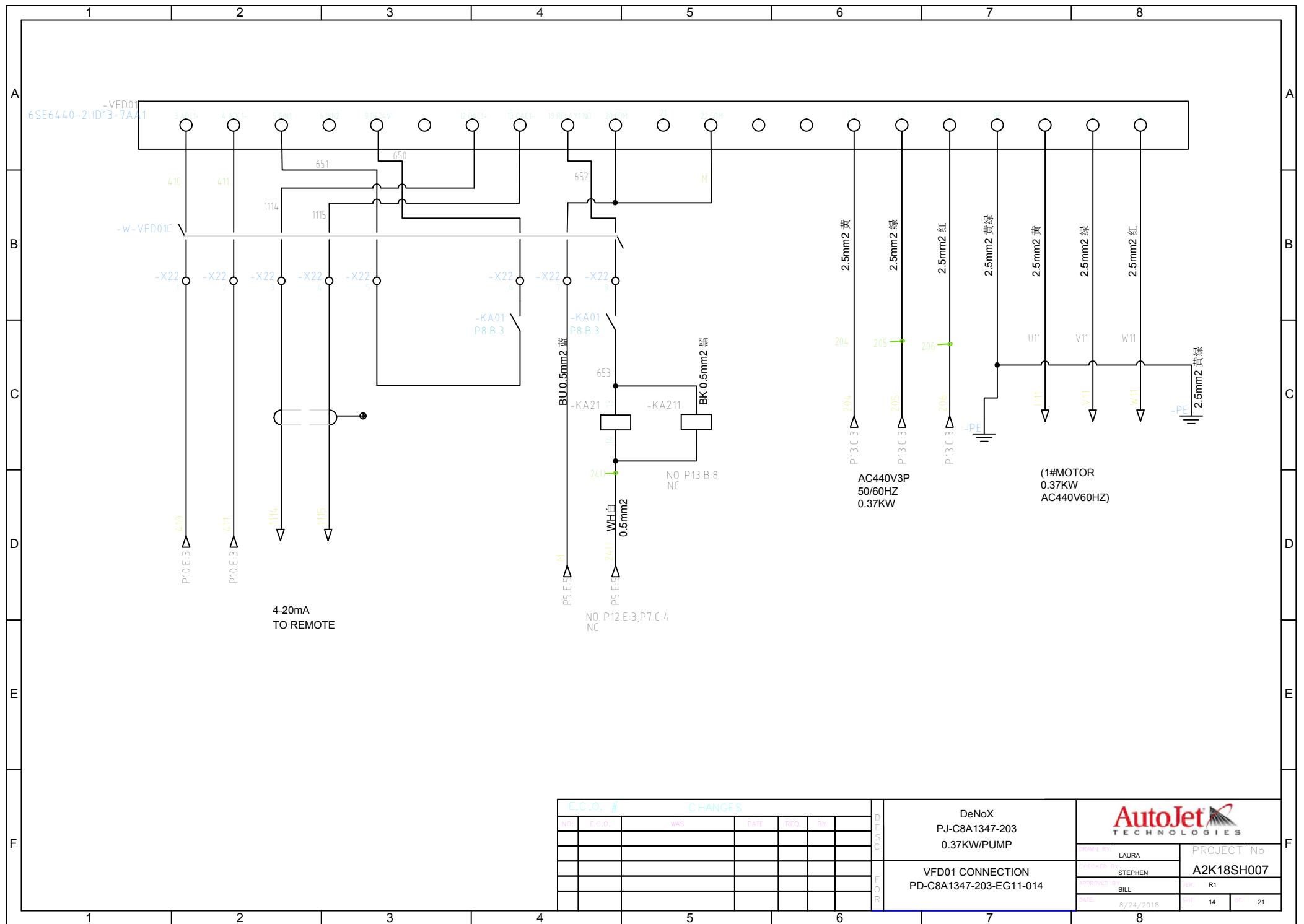
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PJ-C8A1347-203
0.37KW/PUMP

MOTOR LOOP
PD-C8A1347-203-EG11-013

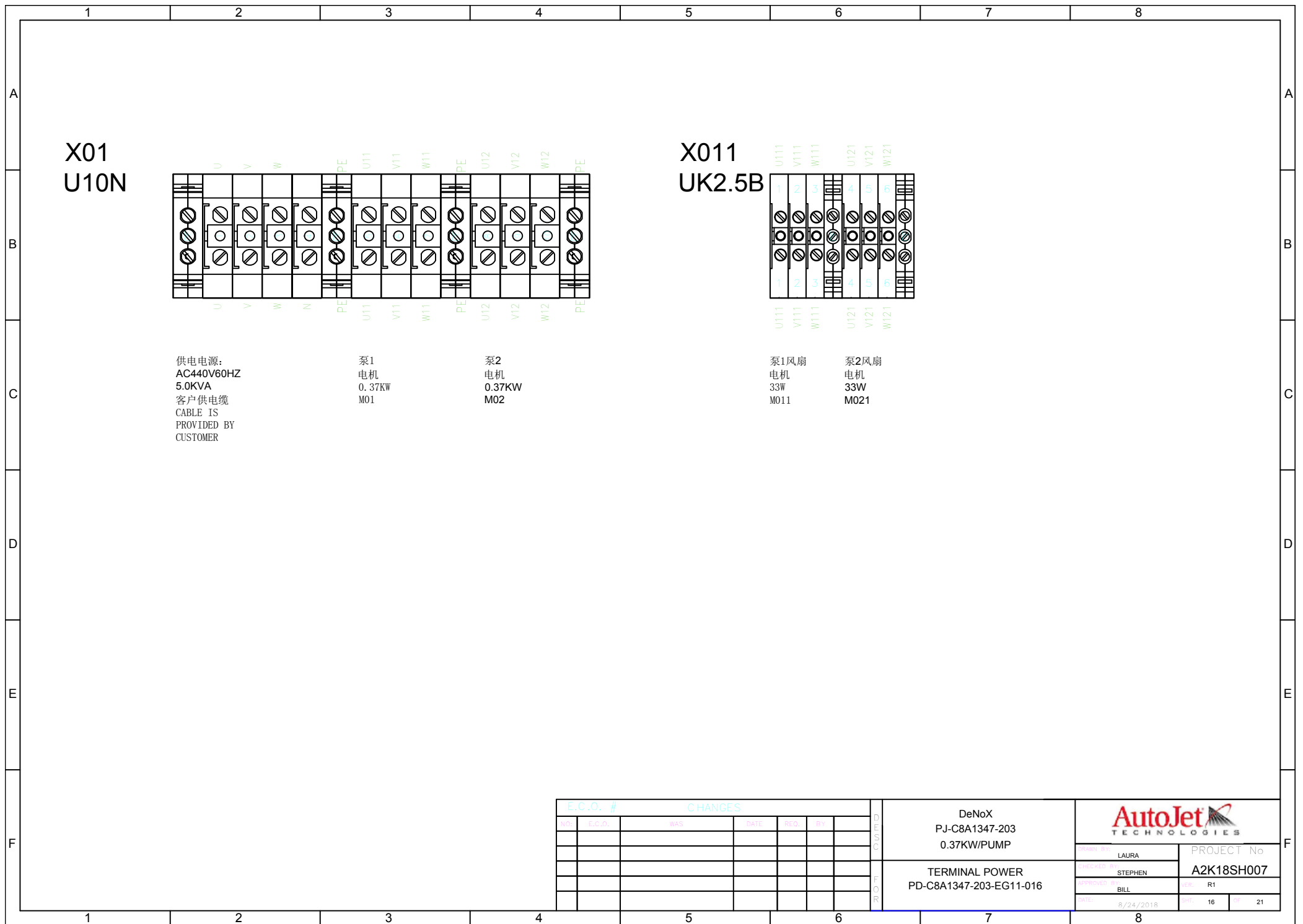


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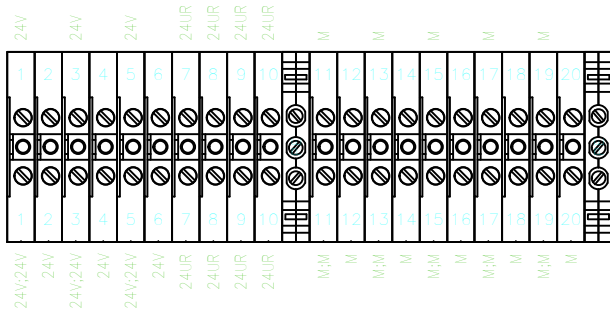


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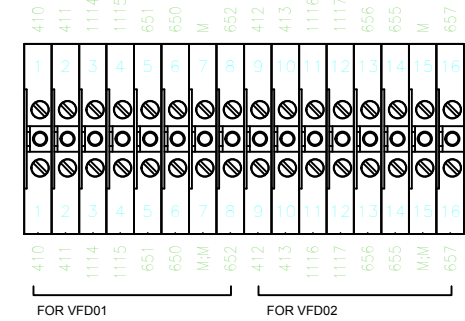
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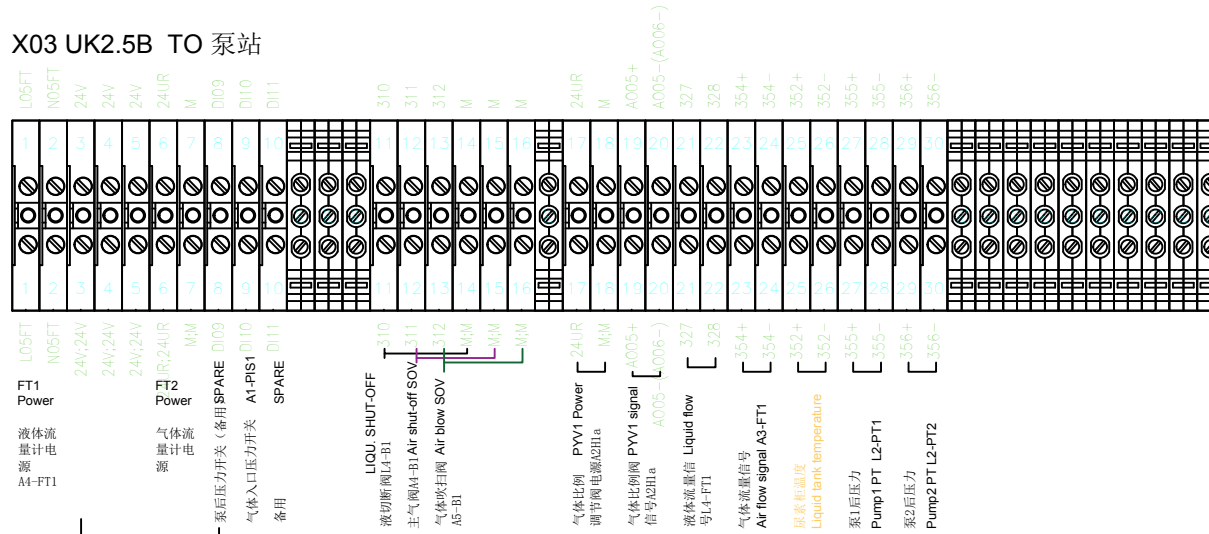
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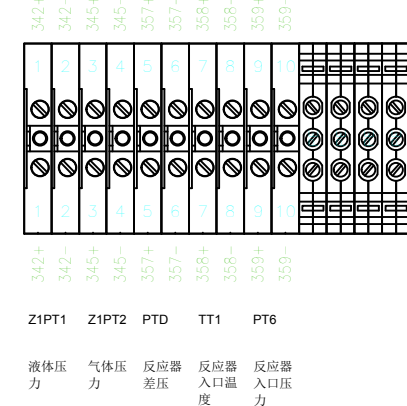
X22 UK2.5B TO VFD01/02



X03 UK2.5B TO 泵站



X04 UK2.5B TO GAS PIPE烟气管道



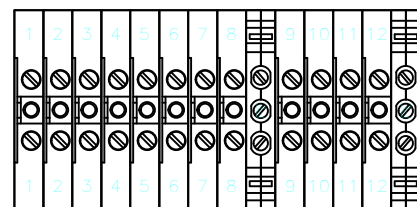
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PJ-C8A1347-203
0.37KW/PUMP

TERMINAL CONTROL 1
PD-C8A1347-203-EG11-017



DESIGN BY LAURA	PROJECT No A2K18SH007	
DESIGNED BY STEPHEN		
APPROVED BY BILL	CHK R3	
DATE 8/24/2018	REV 17	

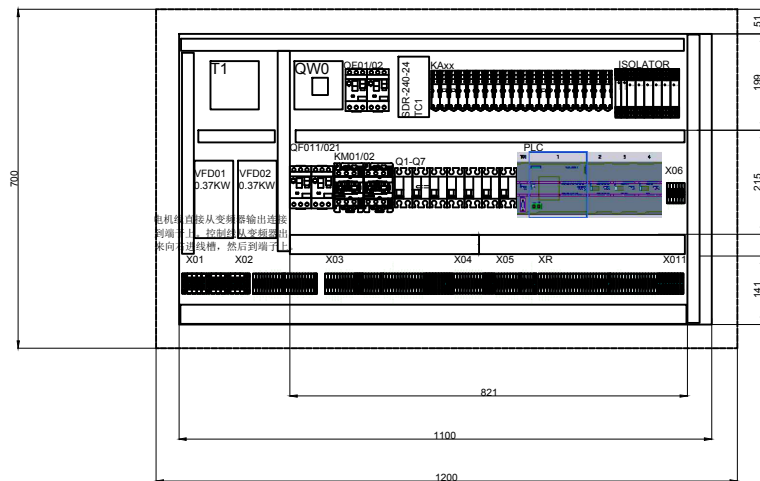


R13
LIQUID FLOW
液体流量4-20mA

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3					
4					
5					
6					

Rx DESCRIPTION	
R1: Enable Reducing Agent Injection	远程启动喷雾
R2: Spare	
R3: Remote Reset	远程复位
R4: Run Dosing System Flush Sequence	远程启动间歇吹扫
R5: Reducing Agent Injection Available	系统运行
R6: Alarm	报警
R7: Dosing system ready	系统准备
R8: Pump1 running	泵1运行
R9: Pump2 running	泵2运行
R10: Remote mode	远程模式
R11: Dosing System Flush Sequence Running	间歇吹扫
R12: Spare	
R13: Reducing Agent FB	液体质量
R14: Reducing Agent SP	远程液体流量设定值
R15: Reactor Diff Pressure	反应器差压
R16: Reactor Inlet Temperature	反应器入口温度
R17: Reactor Inlet Pressure	反应器入口压力
R18: Lance Liquid Pressure	喷嘴液体压力
R19: Lance Air Pressure	喷嘴空气压力
R20: Air Flow	气体流量

E.C.O. # CHANGES							C	DeNoX PJ-C8A1347-203 0.37KW/PUMP	AutoJet TECHNOLOGIES	PROJECT No		
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								TERMINAL CONTROL 2 PD-C8A1347-203-EG11-018				

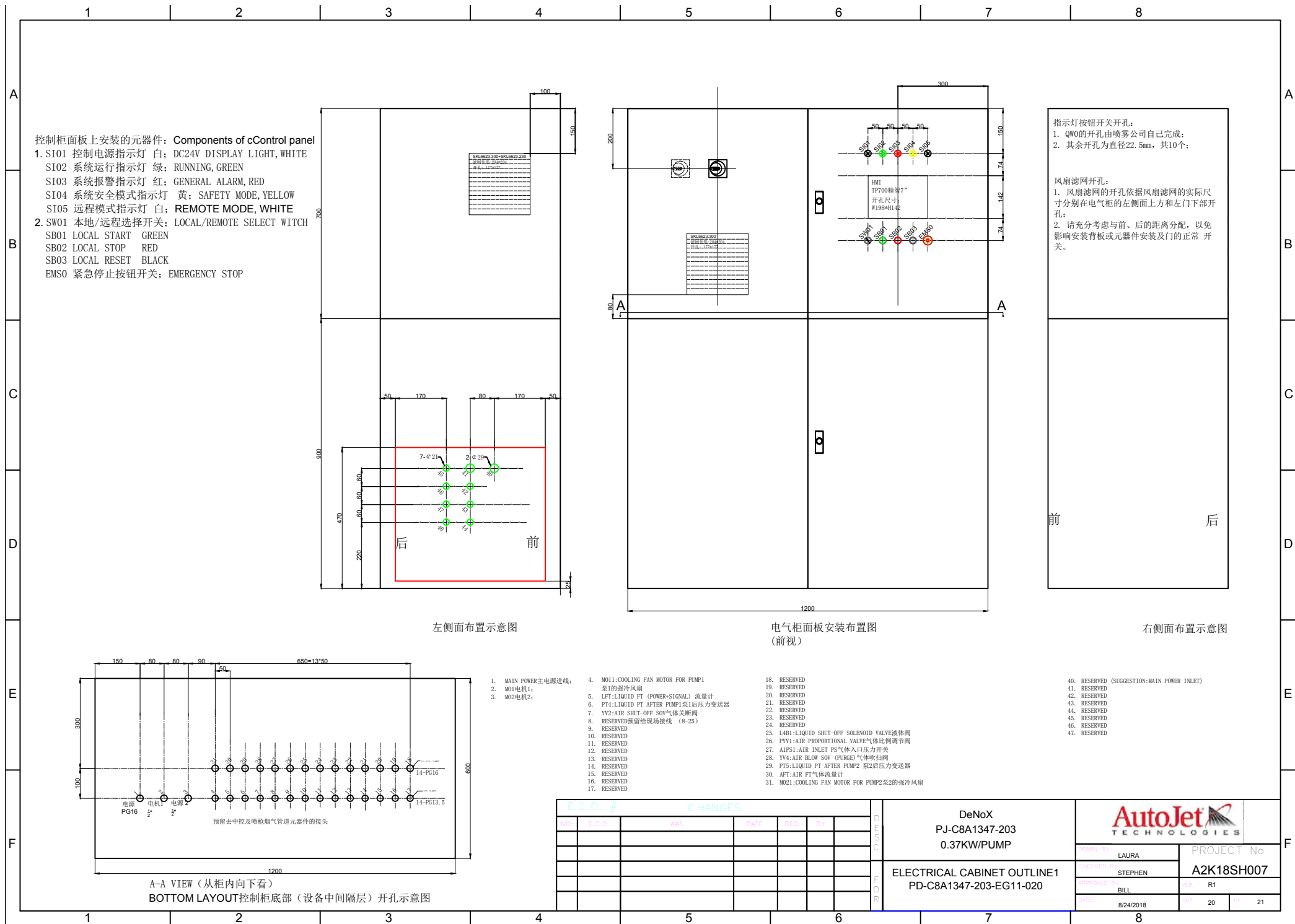


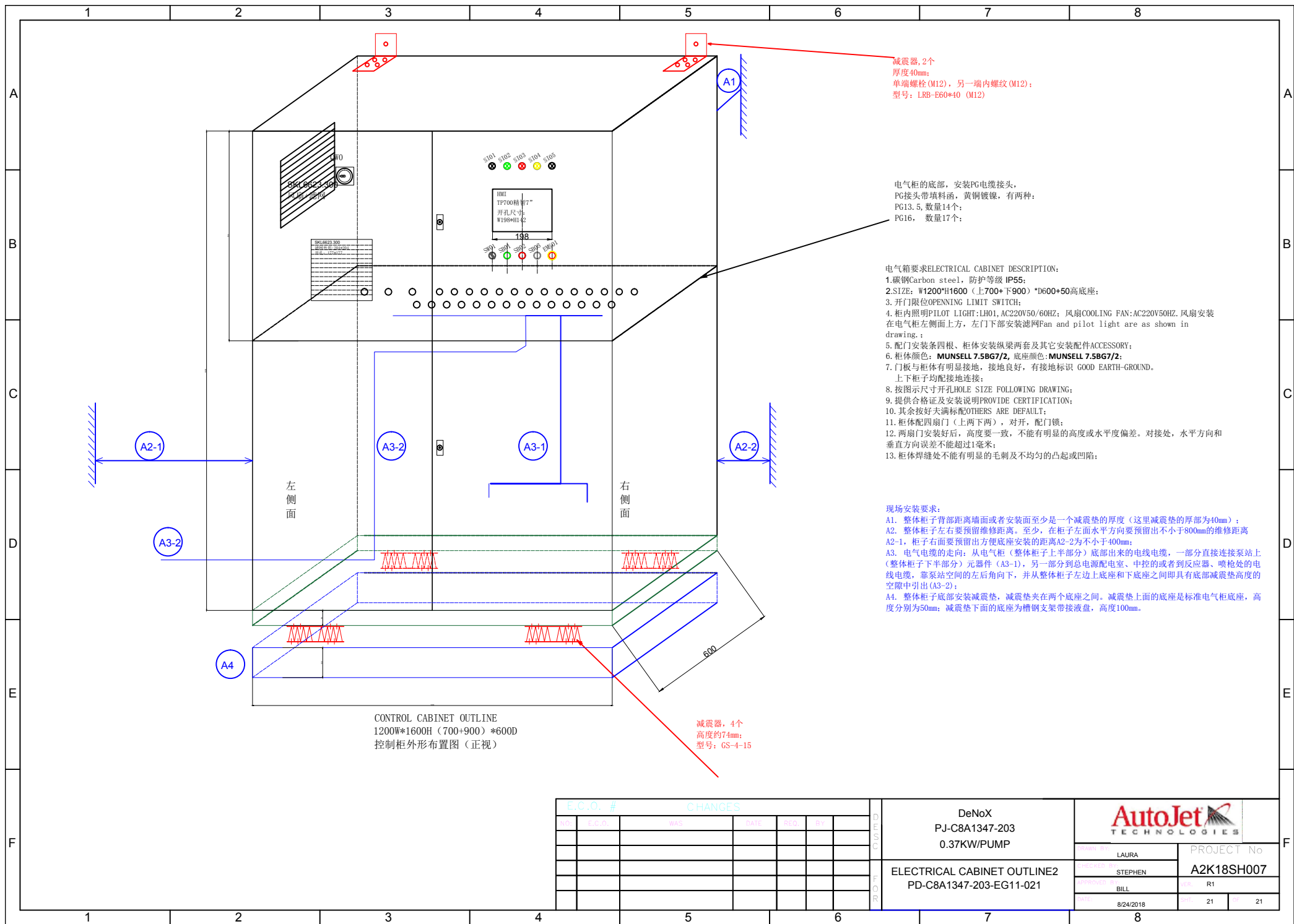
电气安装背板布置图

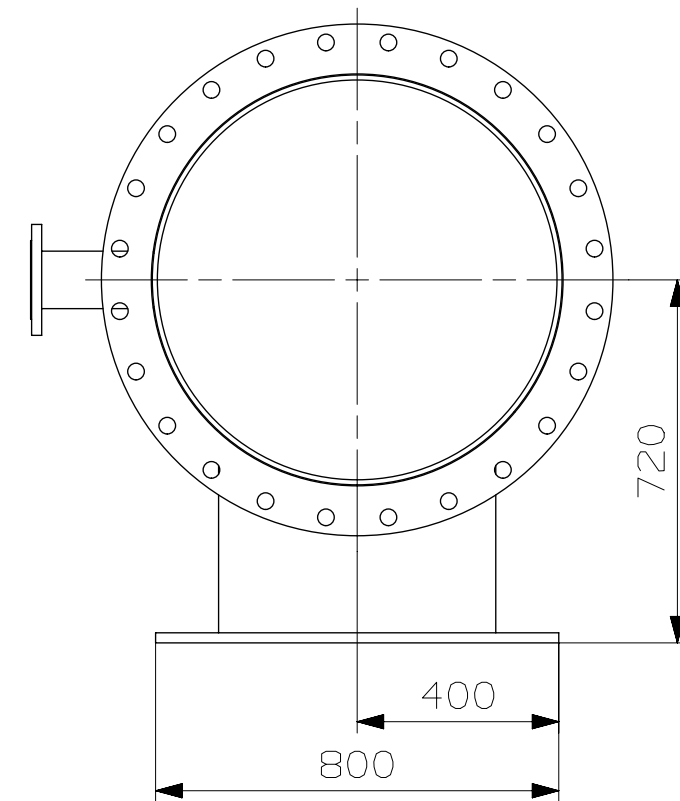
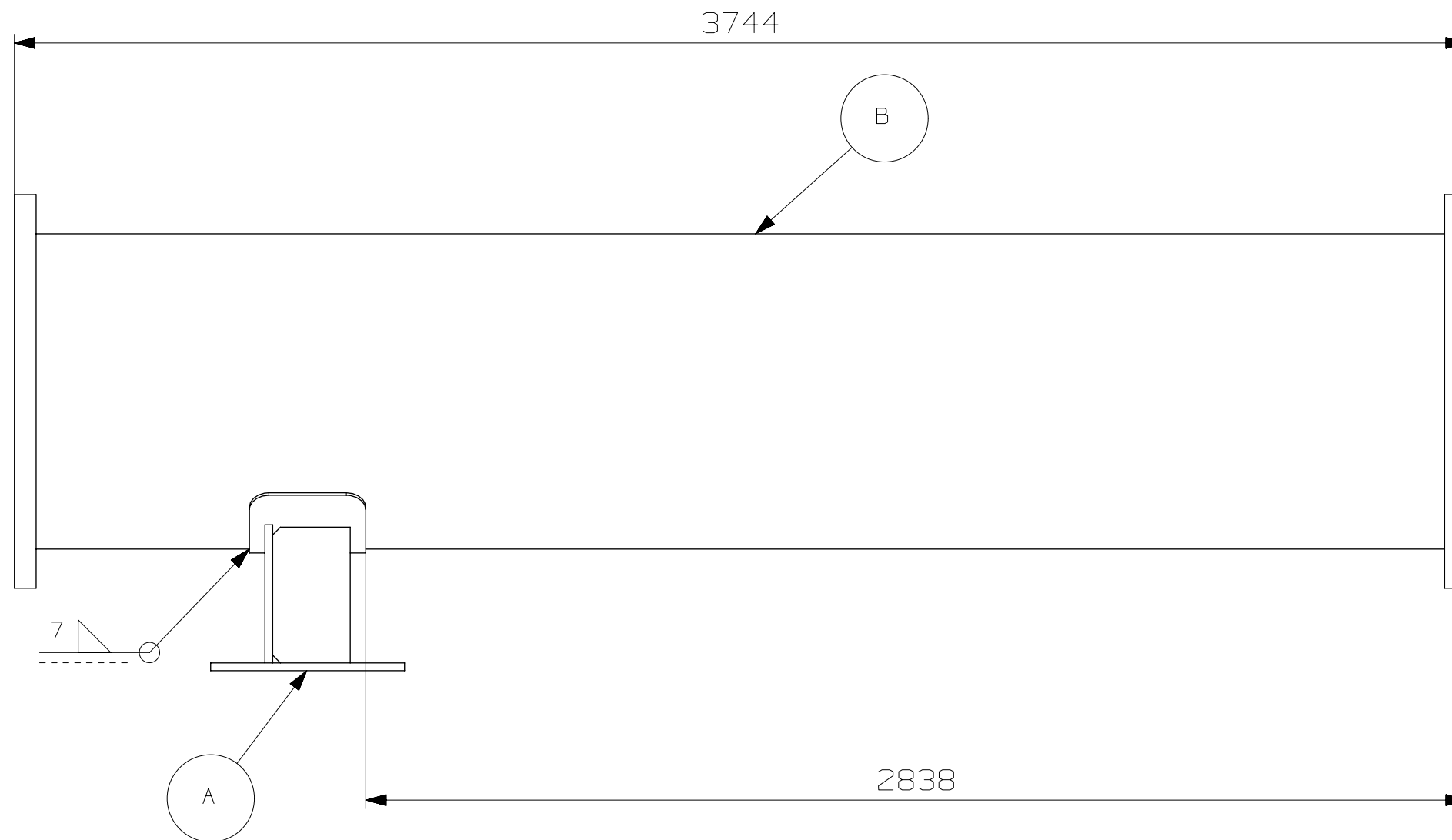
插座以安装在电气柜左侧面；
 交换机安装在电气柜右侧面；
 X22在安装背板没有足够位置时可以取消掉。

E.C.O. #		CHANGES				
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			APPROVED BY BILL		R1	
FOR	ECB LAYOUT PD-C8A1347-203-EG11-019		DATE 8/24/2018		19	21







技术要求:

1. 去除毛刺和锐边;
2. 焊缝等级要求: EN601M, Q3;
3. 未注定位尺寸的零件按中心定位;
4. 自由公差根据 ISO/2768-m.
5. 探伤要求: 目视检测: 参考规范 (EN970))
磁粉检测: 参考规范 (EN601T)

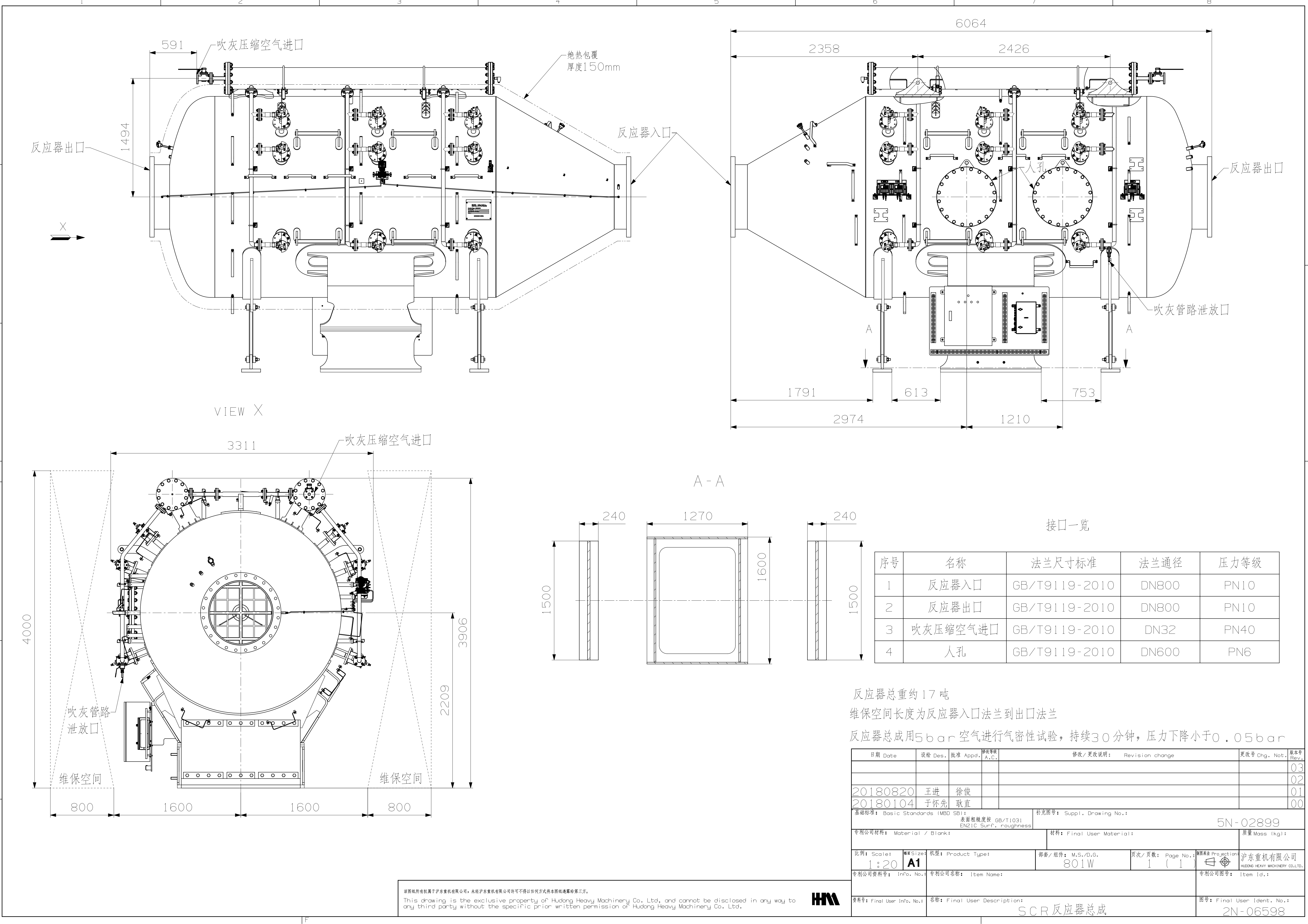
若无特殊说明, 焊缝使用的是厚度“a”, 焊脚尺寸z (国标中的k值) 为1.4a

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							02
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20171227	耿直	杨峰峰					00
Basic Standards (MBD SB):					similar. Drawing No.:		
EN21F-m Tolerances EN21C Surf. roughness							
Material / Blank:					Final User Material:	Mass (kg):	
Scale:	Size:	Product Type:			Page No.:	Projection:	
1:15	A3				1 (1)		
Info. No.:		Item Name:				Item Id.:	
Final User Info. No.:		Final User Description:				Final User Ident. No.:	
801M		还原剂混合管组件				3H-27836	

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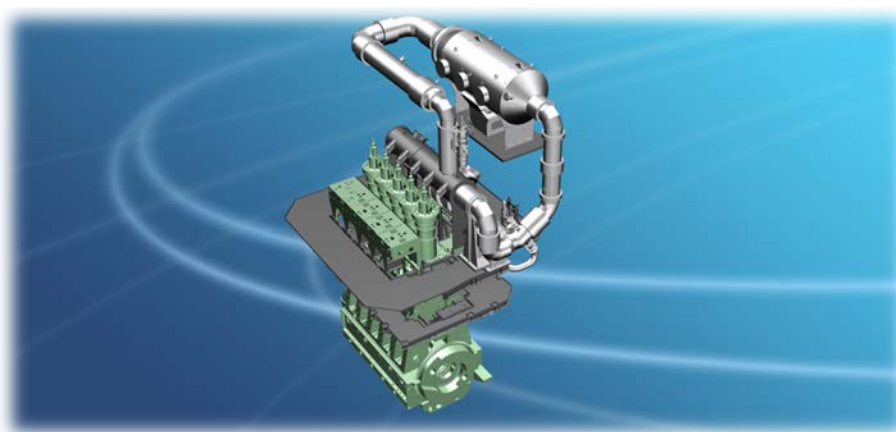


反应器总重约 17 吨

维保空间长度为反应器入口法兰到出口法兰

反应器总成用5bar 空气进行气密性试验，持续30 分钟，压力下降小于0.05bar

日期 Date	设绘 Des.	批准 App.	修改等级 A.C.	修改 / 更改说明: Revision change	更改号 Chg. Not.	版本号 Rev.
						03
						02
20180820	王进	徐俊				01
20180104	于怀先	耿直				00
基础标准: Basic Standards (MBD SBI):				补充图号: Suppl. Drawing No.:		
表面粗糙度按 GB/T1031 EN121C Surf. roughness				5N-02899		
专利公司材料: Material / Blank:			材料: Final User Material:			质量 Mass (kg):
比例: Scale:	图幅 Size:	机型: Product Type:	部套 / 组件: M.S./D.G.	页次 / 页数: Page No.:	制图标准 Projection:	沪东重机有限公司 HUDONG HEAVY MACHINERY CO.,LTD.
1:20	A1		801W	1 (1)		
专利公司资料号: Info. No.:	专利公司名称: Item Name:					专利公司图号: Item Id.:
资料号: Final User Info. No.:	名称: Final User Description:					图号: Final User Ident. No.:
	SCR 反应器总成					2N-06598



Master Manual
for HeNO_x Marine SCR

HUDONG HEAVY MACHINERY CO., LTD.



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Table of contents

1.	HeNO_x Overview	1
1.1	Introduction	1
1.2	Qualified Personnel	1
1.3	Operation in accordance with intended purposes	1
1.4	Chemicals	1
1.5	Complementary documents.....	2
1.6	General Information	2
1.7	Use of symbol	2
1.8	Theory of Operation.....	3
2.	Product Manual.....	5
2.1	Product Identification	5
2.2	Objective.....	5
2.3	Safety Instructions.....	6
2.4	List of Abbreviations	9
2.5	Working Principle	11
2.6	General Description and Arrangement	13
2.7	Technique Data	14
2.8	Utilities.....	15
2.8.1	Consumption of Electricity	15
2.8.2	Consumption of Compressed Air.....	15
2.9	Product handling	17
2.9.1	Unloading and storing the equipment.....	17
2.9.2	Inspecting the delivery	17
2.9.3	Lifting and moving units	17
2.9.4	Storing and handling the catalyst.....	20
2.10	Installing the SCR system.....	23
3.	Reactor	24
3.1	SCR Catalyzer and Housing.....	25
3.1.1	Characteristics	25
3.1.2	Equipment.....	25
3.1.3	Installation	27
3.1.4	Maintenance.....	29
3.1.5	Appendix	35
3.2	Standby Heat System (Option).....	36
3.2.1	Characteristics	36
3.2.2	Installation	36
3.2.3	Appendix	36
3.3	Soot Blowing System	37
3.3.1	Characteristics	37
3.3.2	Equipment.....	37



3.3.3	Installation	38
3.3.4	Maintenance.....	38
3.3.5	Appendix	39
4.	Dosing Handling System.....	40
5.	Valve	41
6.	NO_x Sensor	43
6.1	Function Description.....	43
6.2	Remarks	43
6.2.1	Verification	43
6.2.2	Demarcation.....	43
7.	Control System	44
7.1	Operation of HeNO _x SCR System.....	44
7.1.1	Tier II Operation - HP SCR disengaged	44
7.1.2	Starting the HP SCR System when Entering Tier III Area	45
7.1.3	Accelerating with HP SCR	48
7.1.4	Sailing into Tier III harbor with HP SCR	49
7.1.5	Starting from Tier III harbor with HP SCR.....	49
7.1.6	Stopping HP SCR	50
7.2	Installation	50
7.3	Hardware	51
7.4	Human Machine Interface (HMI).....	53
7.4.1	Overview of modes and states	53
7.4.2	Overview of other info on SCR screens	56
7.5	SCR Failure.....	58
7.6	Main Operation Panel (MOP).....	63
7.6.1	SCR MOP Description.....	64
7.6.2	Selections and Indications on the MOP	65
7.	Appendix.....	65
7.1	Appendix 3.....	65
7.2	Appendix 4.....	77
7.3	Appendix 5.....	141
7.4	Appendix 6.....	201

1. HeNO_x Overview

1.1 Introduction

With the increasingly stringent regulations and continuous attention to environment protection, HeNO_x has been carried out by Hudong Heavy Machinery individually as a Selective Catalytic Reduction System to reduce the concentration of NO_x in exhaust gas emissions. And within the last few years, HeNO_x system has been successfully tested for Tier III compliance as stand-alone NO_x reduction technology.

The process of NO_x reduction is as follows: Inject appropriate amount of ammonia source as reducing agent (normally urea solution) into the exhaust gas. Subsequently the ammonia/exhaust gas mixture passes through catalyst block installed in the reactor, where the NO_x is converted to nitrogen and water vapor.

Because of the outstanding performance, reliability and competitive price of HeNO_x system, our product receives highly complementary remarks given by shipyards and ship owners.

Nowadays, HeNO_x system has been proved to be one of the most effective and mature solutions in exhaust reduction area and favored by worldwide customers.

1.2 Qualified Personnel

Commissioning, operation, maintenance and repairs of the HeNO_x SCR System shall be performed by skilled personnel only. Please read this system description and the safety instructions prior to working on or operating the SCR System.

1.3 Operation in accordance with intended purposes

The HHM SCR System (HeNO_x) may only be used as specified in the system documentation. When used with material, parts or components other than specified without prior written approval by HHM all guarantees void. Correct and safe operation of the SCR - System is dependent on proper operation and maintenance procedures.

1.4 Chemicals

Theoretically, the SCR System can be operated with urea solution, ammonia water and ammonia gas as reducing agent. But in this project, we only provide the method which reduces NO_x in exhaust gas by aqueous urea solution as reducer. Furthermore, a professional catalyst is involved in the reactor in order to make the reaction proceed.

1.5 Complementary documents

In case of any discrepancy between the delivered equipment and the information in this manual, the following documents will override the information in the manual:

- The order confirmation
- The drawings and engineering files
- Changes agreed during the engineering process (by e-mail or in meetings)
- The order
- The offer.

1.6 General Information

This introductory training and reference manual does not include complete, detailed information of the product and cannot cover every conceivable aspect of installation, operation and maintenance. All images are examples and may differ from actual design. For more detailed information, please contact HHM engineers.

1.7 Use of symbol

WARNING	
	Warning is used in the text whenever there is a risk of personal injury.
WARNING - ELECTRICITY	
	The electricity warning is used in the text when there is a risk of personal injury due to electrical shocks.
CAUTION	
	Caution is used in the text whenever there is a risk of damaging equipment.

1.8 Theory of Operation

The concentration of polluting nitrogen oxide (NO_x), carbon mono-oxides (CO) and hydrocarbons (HC) in exhaust gases are to be reduced safely below particular emission limits.

Nitrogen oxides (NO and NO_2) are generated in secondary reactions in the engine during the fuel combustion. The high combustion temperature causes atmospheric nitrogen to react with oxygen, forming harmful nitrogen oxides.

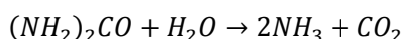
The concentration of the above pollutants can be reduced drastically by means of state-of-the-art catalytic converters. In this connection, when getting into contact with the catalytic surface which has been activated accordingly, the waste gas components to be removed will turn into problem-free "residuals".

In the first phase of reaction, the nitrogen oxides of the waste gas transform into ecologically harmless agents H_2O and N_2 by means of catalysts and an ammonia releasing liquid - the so-called reducing agent - according to the method of selective catalytic reduction (SCR method).

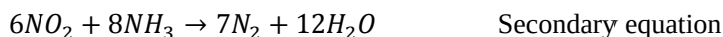
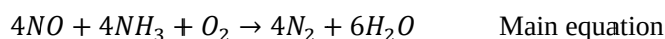
In the second phase of reaction, the oxidation catalyst (OPTION) transforms a considerable part of the toxic carbon mono-oxide into carbon dioxide (CO_2). At the same time the shares of methane-free hydrocarbons are oxidizing into carbon dioxide and water.

When utilizing the selective reduction method, nitrogen oxides (NO, NO_2) are transformed into nitrogen N_2 and water vapor (H_2O). Due to the toxicity of ammonia the use of urea solution is mandatory for marine applications.

The water in the urea solution is evaporated as the solution is injected into the hot exhaust gas. The high temperature also induces thermal decomposition of the urea ($(\text{NH}_2)_2\text{CO}$) into ammonia (NH_3) and carbon dioxide (CO_2):



With nitrogen monoxide (NO) being the most important nitrogen oxide, the following chemical equation is in general the determinative all-over reaction.



The exhaust temperature has to be within a certain range when the urea feed is on. This temperature range is case-specific, depending mainly on the fuel oil used, and it is set during the commissioning of the SCR system.

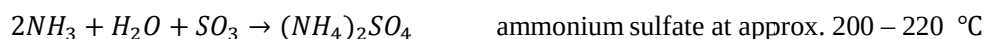
The molar ratio NH_3/NO which is important to NH_3 consumption therefore is 1. As homogenous gas phase reaction, without utilizing the catalyst, this reaction only starts at temperatures above 900°C with satisfying velocity. At lower temperatures, reaction kinetics is too low, thus requiring the utilization of catalysts.

The NO_x conversion efficiency (β) is determined from the NO_x concentrations $\text{NO}_{x_{in}}$ and $\text{NO}_{x_{out}}$ at the catalyst inlet and outlet:

$$\beta = \frac{NO_{x_{in}} - NO_{x_{out}}}{NO_{x_{in}}} \times 100$$

The requisite concentration of the reducing agent, determined based on the NO_x concentration upstream of the catalyst inlet, is virtually proportional to the NO_x conversion efficiency.

If the injection of Ammonia takes place at a too low temperature, Ammonium sulfate or ammonium bisulfate can be generated as a function of the temperature and moisture content of the exhaust gas.



The reaction rate for the formation of (NH₄)₂SO₄ is much lower than that for NH₄HSO₄. This results in preferential formation of ABS at high cooling rates. This substance has the undesirable properties of being viscous, adhesive and corrosive. All exhaust gas path components at or downstream of where ammonium bisulfate is generated are at risk. These ammonia salts can condense in the catalyst pores, resulting in deactivation.

This effect can be prevented by maintaining a minimum temperature as a function of the concentrations of SO₃ and NH₃.

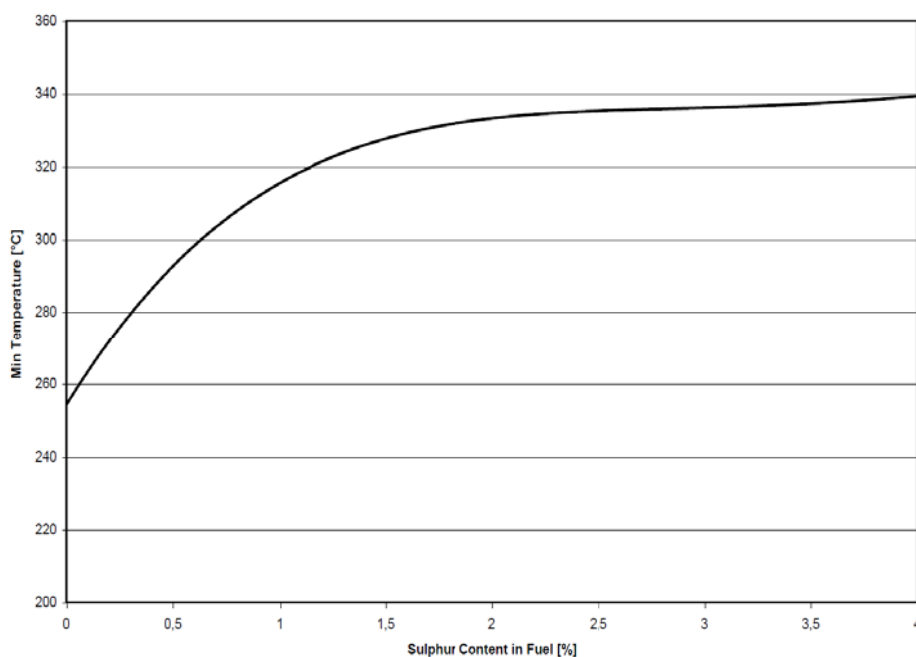


Figure 1.1 Minimum Temperatures for SCR Long-Term Operation

Furthermore, the efficiency of the catalytic reduction depends on a number of factors, including the dosing of reducing agent, the amount of catalyst elements and the exhaust gas temperature.

2. Product Manual

2.1 Product Identification

This manual deals with the HeNO_x Reducer system, which is designed for controlling the emissions of nitrogen oxide from marine diesel engines. The operation of the system is based on nitrogen oxide abatement by Selective Catalytic Reduction (SCR).

The manual covers the following equipment according to the standard scope of supply.

- SCR Reactor and Catalyst Elements
- Soot Blower System
- Venting System
- Standby Heat System
- Dosing Handling Unit
- Main Valves
- Sensors
- Control Unit.

The standard scope of supply does not include compensators, piping, supports and insulation material. The operation of the system also requires an air compressor and a tank for storage of reducing agent. These units or any other external systems are not covered by the manual except for some brief guidelines, but they must be considered when applying the instructions.

The information given in this document is for guidance only, and the local conditions must be considered when applying the information. Also, any local regulations must always be followed.

2.2 Objective

This manual is aimed at the personnel involved in the installation, operation and maintenance. The main objective is to give guidance information for installing and running the equipment in a safe and correct way. Besides, a complementary accessories instruction is also given for our customers to purchasing the spare parts.

To make the information clear and easy to understand, only foreseeable conditions have been considered. Situations that may arise from unintended use of equipment, machinery or tools are not covered.

Furthermore, the information given in this document is for guidance only, and the local conditions must be considered when applying the information. Also, any local regulations must always be followed.

2.3 Safety Instructions

2.3.1 General

Only persons with adequate training are allowed to perform installation, operation and maintenance on the equipment.

- Read and obey any safety instructions.
- Observe the warning signs on the equipment. The signs must not be removed.

2.3.2 Be aware of chemicals

The safety data sheets (see the appendices) provided with the chemicals must be thoroughly studied before the chemicals are used.

- When handling chemicals, contact with skin and eyes must be avoided. Therefore, always use protective clothing, including safety glasses and impermeable gloves. Also, respiratory protective equipment may be required. Never eat or drink while handling chemicals.
- The chemicals must be kept in a well-ventilated place. Spills must be properly collected and the chemicals disposed of in accordance with the regulations.

2.3.3 Notice personnel safety during installation and operation

- Make sure that all units are properly supported during the installation work, so that they cannot fall or tip over.
- Notify the other installation workers before starting an installation task that requires special attention from co-workers.

2.3.4 Pay attention to welding work

All welding operations must be performed by qualified personnel.

- Before starting the welding, check that there is no flammable material nearby. Also make sure that there are no explosive gases and that the ventilation is sufficient.
- Beware of hot surfaces during and after the welding.

2.3.5 Pay attention to the risk of ignition

The equipment may contain combustible material.

- Do not light matches or open flames in the vicinity of combustible material.
- Prevent electrical sparks from occurring.
- Check that the area is free of combustible gases, liquids or dust before using any power tool

or welding equipment.

2.3.6 Prevent unintended starting during maintenance work

Before starting any maintenance work, make sure that the equipment cannot be accidentally started.

- Set the safety switch to the OFF position and lock the switch.
- Disconnect the electrical power and tag out the device.
- If needed, isolate the unit by closing and securing inlet and outlet valves and releasing the pressure.

2.3.7 Prevent electrical shocks

Only trained electricians may perform work on electrical equipment.

- Before connecting power cables or starting any other electrical installation work, check that the system is not energized. Also make sure that the power cannot be connected during the installation work.
- Be careful not to damage any cables or other electrical equipment during the installation.
- Do not open the electrical cabinet during operation.
- Do not touch electrical wiring and components until the main switch has been switched off and secured.
- If the equipment contains capacitors, be aware that the capacitors can retain a charge even after being disconnected from the mains.

2.3.8 Avoid burns and splashes

Before dismantling or opening any process equipment, consider what the system may contain and take the necessary precautions to avoid burns, exposure to hazardous substances, spills or splashing.

During operation, the pipes will contain hot liquids, and the surface may be hot. Allow all elements cool down before performing any maintenance work on them. Remove all pressure from the system before opening any part of it.

2.3.9 Be aware of the power of pressurized air

The compressed air system contains air under very high pressure.

- Do not open any component, unit or part of the system before ensuring that it is not pressurized.
- Look out for jets of pressurized air.

- If a part of the system is isolated for maintenance work, the valves must be locked and properly tagged out in order to prevent accidental opening.

2.3.10 Take precautions for confined entry

Before working in a confined space, take the following precautions:

- Close and lock all inlet valves and outlet valves and dampers to the space.
- If the space has contained chemicals that can produce vapors, the space must be properly vented and the air must be tested.
- Use respirators if there is hazardous dust.
- Assign two people for a hole watch. They must remain stationed outside the space where they can observe the workers inside
- Test the air again at the beginning of each shift.

2.3.11 Use protective clothes and equipment

Use overalls made according to safety regulations, protective gloves, safety glasses, industrial shoes, ear protection and helmet.

2.3.12 Keep the area clean

Wipe up oil spills and dispose of all debris that might cause accidents.

2.4 List of Abbreviations

ABS	Ammonium BiSulphate
CBV	Cylinder Bypass Valve
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DN	Nominal Diameter
ECC	Electrical Control and Communication System
EGB	Exhaust Gas Bypass
EMS	Engine Management Services
ERCS	Emission Reduction Control System
ERR	Error Message
HMI	Human Machine Interface
H ₂ O	Water
HP	High Pressure
HS	High Sulfur
LP	Low Pressure
LS	Low Sulfur
ME	Electronically controlled engine
MOP	Main Operating Panel
MPC	Multi Purpose Controller
MSDS	Material and Safety Data Sheets
N ₂	Nitrogen
NH ₃	Ammonia
NO	Nitrogen Monoxide
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides (NO and NO ₂)
O ₂	Oxygen
OP	Operation Panel
p-scr	Pressure in the SCR line
P&ID	Process and Instrumentation Diagram



PLC	Process Logic Control
PN	Nominal Pressure
RBV	SCR Reactor Bypass Valve
RP	Reset Point
RSV	SCR Reactor Sealing Valve
RTV	SCR Reactor Throttle Valve
S	Sulfur
SCR	Selective Catalytic Reduction
SO ₂	Sulfur Dioxide
SP	Set Point
T/C	Turbo Charger
T-reactor in	Exhaust Gas Temperature at Reactor Inlet
T-SCR in	Exhaust Gas Temperature at SCR Inlet
T-SCR out	Exhaust Gas Temperature at SCR Outlet
T-turbine in	Exhaust Gas Temperature at Turbocharger inlet
wt.	By weight
WNG	Warning Message

2.5 Working Principle

This section briefly describes the basic theory for HeNO_x HP SCR process. The HP SCR process, illustrated in Fig. 2.1, takes place in the SCR line, which consists of three major components: the SCR reactor, combined vaporizer/mixer unit and the dosing unit. The reducing agent is injected by the dosing system in the vaporizer/mixer, which will vaporize and mix with the exhaust gas. The prepared gas is led to the SCR reactor where the NO_x reduction takes place.

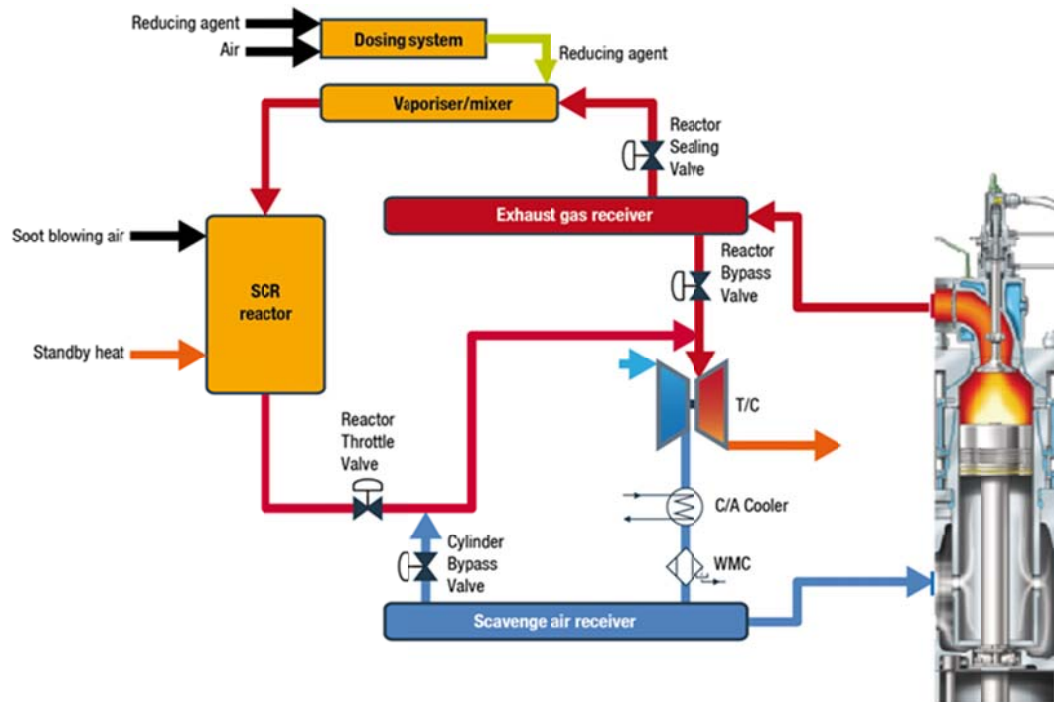


Figure 2.1 HP SCR Layout

Due to the demand for a relatively high temperature of the SCR process, it is convenient to place the SCR line on two stroke marine diesel engines on the high pressure side, i.e. before the turbocharger. Because of this aspect, the term HP is used. Depending on the engine load, the exhaust gas temperature on this side is 50-175 °C higher than on the low pressure side.

When operating in Tier II mode (SCR not yet enabled, reactor by-passed) the SCR system is cut off by the Reactor Sealing Valve (RSV) and the Reactor Throttle Valve (RTV). The Reactor Bypass Valve (RBV) is open and exhaust gas passes directly to the turbocharger. A venting system is running, in order to keep the SCR line and the reactor clean. The system might also include an Exhaust Gas By-pass valve (EGB) to provide the engine with low load EGB tuning when operating in Tier II mode (the EGB is not shown on Figure 2.1).

When operating in Tier III mode the SCR system will be engaged if the exhaust gas temperature is above the sulfuric acid condensation limit (200°C). If not, a standby heat system will keep the SCR system above the sulfuric acid condensation limit, if possible. If the exhaust gas temperature is ok, the SCR line is opened by the valves, RSV and RTV, and hereafter the RBV will be closed. As soon as gas flows through the reactor, soot blowing is started, in order to avoid clogging of the reactor with soot particles.

Even though the reactor is placed before the turbine, the exhaust gas temperature will still not be sufficiently high at low loads for the SCR process to take place. To increase the temperature, a cylinder bypass from the scavenge air receiver to the turbine inlet is installed. The bypass is controlled by the cylinder bypass valve, CBV. When opening the bypass, the gas flow through the cylinders will be reduced without losing the scavenge air pressure and, accordingly, the exhaust gas temperature will increase. This system make-up enables maintenance of the sufficiently high temperature for the SCR process to take place. However, the cylinder bypass will increase the SFOC depending on the required temperature.

When all temperature sensors in the SCR line measure a value within the allowed temperature window, the injection of reducing agent, and hence NO_x reduction, can begin.

2.6 General Description and Arrangement

The general arrangement for HeNO_x System is shown in Figure 2.2.

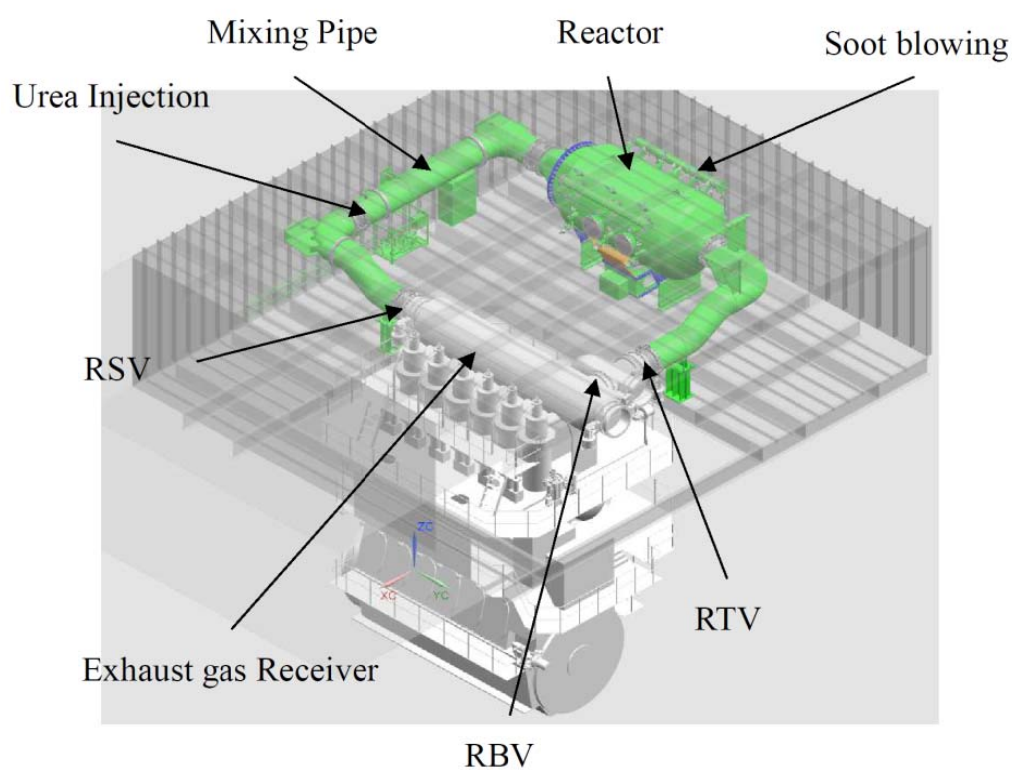


Figure 2.2 General HeNO_x System Arrangement

2.7 Technique Data

The technical properties of HHM SCR system which fulfill the requirement of regulations are shown as follows,

No.	Items	Specifications	Remark
1	NO _x Emission (E3 cycle)	≤ 3.4 g/kW.h	
2	NH ₃ Slip	< 10 ppm	
3	Max Pressure Drop	70 mbar	
4	SO ₂ Oxidation	< 2%	
5	Lifetime of Catalyst	5 years or 10000 operation hours	
6	Reducing Agent	40%wt Urea Solution	
7	Temperature Condition	285~500 °C	

Table 2.1 Technical Properties of HHM SCR System

2.8 Utilities

The consumption of energy in the HHM SCR system can be summarized into two parts, which are electricity and compressed air. The data for these parts will be discussed separately.

2.8.1 Consumption of Electricity

The electricity consumption can be classified into the following parts and compared with all other parts, standby heat unit takes up the biggest p

No.	Items	Power	Voltage
1	Control Cabinet	0.3KW	AC220 V, 50/60 Hz, Single Phase
2	Pump Unit	6KW	AC440 V, 60 HZ, Three Phase
3	Dosing Unit	1KW	AC220 V, 60 HZ, Single Phase
4	Soot Blowing	0.1KW	AC220 V, 60 HZ, Single Phase
5	Standby Heat Unit	30KW	AC220 V, 60 HZ, Single Phase

Table 2.2 Consumption of Electricity of HHM SCR System

2.8.2 Consumption of Compressed Air

The compressed air in the system is mainly consumed by the following three parts. There are several points that need to be notice.

- The pressure of compressed air should always be kept at or above 6 bars.
- Before turning of or reducing compressed air switch of the SCR on the main cabinet and wait for the procedure for cleaning the lance to finish.
- Assure that the quality of compressed air should comply with the specification ISO 8573-1, class 2.4.2.

No.	items	Pressure/Amount
1	Urea Injection Assist ^{*1)}	9-11 bar/ 225 Nm ³ /h
2	Soot Blowing System	9-11 bar/ 15 Nm ³ /h
3	Venting ^{*2)}	5-7 bar/ 260 Nm ³ /h

Table 2.3 Consumption of Compressed Air of HHM SCR System

*1): The urea solution consumption and the compressed air consumption are not guaranteed, since it is based on estimated engine NOx emissions. The final NOx consumption data is to be determined on testbed. So a tolerance of 25% should apply to the urea consumption and the compressed air consumption of the urea injection.



*2): The compressed air consumption of venting system finally depends on the SCR pipe layout. So if you use this data, a tolerance of 10% should be considered.

2.9 Product handling

2.9.1 Unloading and storing the equipment

To facilitate the installation and prevent damage to the equipment, the unloading and intermediate storage of the shipment must be carefully planned.

The units are delivered in containers or wooden crates. The containers or crates can be lifted and moved with a crane. The crates can also be transported with a forklift truck, provided that a truck with sufficient capacity is available.

- Check the delivery before starting to unpack the components.
- Unload the units as close to the assembly point as possible.
- Make sure that the stored units do not block any passage or otherwise obstruct the work.
- Place all units and components on a solid support.
- Place timber under and between different steel parts, to avoid paint damage or other damage.
- Do not remove the protective covers until it is time for the installation or inspection of the equipment.
- If a unit must be stored outdoors for a long period of time, cover it with a tarpaulin.

2.9.2 Inspecting the delivery

When the equipment has arrived to the site, it should be checked for transport damage or missing parts.

Procedure:

1. Check the delivery against the packing list, to make sure that all parts are included.

Make sure that all pipes and other components that were dismantled for the transport are included in the delivery.

2. Make a visual inspection of the equipment for signs of transport damage.

Check that any temporary fastening and locking devices are intact, and that all protective covers are in place and undamaged.

3. If transport damage is found or suspected, make a thorough inspection and immediately issue a failure report.

Consider that the process of delivering replacement parts may be time-consuming.

Postrequisites: If the equipment will be stored outdoors before the installation, it must be repacked after the inspection.

2.9.3 Lifting and moving units

Prerequisites: Make sure that the capacity of the lifting device is sufficient before starting to lift a unit. For weight information, check the marking on the unit. The weight is also specified in the dimensional drawings.

The units can be lifted and moved with a crane. They can also be moved with a forklift truck, provided that a truck with sufficient capacity is available. Always ensure that the unit is well balanced and cannot tip or fall out of position.

Procedure:

1. Inspect the lifting ropes/belts or chains.
 - Check that the ropes or chains are in perfect condition.
 - Make sure that the ropes are strong enough.
2. Attach the lifting tools to the unit.

Lift the unit at the dedicated lifting points, when available.

- Make sure that the lifting hooks are securely fastened.
 - Make sure that the lifting ropes are long enough to obtain a sufficient lifting angle. Use spreaders if required.
 - Adjust the lifting ropes so that they carry the load evenly and the unit is well balanced. The ropes must not get twisted, and they must not press against any part of the unit that could be damaged.
3. Warn other persons near the lifting area that the lifting is about to begin.
 4. Test the lifting arrangement.
 - Tighten the lifting ropes until the unit is lifted off the floor.
 - Check that the lifting tools are securely fastened.
 - Check that the unit is well balanced.
 5. Lift the unit carefully in position, avoiding rapid movements or jerks that may damage the equipment.

Do not lift the unit higher than necessary.

WARNING



Always make sure that nobody is under the lifted unit.

6. Make sure that the unit is stably positioned and secure before removing the lifting equipment.

2.9.3.1 Lifting the reactor

The reactor can be lifted in horizontal or vertical position. Fastening points for the lifting hooks

are located in each corner of the reactor.

Using lifting belts, the reactor can be lifted also without removing the packaging material.

CAUTION	
	An incorrect lifting arrangement may damage the reactor housing due to excessive stress.

- Preferably, lift the reactor in horizontal position using lifting belts when moving it from one place to another.

CAUTION	
	Protect the lifting belts properly from any sharp edges on the reactor.

- If the reactor is to be installed in a vertical position, raise it carefully from horizontal to vertical position before the installation. Lift the reactor in vertical position when installing it in the exhaust gas duct.
 - Be careful not to damage the reactor end.
 - Take care to prevent that the reactor starts swinging.

Example: Lifting arrangement examples are shown in Figure 2.1. Refer to the dimensional drawing for information about lifting points, etc.

Note: The maximum angle for lifting belts is 60°.

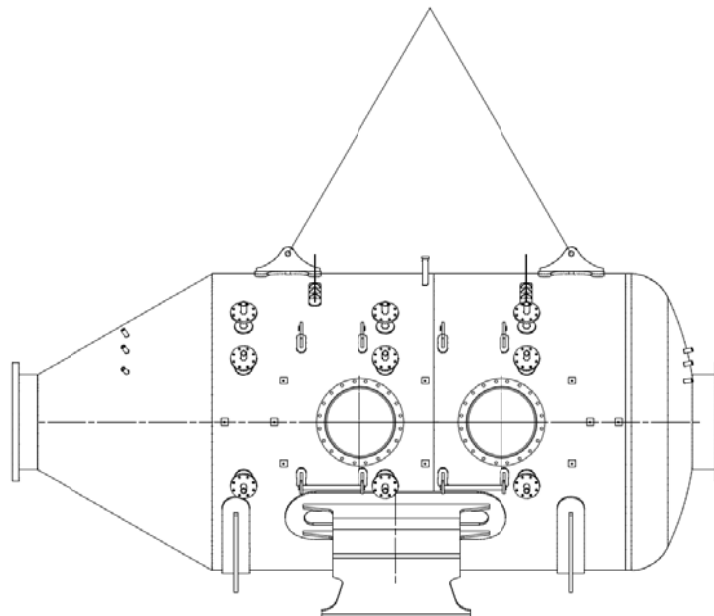


Figure 2.3 Lifting the Reactor in Horizontal Position Using the Lifting Lugs

2.9.3.2 Lifting the units

Lift the pump unit using the lifting lugs. Use spreaders if required, to ensure that the lifting angle does not cause a risk of damaging the pump unit.

Lift the urea dosing unit, the air unit and the control unit to the mounting position using lifting belts or lifting lugs. As an additional safety precaution when lifting to high positions, place and strap the units on a pallet, and attach the lifting equipment to this.

Use lifting belts or ropes when lifting the mixing and injection unit. Use spreaders if required for additional balance. If the mixing and injection unit is to be installed in a vertical position, raise it carefully from horizontal to vertical position before the installation. Take care to prevent that the unit starts swinging.

CAUTION	
	Protect the lifting belts or ropes properly from any sharp edges.

Example:

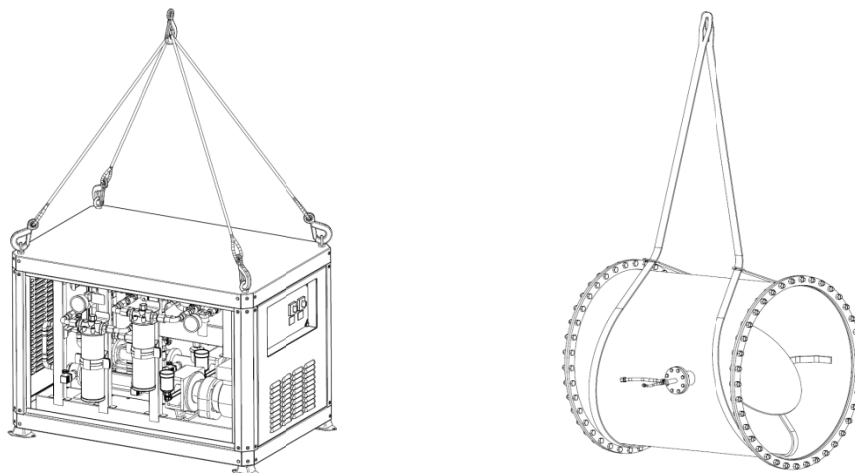


Figure 2.4 Schematic Diagrams for Lifting Units

2.9.4 Storing and handling the catalyst

Make sure that the catalyst storage conditions fulfil the following requirements. During prolonged storage, check and record the storage conditions at least once a month to verify that the requirements are met.

- Keep the catalyst elements in the original packaging during storage. Do not remove the packaging until the installation of the catalyst.
- Preferably, store the catalyst elements indoors in a closed and dry area. If this is not possible, the catalyst can temporarily be stored in the container. The catalyst must be protected from

rain.

- Make sure that the catalyst is protected from oils and other chemicals.
- Store the catalyst in a stable position on solid and plain ground. The crate containing the catalyst elements must be placed with the right side up.
- Used catalyst elements that have been in contact with exhaust gas must be stored under strictly controlled conditions. Keep the catalyst as clean and dry as possible. The catalyst can be carefully cleaned using compressed air, to prevent unwanted chemical reactions resulting in inactivation of the catalyst.

Handle the catalyst elements carefully, to avoid damage.

- The catalyst element frames are open at the top and the bottom. Make sure that the catalyst elements are not exposed to any environmental conditions (moisture, contamination, etc.) that may damage the catalyst.
- Do not tread on the catalyst surface.
- Take care to avoid mechanical stress, vibration, etc. during transport or installation.

Take care to avoid personal injury and reduce the exposure to hazardous substances when installing the catalyst or removing used catalyst elements from the reactor.

- Handle the catalyst elements in accordance with the material safety data sheet (see the appendix).
- Always use adequate protective equipment. The required personal protective equipment includes, at least, safety shoes, working gloves, working clothes, hard hat and safety harness.

Example:



The right image shows the catalyst elements after opening the crate.

Source: JOHNSON MATTHEY CATALYSTS (Germany) GmbH

Figure 2.5 Incorrect Storage of the Catalyst



The right image shows the catalyst elements after opening the crate.

Source: JOHNSON MATTHEY CATALYSTS (Germany) GmbH

Figure 2.6 Correct Storage of the Catalyst

WARNING	
	When handling used catalyst elements that have been in contact with exhaust gas, additional safety equipment is needed, as there may be hazardous exhaust components on the catalyst. The additional safety equipment includes a category III protective suit with hood, protective goggles and a particle mask

2.10 Installing the SCR system

Procedure:

1. Unpack and inspect the equipment.
Make sure that all parts are included in the delivery and that no units are damaged.
2. Mount the reactor.
Install also the soot blowing system on the reactor, if it is not already in place.
3. Mount the exhaust gas ducts, including the injection duct and the mixing duct.
 - The ducts between the injector and the reactor must be made of urea-resistant material.
 - Install flexible bellows as required, to reduce the transmission of vibration from the engine and compensate for thermal expansion.
4. Mount the injector lance on the connection point of the injection duct.
5. Mount the urea dosing unit.
6. Mount the air unit.
7. Mount the pump unit.
8. Mount the control unit.
9. Insulate the exhaust gas ducts and the reactor, and mount the cladding.
10. Install any external units for urea and compressed air supply.
11. Make the urea and compressed air piping between the units, and connect the pipes.
Before the pipes are connected, they must be properly cleaned and flushed to remove any dirt.
12. Connect the power supply and control cables.
13. Install the catalyst elements inside the reactor.

The detailed installation process for each unit mentioned before will be presented in the following chapters.

3. Reactor

The nitrogen oxides reduction takes place in the reactor, which is installed in the exhaust gas duct from the engine, between the exhaust gas receiver and turbocharger.

The reactor is a steel casing containing a number of catalyst elements. As the exhaust gas flows through the catalyst layers in the reactor, the nitrogen oxide reacts with the reducing agent. The reactor has space for several catalyst layers, depending on the installation. An optional oxidation catalyst layer can be installed in addition to the SCR catalyst.

Using multiple catalyst layers enables adjustment of the reactor performance to an optimal level, and flexible replacement of the catalyst elements. The space between the catalyst layers enables inspection and manual cleaning of the catalyst. The catalyst elements are accessed for maintenance and replacing through manholes in the reactor wall. Compressed air connections for soot blowing are installed at each catalyst layer. The soot blowing connections are located on two opposite reactor walls, to ensure efficient cleaning of all catalyst elements.

The reactor is equipped with a differential pressure transmitter for monitoring the condition of the catalyst elements, as well as upstream and downstream temperature transmitters for monitoring the exhaust gas temperature.

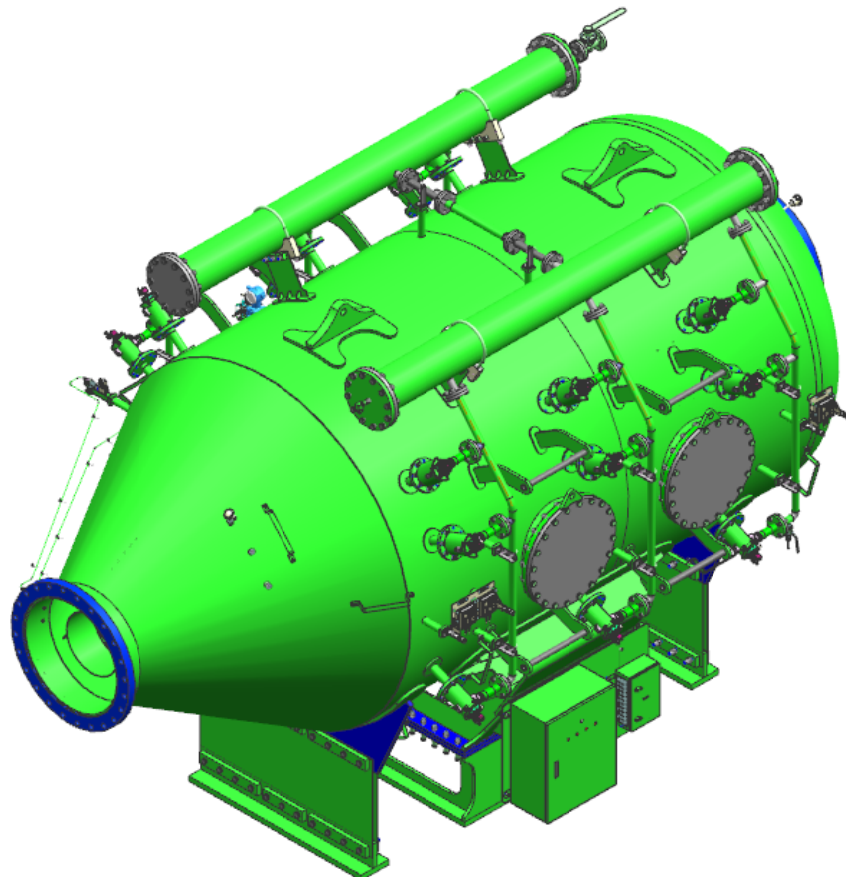


Figure 3.1 Reactor and Sootblowing

3.1 SCR Catalyzer and Housing

3.1.1 Characteristics

The conversion of NO_x into nitrogen and water takes place in the reactor.

The catalyst elements are located in steel frames inside the reactor. The brick-shaped catalyst elements have a honeycomb structure, to increase the catalytic surface. The SCR catalyst uses vanadium pentoxide (V_2O_5) as the catalytic material and the formulation also contains TiO_2 and WO_3 .

The catalyst is cleaned by regular soot blowing, to prevent deposit formation and clogging, but it will still be deactivated with time. The catalyst ageing is mainly caused by thermal load and small amounts of catalyst poisons. When the catalytic activity has decreased too much, the catalyst must be changed.

There are four important things that the reactor must live up to:

1. The reactor volume contains the necessary amount of catalyst material in order to achieve the desired NO_x reduction. The catalyst material must be kept clean, in order to work as intended.
2. Excessive pressure drop is undesirable.
3. The maximum exhaust gas temperature is 500 °C
4. Satisfactory distribution of the exhaust gases. The mass flow profile through the reactor should be as uniform as possible. This is to ensure optimum contact between the process gas and the catalyst.
5. The mechanical strength as well as tightness may not be compromised.

The material used for housing and structure elements of the reactor, flanges is 15CrMoR (16MO₃). All flanges on reactor are according to GB/T 9119, PN10.

3.1.2 Equipment

- 1 x flow-in hood
- 1 x reactor housing
- 1 x flow-out hood
- 1 x heat insulation
- Catalyst modules
- 2 x temperature measuring devices for inlet and outlet of the reactor
- 1 x differential pressure measuring device

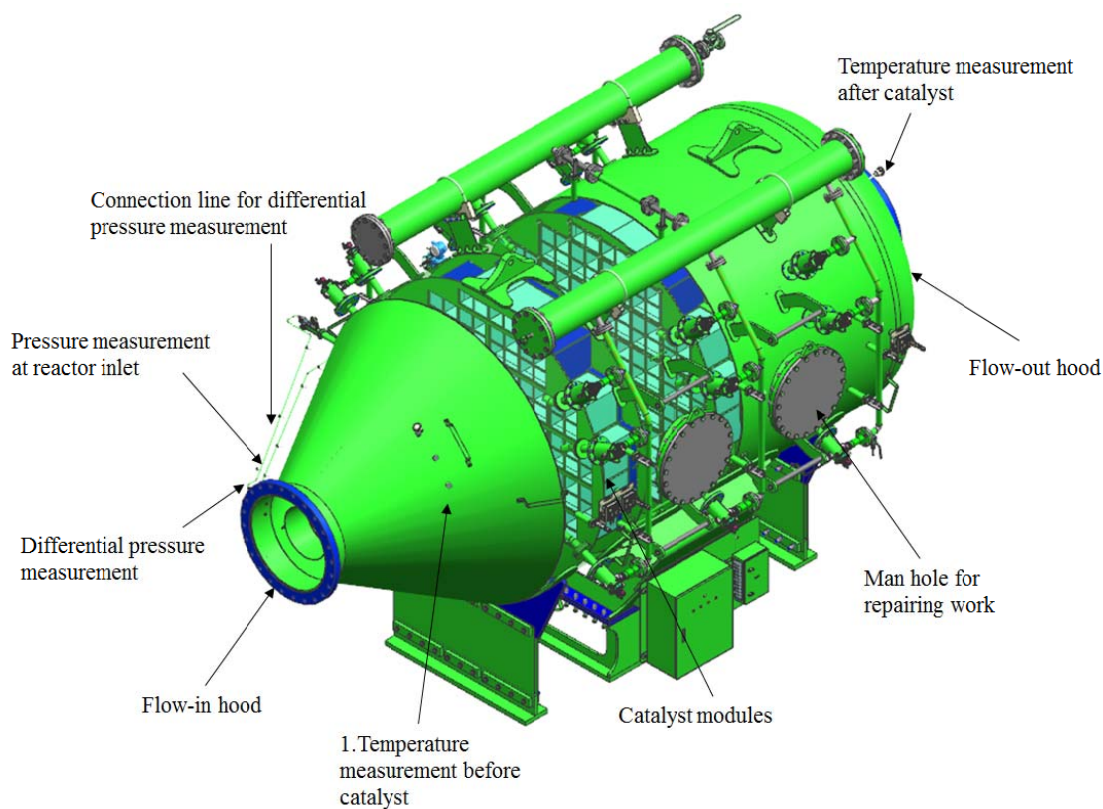


Figure 3.2 Components of SCR Reactor.

	Designation	Function
1	Temperature measuring device	Measures the temperature at the inlet of the SCR Reactor.
2	Differential pressure measuring device	Measures the differential pressure above the catalyst.
3	Pressure measuring device	Measures the pressure at the inlet of the SCR Reactor.
4	Flow-in hood	Forms the connection between exhaust gas pipe on the inlet of the Reactor and the Reactor housing. Diameter increases towards the Reactor.
5	Catalytic converter element	Makes possible the reaction of the reducing agent with the exhaust gas.
6	Man holes	Make the staff check and replace the catalyst modules.

	Designation	Function
7	Temperature measuring device	Measures the temperature of the exhaust gas at the SCR Reactor outlet.
8	Flow-in hood	Forms the connection between exhaust gas pipe on the inlet of the Reactor and the Reactor housing. Diameter increases towards the Reactor.
*	Reactor housing (thermal insulation not included in the scope of delivery)	

Table 3.1 Functions of Components in SCR Reactor

3.1.3 Installation

The SCR reactor and the mixing duct should be installed in the exhaust gas system directly before the turbocharger. In the standard configuration, the reactor is installed in a horizontal position.

Due to the high exhaust gas temperatures required for efficient and durable SCR operation, the reactor must be installed upstream of any equipment that decreases the exhaust gas temperature such as silencer, exhaust boiler, and scrubber. An exception is combined mixing duct and silencer.

The flow-in hood is the connection between the waste gas steel tube and the reactor, and has a steadily enlarging diameter. The reactor housing is reinforced by fins. It is a self-bearing, gastight steel casing that compensates for the weight forces and flow resistance of the SCR and oxidation catalyst modules and protects them against mechanical damages.

The catalyst modules are controlled and cleaned through revision openings located on the sides which are to be closed gastight with a cover. These openings also permit a quick and safe upgrade or replacement of the catalyst modules.

In addition, the housing also includes all facilities required for installation of the catalyst modules as well as the gas inlets and gas outlets which are designed as flanges.

Being the connection between reactor outlet and waste gas tube, the flow-out hood permits the waste gas streaming into the cylindrical waste gas channel.

The modular design ensures easy installation and removal of catalytic components. Individual catalytic honeycombs are combined to larger units, several levels of which are installed each time at once into the housing. This method avoids the complicated production of individual ceramic honeycombs in favor of a rapid, problem-free and safe modular installation.

Particular constructive measures avoid friction contacts of the ceramic honeycombs with neighboring elements and the steel shell. Thus, additional safety against abrasion and mechanical vibration is created.

Procedure:

Some critical points that need to be notices during the installation process are shown as follows,

1. Make sure that the support structures for the reactor have been properly mounted and secured.
 - There is enough space and the possibility for the transport of the single SCR catalyst modules.
 - The reactor must be safely mounted on a suitable foundation. The foundation must be designed to hold the weight of the reactor, the catalyst and the insulation.
 - The mounting arrangement must ensure that the reactor housing is not submitted to any excessive stress caused by engine vibration or other external loads during operation. Install dampers as necessary. Avoid excessive pulsation (higher than +/- 50 mbar).
2. Lift the reactor carefully in position.
 - Before installing the reactor, ensure that the service space around the reactor will be sufficient for the installation of the catalyst elements. The required service space is specified in the drawings, which means that enough space for mounting, dismounting and cleaning the catalyst modules (min. 700 mm in front of all inspection doors) is permanently available.
 - Furthermore, enough space is needed for mounting and dismounting the thermocouples (min. > 450 mm). And the space for service and maintenance of soot blower equipment and differential pressure device also need to be considered.
3. Fasten the reactor to the support structures.
 - A vertical reactor is fastened with bolts and turnbuckle screws.
 - A horizontal reactor is fastened with bolts in the corners of the reactor housing
4. Connect the exhaust gas inlet and outlet ducts to the reactor.
 - a) Mount the seals at the flange connections.
 - b) Bolt the flanges of the exhaust gas duct and the reactor together.
 - c) Check that the connections are tight.
5. Mount the temperature and pressure transmitters
 - a) Install the temperature sensors on the inlet and outlet sides of the reactor.
 - b) Lubricate the thread with a stainless steel lubricant.
 - c) Screw tight.
 - d) Install the differential pressure transmitter.
 - Connect the transmitter by pipes to the inlet duct (positive side) and the outlet duct (negative side) of the reactor.
 - Mount the transmitter in an accessible place.

- The transmitter must be mounted above the measuring points and the impulse pipes must be continuously rising, so that any condensate will drain off.

6. Insulate the reactor and mount the cladding.

Ensure that the insulation meets the requirements provided by local regulations, applicable safety requirements and standards. A mineral wool insulation material is normally recommended. An insulation thickness of 150 mm is suitable for the reactor and does not increase the reactor width significantly due to the reactor structure.

- Make sure that the material of the insulation fasteners is compatible with the reactor material.
 - The service hatches, instrumentation equipment and tightening bars bolts must be accessible for maintenance work without destroying the insulation.
 - The insulation should not cover the soot blowing pipes, to avoid overheating of valves.
 - The operator safety is to be ensured by preventing access to any hot surfaces. If access prevention is not applicable, it is recommended to use warning signs for hot surfaces.
 - If the reactor is installed outdoors, ensure that the cladding is watertight.
7. Attach the reactor sign to the insulation of one of the service hatches using, for example, rivets.
8. Connect the signal cables from the temperature transmitters and the differential pressure transmitter to the control unit.

The distribution box will be installed near the catalyzer housing. The Maximum distance of cables is 20 m.

Note: HHM strongly recommends to place the housing on all-metal dampers and to use flexible upper mounting parts for the installation of the housing.

Regarding dampers consider all forces (SCR housing incl. catalysts, silencer, insulation, pipes...). The housing is designed to carry axial forces only.

As the reactor involves no moving equipment, daily maintenance is almost unnecessary. The SCR reactor may be inspected according to applicable Codes and Standards (already in place at the station for entering confined spaces etc.) and at intervals recommended by the manufacturer.

Recommended inspection intervals: once per year (i.e. during major inspection)

3.1.4 Maintenance

3.1.4.1 SCR performance control (monitoring)

The performance of the SCR system declines gradually, without sudden changes. Thus, in order to estimate the service life of the catalyst during operation and to evaluate the need for catalyst

replacement in advance, it is important to record the performance of the ERCS MOP over time.

Our operating experience to date indicates that the performance of the ERCS MOP deteriorates gradually, without any sudden changes. The long-term deterioration in HeNO_x performance is due to the decrease in catalytic activity; in some cases, however, it is equipment related, e.g. non uniform NH_3 injection, fly ash accumulation on the catalyst layer, etc.

For this reason, real HeNO_x performance over time is recorded by collecting the following three data:

- Operating data from actual unit (daily operating records)
- Performance test data from actual unit
- Activity evaluation data from sampled catalyst

3.1.4.2 Cleaning and inspecting the catalyst

WARNING	
	Danger of hot gases - before doing maintenance inside the reactor, ensure that the engine is shut down and locked out.
WARNING	
	Danger of hot surfaces - do not enter the reactor until it has cooled.
WARNING	
	When handling used catalyst elements that have been in contact with exhaust gas, additional safety equipment is needed, as there may be hazardous exhaust components on the catalyst. The additional safety equipment includes a category III protective suit with hood, protective goggles and a particle mask according to EN 149:2001, protection class FFP3D.

Cleaning the catalysts yearly will improve performance; a thorough visual inspection is needed if performance control measurements indicate catalyst degeneration. At the beginning of a long downtime, the reactor and catalyst must also be inspected and cleaned. This is needed to prevent chemical reactions with the ash and catalyst material.

Procedure:

1. Remove the manhole covers.

Carefully remove the insulation over the manhole covers.
2. Clean the catalyst surface.
 - Use a mechanical process such as compressed air or a vacuum cleaner.
 - Blow the air from the outlet side (the side free of deposits) to the inlet side.
 - Do not use water to clean the catalyst

- Avoid damaging the catalyst. Do not walk directly on the catalyst surface.
3. Inspect the catalyst.
A thorough visual inspection is needed if performance measurements indicate catalyst degeneration.
 4. Clean the reactor if needed.
Use a mechanical process such as compressed air or a vacuum cleaner. Do not use water.
 5. Inspect the reactor.
 6. Install the manhole covers and insulation.
Use new sealing cord.

3.1.4.3 Adding catalysts to the spare layer, as required

WARNING	
	Danger of hot gases - before doing maintenance inside the reactor, ensure that the engine is shut down and locked out.
WARNING	
	Danger of hot surfaces - do not enter the reactor until it has cooled. The recommended minimum time is 16 hours.
WARNING	
	When handling used catalyst elements that have been in contact with exhaust gas, additional safety equipment is needed, as there may be hazardous exhaust components on the catalyst. The additional safety equipment includes a category III protective suit with hood, protective goggles and a particle mask according to EN 149:2001, protection class FFP3D.
CAUTION	
	Protect the new catalysts before installation - ensure that the catalysts are protected from rain or other unfavourable conditions.

Procedure:

1. Open the service hatches of the reactor.
 - a) Carefully remove any insulation over the service hatch.
 - b) Remove the fastening bolts of the hatch.
 - c) Open the hatch and secure it in the open position.

If the service hatch is not hinged, secure it with the lifting device before removing the bolts. Lift away the hatch and place it in a safe location, using proper lifting equipment and safety precautions.

2. Check that the reactor is ready for the installation of the catalyst.
 - a) Remove the old catalyst elements if existing.

Move the old catalyst elements to a location where they will not interfere with the new catalyst installation.
 - b) Check that there are no foreign objects in the reactor.
 - c) Clean the interior of the reactor of dust and soot.
 - d) Check the reactor interior walls and the catalyst supports for damage.
 - f) Ensure that the lighting inside the reactor is sufficient for the installation work.
3. Unpack the catalysts elements.

Unpack the catalyst elements close to the reactor to facilitate the installation. Handle the catalyst with care; avoid impact against steel structures, etc.

Do not install any catalyst elements that appear to be damaged.
4. Load the catalyst elements into the reactor through the service hatch.

Install the catalyst elements in the specified order.

 - a) Insert catalyst modules, item 1 and 2 for example, into the catalyst element frame supports.
 - b) There are gaps between catalyst element frame and its supports which are generated by dimensional tolerance or welding error. So in order to avoid unintentional movement of catalyst element frame during the SCR working process, “L” shaped lath (Item 4 and 5 in graph) with half waist hole is inserted into the gap to fasten the catalyst element frame. And the laths are fixed on support by double-screw bolts and nuts.
 - c) Install the baffle plates (Item 3, 6, 7, 8) to prevent catalyst element frame from axial movement.

Note: This part need to be read combined with SCR Catalyst Installation in section 3.1.5 Appendix.

Make sure that the catalyst elements are tightly fitted to each other, so that the position is secured and there are no leaks between the elements.

WARNING



Ensure that no one is in the area below when lifting and moving the catalyst elements. Use appropriate lifting equipment and a transport box when lifting the catalyst elements to the installation height.

CAUTION



Do not walk on the catalyst elements.

5. Remove any tools or equipment from the reactor.
6. Close the service hatches.
Replace the seals on the service hatches. Use new seals if required.
7. Carefully attach the insulation cover over the service hatches.

3.1.4.4 Replacing catalyst elements

WARNING	
	Danger of hot gases - before doing maintenance inside the reactor, ensure that the engine is shut down and locked out.
WARNING	
	Danger of hot surfaces - do not enter the reactor until it has cooled.
WARNING	
	When handling used catalyst elements that have been in contact with exhaust gas, additional safety equipment is needed, as there may be hazardous exhaust components on the catalyst. The additional safety equipment includes a category III protective suit with hood, protective goggles and a particle mask according to EN 149:2001, protection class FFP3D.
CAUTION	
	Protect the new catalysts before installation - ensure that the catalysts are protected from rain or other unfavourable conditions.

Procedure:

1. Open the service hatches of the reactor.
 - a) Carefully remove any insulation over the service hatch.
 - b) Remove the fastening bolts of the hatch.
 - c) Open the hatch and secure it in the open position.

If the service hatch is not hinged, secure it with the lifting device before removing the bolts. Lift away the hatch and place it in a safe location, using proper lifting equipment and safety precautions.

2. Remove the catalyst elements that need to be replaced.

Move the old catalyst elements to a location where they will not interfere with the new catalyst installation.

WARNING

Ensure that no one is in the area below when lifting and moving the catalyst elements.

3. Unpack the new catalysts elements.

Unpack the catalyst elements close to the reactor to facilitate the installation. Handle the catalyst with care; avoid impact against steel structures, etc.

Do not install any catalyst elements that appear to be damaged.

4. Load the catalyst elements into the reactor through the service hatch.

Install the catalyst elements in the specified order.

- a) Insert catalyst modules, item 1 and 2 for example, into the catalyst element frame supports.
- b) There are gaps between catalyst element frame and its supports which are generated by dimensional tolerance or welding error. So in order to avoid unintentional movement of catalyst element frame during the SCR working process, “L” shaped lath (Item 4 and 5 in graph) with half waist hole is inserted into the gap to fasten the catalyst element frame. And the laths are fixed on support by double-screw bolts and nuts.
- c) Install the baffle plates (Item 3, 6, 7, 8) to prevent catalyst element frame from axial movement.

Note: This part need to be read combined with SCR Catalyst Installation in section 3.1.5 Appendix.

Make sure that the catalyst elements are tightly fitted to each other, so that the position is secured and there are no leaks between the elements.

5. Remove any tools or equipment from the reactor.

6. Close the service hatches.

Replace the seals on the service hatches. Use new seals if required.

WARNING

Ensure that no one is in the area below when lifting and moving the catalyst elements. Use appropriate lifting equipment and a transport box when lifting the catalyst elements to the installation height.

CAUTION

Do not walk on the catalyst elements.

7. Carefully attach the insulation cover over the service hatches.

Note: Disposal is to be done according to federal, state, and local environmental control regulations. HHM advises that the best available technology (BAT), (e.g. recycling), should be used in order to minimize the environmental impact.

The catalyst's active material consists of vanadium. During use, heavy metals may accumulate on the catalysts; this means that the catalysts should be treated as hazardous waste. Please contact your local authority or disposal company for further advice.

3.1.5 Appendix

SCR Reactor & Catalyst Element Frame Installation

3.2 Standby Heat System (Option)

3.2.1 Characteristics

A standby heat system for avoidance of sulfuric acid condensation in the SCR reactor during stand-still and start-up is included in the HP SCR system.

The standby heat system keeps the temperature of the reactor above 200°C in Tier III areas, which is the expected sulfuric acid condensation limit. Furthermore a pre-heated SCR reduces the heating times of the SCR.

3.2.2 Installation

The Standby heat system is directly mounted on the reactor housing and inside the insulation layer by HHM and the arrangement can be varied.

3.2.3 Appendix

Standby Heat System P&ID Diagram

Standby Heat System Instruction Outline

Standby Heat System Installation Diagram

3.3 Soot Blowing System

3.3.1 Characteristics

To prevent contamination of the reactor elements, a soot blowing system is installed.

The soot blowing process is performed periodically when the exhaust gas passes through the SCR reactor and the soot is led out with the exhaust gas after being blown loose from the elements inside the reactor. The soot blowers installed in the SCR reactor are designed in a way that ensures only low permanent increase of the pressure loss across the SCR system over time i.e. keep the total pressure drop of the SCR system below the maximum pressure losses.

The task of Soot Blower System can be summarized as: blowing off particles and soot deposits from the catalyst modules with the help of compressed air impulses.

Note: All soot blower valves are connected with the catalyzer housing and supplied with compressed air (pressure level > 5bar overpressure) before running the engines. Otherwise the valves will be damaged. If engines should be tested without soot blower, install valves after testing the engines and close the sleeves in the housing.

3.3.2 Equipment

- Pressure switch
- Ball valve compressed air
- Soot blower air bottle

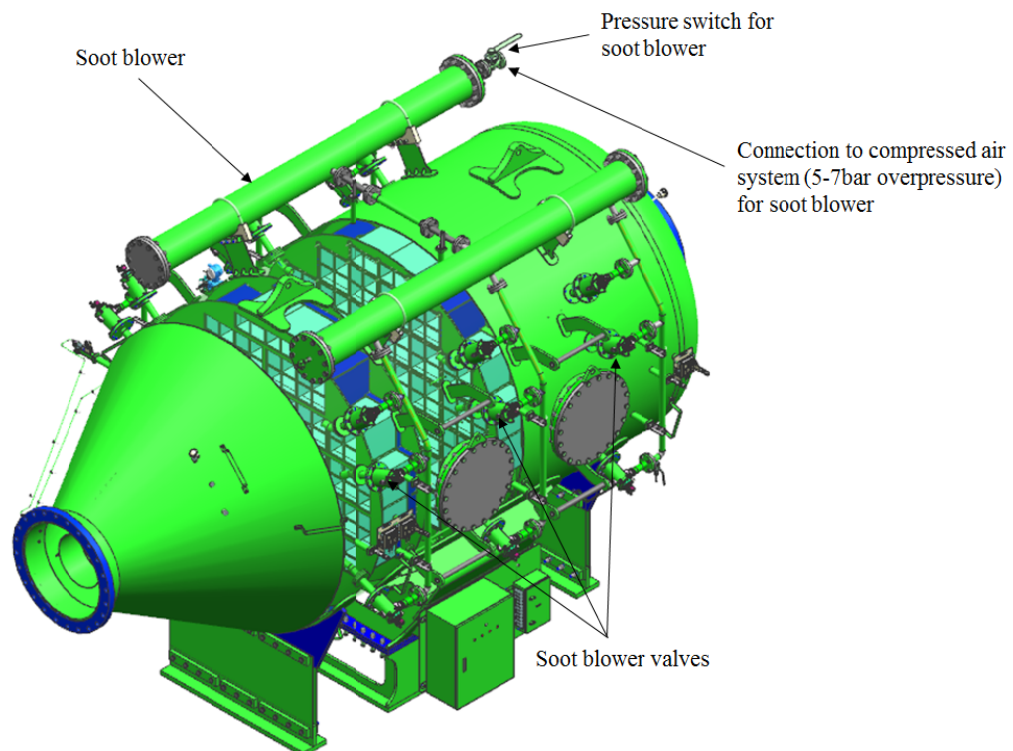


Figure 3.4 Soot Blowing System

	Designation	Function
1	Compressed air tank	Stores compressed air
2	Soot blower diaphragm valve (2 pcs per level)	Regulates the flow of the compressed air when soot blower is active.
	Compressed air ball valve	Opens/closes the compressed air supply from the compressed air tank.
3	Pressure switch	Opens/closes the compressed air supply from the air reservoir
4	Pipe	Connection to compressed air system for soot blower

Table 3.2 Components of Soot Blowing Unit

3.3.3 Installation

The soot blowing system is normally mounted on the reactor already before the delivery. If the soot blowing equipment is delivered loose, it has to be assembled in connection with the reactor installation. The pressure transmitter of the air vessel is always delivered loose.

Refer to the drawings when installing the soot blowing system.

Procedure:

1. Connect the prefabricated soot blowing pipes to the soot blowing connections of the reactor.
2. Mount the air distribution headers with the solenoid valves, and connect them to the soot blowing pipes.
3. Mount the air vessel and connect the pipes to the air distribution headers.

The air vessel is installed on brackets on the side of the reactor.

4. Install the pressure transmitter on the air vessel.
5. Connect the air inlet pipe from the urea dosing unit to the air vessel.
6. Connect the electrical cables of the solenoid valves and the pressure transmitter to the control unit.

3.3.4 Maintenance

3.3.4.1 Checking the soot blower valve operation

1. Check that the valves open and close correctly and according to the programmed sequence (if applicable).

2. Check that there is sufficient cooling air flow to the valve.

If the cooling air flow is not sufficient, the valve surface temperature will be higher than normal. The surface temperature should be below 80 °C.

A prolonged running without sufficient cooling will damage the valve membrane. A damaged membrane will result in a higher air consumption and insufficient soot blowing air pulse when the valve opens.

3.3.4.2 Maintaining the soot blower valves

WARNING - ELECTRICITY	
	Before doing any maintenance, make sure that the equipment is disconnected from the electrical mains and tagged out.
WARNING	
	The equipment is pressurized. Isolate and release the pressure before starting any maintenance.

Procedure:

1. Disassemble the valve.
2. Clean all parts.
3. Inspect the main diaphragm and pilot diaphragm for damage.
Replace if damaged.
4. Inspect the cover for damage or cracks.
5. Inspect the flexible pressure hose.
Replace if damaged.
6. Inspect the connecting pipes between the valve and the reactor.
Check that there are no tears or damage due to overheating. Replace if damaged.

3.3.5 Appendix

Soot blower System Outline

4. Dosing Handling System

4.1 Introduction

The dosing handling system is used for supplying reducing agent for SCR system. It includes pump unit, dosing unit and urea injection unit. The P&ID for DHS is shown in the following.

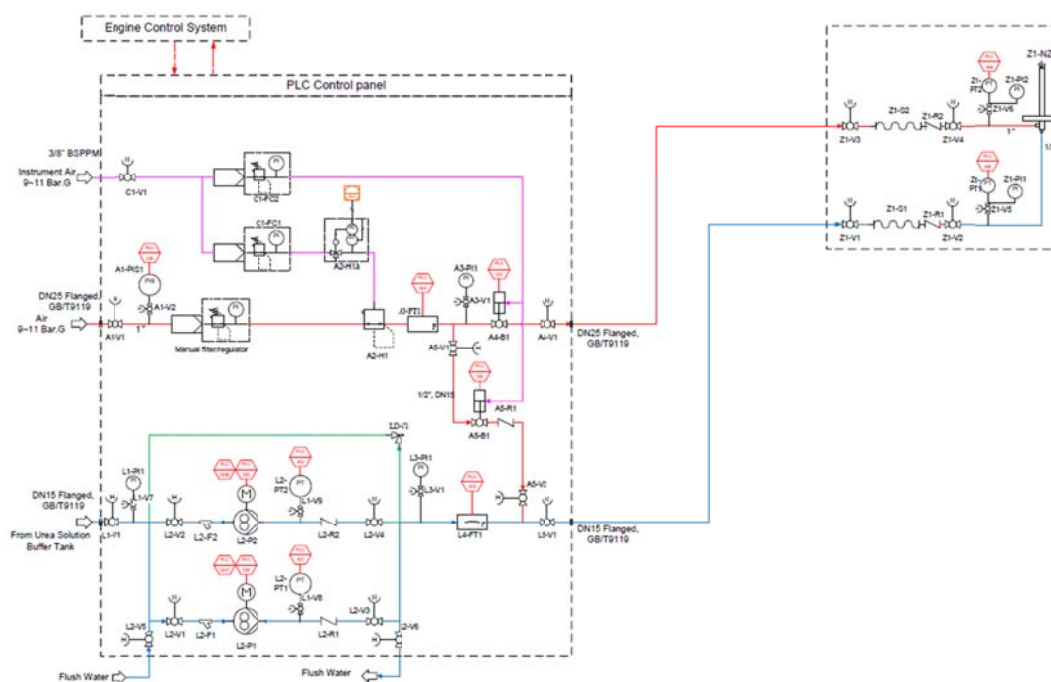


Figure 4.1 P&ID for DHS

The detail information for this part is described in Appendix 4.

5. Valve

There are four major functioning valves which control the respective process flows within the system.

The valves are controlled by the measured temperatures in the system. The most important functional aspect of the employed valves is to ensure that the engine does not become damaged as a result of unsuitable operational conditions, e.g. insufficient energy to the turbocharger. Besides this, the flow control is to subsequently ensure a suitable temperature, so that the reduction process can proceed satisfactorily.

Note: The configuration and number of employed valves can vary according to the number of turbochargers.

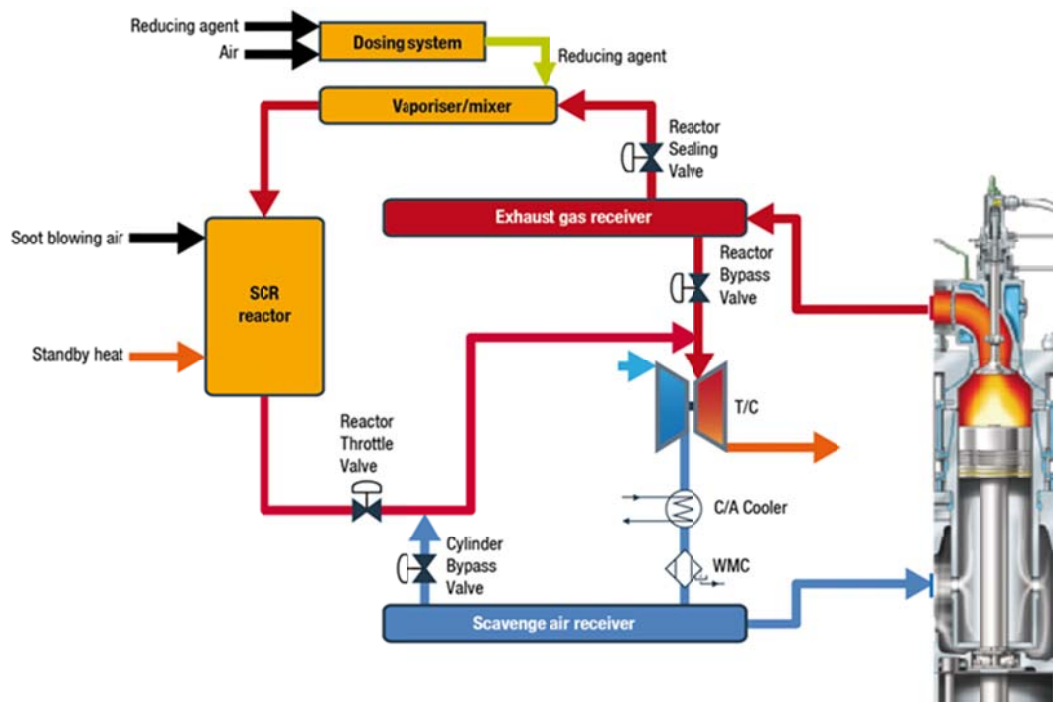


Figure 5.1 HP SCR Layout (Figure 2.1)

- RSV: This valve is used to seal the reactor during heat tracing/venting when the SCR system is not in operation. It is furthermore opened if the pressure in the SCR line is too high, compared to the pressure in front of the turbocharger.
- RTV: During heat-up, more flow is gradually fed through the SCR reactor by control of this particular valve thus ensuring a predefined minimum temperature for the exhaust gas and a maximum temperature difference (for proper engine operation) between the exhaust gas temperature at the SCR inlet (TSCR in) and the exhaust gas at turbine inlet (T-turbine in). This valve is furthermore used to equalize the pressure in the SCR line, if it increases to above the pressure in the bypass line, during operation without the SCR engaged.
- RBV: This valve (one or more) is used to bypass the SCR reactor in Tier II operation and during fast accelerations, and to regulate the flow of process gas during heat-up. When the RTV is fully opened, the RBV valve(s) will close gradually, ensuring a predefined

maximum temperature difference over the SCR line. This ensures that the flow to the turbocharger has enough energy for the engine to work properly.

- CBV: Regulation of this valve is used to increase the exhaust gas temperature at low load if it is needed by the reactor. This valve is furthermore used to increase the temperature in the SCR reactor prior to stopping the auxiliary blowers, for a smooth stop. Additionally, this valve is used to dampen eventual temperature oscillations.

5.1 Appendix

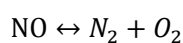
Appendix O: High Performance Butterfly Valves Handling Manual provided by *OKUMURA ENGINEERING CORP.*

6. NO_x Sensor

6.1 Function Description

A ceramic sensor made of zirconia electrolyte measures in amperometric operation the oxygen concentration entering from exhaust gas through a diffusion barrier into a first cavity. The oxygen concentration inside the cavity is controlled to the constant concentration of a few ppm NO_x. Other components of the exhaust gas also entering the cavity as HC, CO and H₂ are oxidized at the pumping electrode made of Pt.

From the first cavity the test gas with a few ppm O₂ and NO_x enters a second cavity, where gaseous oxygen is totally removed by an auxiliary pump. At the measuring electrode the equilibrium of



is changed by removing oxygen generated by the reduction of NO. The amperometric measurement IP2 of this generated oxygen represents the NO_x concentration of the exhaust gas.

6.2 Remarks

6.2.1 Verification

The NO_x sensor supposed to be verified every year, and if the testing shows that the measurement is not accurate. It should be replaced immediately. Furthermore, if an alarm from NO_x sensor is generated in the system, it also needs to be verified by specified authority.

6.2.2 Demarcation

The NO_x monitoring system does not need to be demarcated, thus, correspondingly, demarcation device and gas are not needed to be prepared on ship.

7. Control System

7.1 Operation of HeNO_x SCR System

7.1.1 Tier II Operation - HP SCR disengaged

When the vessel is not in Tier III regulated waters, it will operate in Tier II Mode, hence the SCR will be bypassed. On the ECS MOP/bridge the Engine Mode Tier II will be selected and the SCR prepare function will be disabled. On the ERCS MOP the SCR Selection will consequently be 'No SCR'. The SCR State, shown on both the ECS MOP/bridge and the ERCS MOP will be Standby. The RBV will be open and the RSV, RTV and CBV will be closed, so that all the exhaust gas is led directly to the turbocharger(s), and the engine is working as if it had no SCR installed.

Please note that if the pressure in the SCR line exceeds the pressure in the bypass line, e.g. after a fast load down, then the RTV will temporarily open slightly, to equalize the pressure. If the pressure in the SCR line is too high, e.g. due to a leakage of air into the SCR system from a subsystem, and an opening of the RTV cannot equalize the pressure, the passive Pressure Difference Control will open the RSV fully and thereby equalize the pressure.

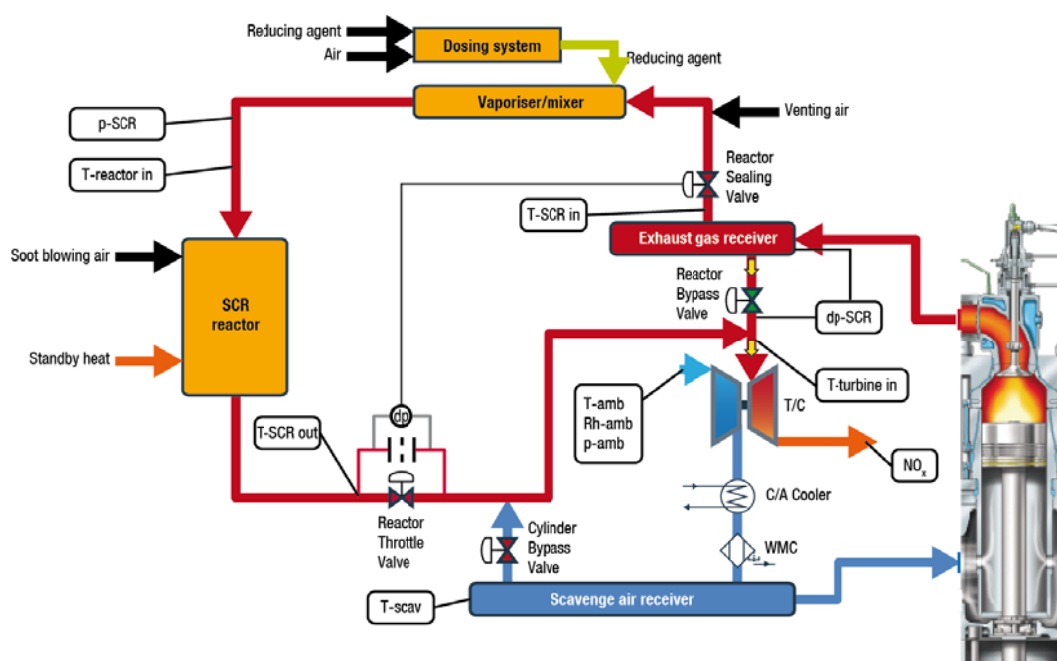


Figure 7.1 HP SCR System in Tier II Mode

While running in Engine Mode Tier II, the SCR Control System (SCR-CS) will be sending a signal to an external Venting system that it should start, and keep venting the SCR line during Tier II operation. The venting is keeping the exhaust gas containing sulfur out of the (cold) SCR system, where it would be cooled down and condenses sulfuric acid, which would harm the SCR system.

Please note that if the engine is stopped while Engine Mode is Tier II, there will be no venting,

and the Valve State will be Valves in Fail Safe, hence the RSV and RTV valves will be ordered open, and it will be safe to remove the control air to the SCR valves.

7.1.2 Starting the HP SCR System when Entering Tier III Area

The operator must manually start the SCR system, see box below.

Before approaching a Tier III regulated area, some preparations must be done.

First of all, before starting the SCR System, it should be verified that the sulfur content of the fuel is corresponding the specifications of the present SCR System and is updated to fit the actual fuel used. The actual fuel sulfur content is shown on the SCR Main Screen. If this is not the case, fuel must be changed and/or the value of the fuel sulfur content must be updated. This is done on the ECS MOP, see the ME Manual for details. If the SCR System is started with an actual fuel sulfur content exceeding its limits, an alarm will be raised. Running with a fuel with a too high content of sulfur will lead to contamination of the reactor, degradation of the catalyst and is not covered by the warranty.

Furthermore it should be verified that the reducing agent concentration value shown on the SCR Main Screen is corresponding to the actual reducing agent used. If not, it should be updated. The operator must be in chief level to adjust the value.

The SCR System can then be started. Please note that at this point the SCR System might be cold. While engaging the SCR System it must therefore also be heated, which might take some time, as the SCR System contains a large heat capacity. How long time it takes depends on a variety of factors, e.g. the specific setup and the actual engine load.

The SCR System can be started in two ways - a one-step method or a two-step method.

- The one-step method is to change Engine Mode to Tier III directly, and then the SCR CS will provided that the SCR Mode is Auto, and the conditions for running the SCR are ok (the load and hence the temperatures are high enough) - start heating, and later, start dosing of reducing agent hence start the NO_x reduction. Aforementioned the heating process is rather long, and it is difficult to estimate exactly when the actual NO_x reduction is started by choosing this method.
- If more control is desired, the two-step method could be an option: The prepare SCR function is enabled while still being in Engine Mode Tier II. The SCR CS will then start heating the SCR System exactly as before, but it will stop as the SCR is fully engaged and the temperatures in the SCR line are satisfying. The SCR State will then be Reactor Ready. When the operator then chooses Engine Mode Tier III, the SCR System is already warm, and the reducing agent injection will start as soon as the external Dosing handling system is ready to start actual dosing.

No matter which method is used for starting the SCR System, the same steps will be performed. They will be described in the rest of this section.

Start with prepare function	Start without prepare function
a) Control fuel sulfur content b) Control Reducing Agent Concentration c) Control SCR Mode is Auto	a) Control fuel sulfur content b) Control Reducing Agent Concentration c) Control SCR Mode is Auto
1) Select SCR->Enable Prepare on ECS MOP 2) When Tier III zone is reached: Select Engine Mode Tier III on ECS MOP	Select Engine Mode Tier III on ECS MOP

Table 7.1 Options for Start-up

As the operator chooses Engine Mode Tier III or enables the prepare function, the SCR State changes to Heating. This is seen on the ECS MOP/bridge and the ERCS MOP. A condition for this is that the SCR Mode is Auto and that the exhaust gas temperature is above the sulfuric acid condensation limit. On the SCR Main Screen it is seen that venting has stopped, but the soot blowing has started. Soot blowing is always on when exhaust gas is passing the SCR reactor, as soot blowing is necessary to keep the reactor catalyst elements from clogging due to particles.

At the same time, on the SCR Valve Info screen it is seen that the Valve State changes to SCR Line Min Open. In this state the RSV - which is an on/off valve – is opened, and the controllable RTV is opened to a minimum. This means a small part of the exhaust gas is flowing through the SCR line and thereby passing the T-SCR in sensors that can now begin to measure a correct value of the exhaust gas temperature. Then the Valve State changes to Automatic, and the valves are controlled automatically based on a temperature controller. Valve State will stay in Automatic until the SCR is stopped.

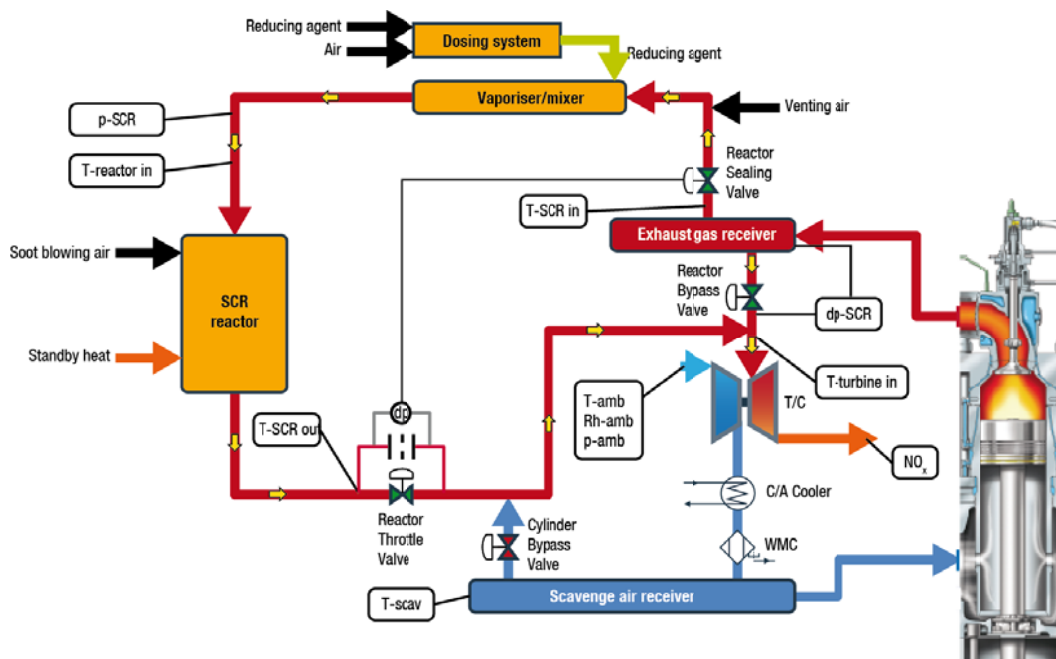


Figure 7.2 HP SCR System Engaging

Only one valve is controlled at a time. First RTV is opened fully, and then RBV is closed. In this

way gradually more exhaust gas is led through the SCR line. The valves are controlled in such a way that the difference between the exhaust gas temperature (T-SCR in) and the temperature that the turbine sees (T-turbine in) never exceeds a predefined value. The maximum acceptable temperature difference is shown on the Valve Info Screen on the ERCS MOP, together with the actual temperature difference. This control is to always ensure that only an acceptable part of the energy in the exhaust gas is used to heat up the SCR System instead of being used to power the turbocharger.

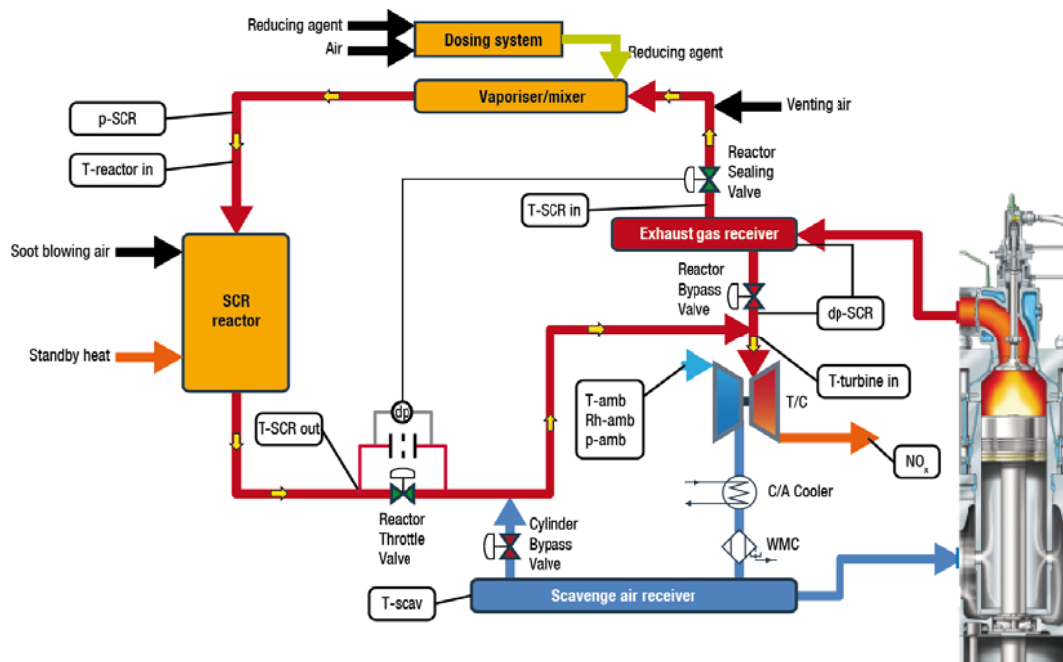


Figure 7.3 HP SCR System in Tier III Mode

As the SCR System is being engaged, the exhaust gas temperature will typically increase. If the exhaust gas temperature is still lower than the acceptable temperature window for SCR operation, the CBV valve will start to open. The CBV valve is regulated so that all temperatures in the SCR line reach the SCR operation temperature window, but still keeping the temperature difference below the maximum acceptable. Please note that when CBV is open, the temperature measurement before the turbine (T-turbine in) is affected by cold air from the scavenge air receiver. Therefore the temperature measurement after the SCR reactor (T-SCR out) is used to calculate the actual temperature difference when CBV is open. On the Valve Info Screen it is shown with a graphical switch which sensor is used for the calculation of the temperature difference.

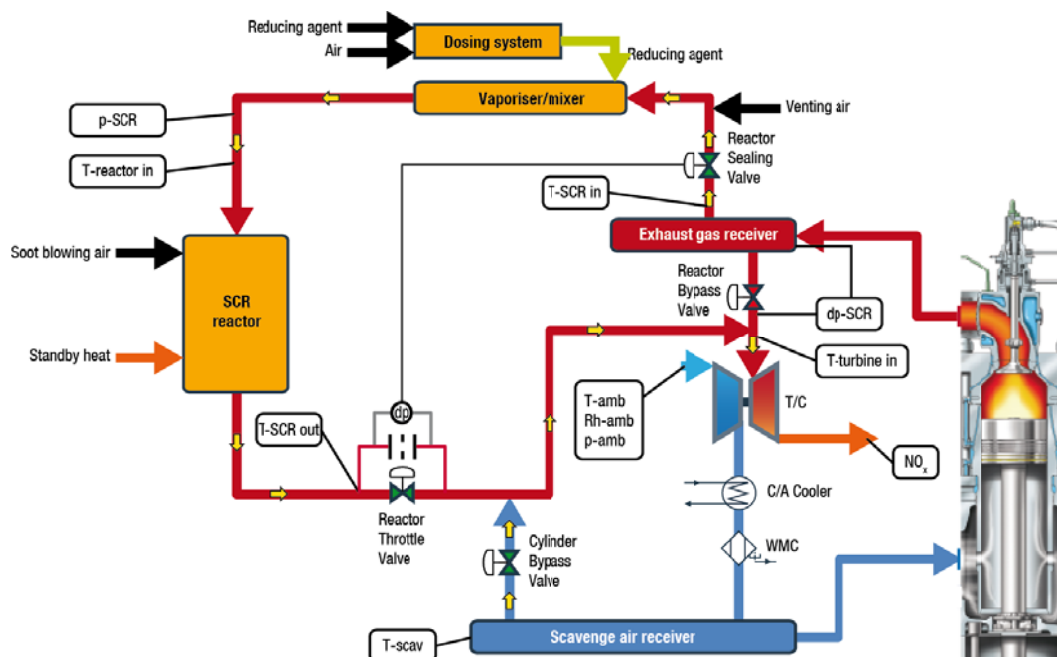


Figure 7.4 HP SCR System in Tier III Mode with CBV Open

When the correct temperature has been reached at all measurement points in the SCR line, the SCR is engaged and heated, and ready for dosing. The SCR State is shown on the ECS MOP/bridge and the ERCS MOP changes to Reactor Ready. If the SCR System was started by selecting the enable prepare function nothing else will happen and the SCR State will continue to be Reactor Ready (unless a failure occurs or engine load is changed rapidly leading to RBV opening) until Engine Mode Tier III is selected. When this is done - or if the SCR System was started by selecting Engine Mode Tier III - the SCR State will change to Dosing Enabling. In this state the SCR-CS gives signal to the external Dosing handling system to prepare for injection of reducing agent. When the reducing agent injection is ready, it signals back to the SCR-CS, which then changes state to Dosing (SCR Active) and gives the Dosing handling system a reducing agent set-point that it will follow. NO_x reduction is active.

At low loads, the SCR-CS will always request the ECS to keep the blowers running, but if the engagement is happening in a predefined engine load window, the SCR-CS will stop the auxiliary blowers run request when the engagement of the SCR reactor is finished. When stopping the blowers, the exhaust gas temperature will increase, which might affect the valve control so that RBV temporarily opens, and the NO_x reduction will be reduced. In order to prevent this, and to secure a smooth stop of the blowers, the CBV is temporarily opened to heat up and prepare the SCR reactor for the higher exhaust gas temperature. It is returning to its original position simultaneously with stopping the blowers. Above a pre-defined engine load the blowers will be stopped immediately.

Please note that at some loads the temperature in the SCR reactor might start to oscillate, at some plants, due to the temperature delay caused by the large heat capacity in the SCR reactor. If this happens, the CBV valve will be used to dampen the oscillations. This will happen automatically.

7.1.3 Accelerating with HP SCR

The SCR-CS handles this automatically. In the case where the SCR System is engaged and the engine is accelerated, the exhaust gas temperature (T-SCR in) will increase fast, while the temperature out of the SCR (T-SCR out/T-turbine in, depending on CBV opening) will only increase slowly, due to the large heat capacity of the SCR System. In order to fulfill the requirement of a maximum temperature difference between those two, it might be necessary for the SCR-CS to temporarily close CBV if it is open, and even open RBV. If RBV opens, full flow is no longer passing through the SCR System, and full reducing agent dosing is therefore no longer possible. If one or more temperatures in the SCR line does not fulfill the new - and higher - requirements to temperature after a load change, full reducing agent dosing is neither possible. In both cases a minimum dosing amount is kept, to prevent the dosing nozzle from clogging (see section 2.1.4), until RBV is again closed and all temperatures in the SCR line are again within the SCR operation temperature window. Then full flow and hence Tier III NO_x reduction is continued.

If the engine is accelerated to above a pre-defined load, the SCR-CS will stop the request to the ECS of running the auxiliary blowers. See detailed description at the end of 2.1.2.

7.1.4 Sailing into Tier III harbor with HP SCR

The SCR-CS handles this automatically.

When the vessel is approaching a Tier III harbor, the SCR-CS will automatically close down the SCR System, as the engine load is so low that the exhaust gas temperature (T-SCR in) decreases below the sulfuric acid condensation limit. First the SCR State shown on the ECS MOP/bridge and ERCS MOP will change to Flushing. A signal will be sent to the external Dosing handling system, which will start flushing of the reducing agent dosing system and nozzle with water or air or both, depending on the type of Dosing handling system. If flushing is not performed correctly, the reducing agent might clog the dosing system and injection nozzle.

When flushing is finished, the SCR State changes to Standby, and the Valve State, shown on the Valve Info Screen will change to Open SCR Bypass. The CBV will close and the RBV will open. When the RBV is fully open, the Valve State will change to Close SCR Line and the RTV and the RSV will close. On the SCR Main Screen it can be seen that the soot blowing will stop, and the external Standby Heat System will start.

The Standby heat system is meant to keep the SCR reactor above the sulfuric acid condensation limit, when the engine is stopped or the engine load is so low that the exhaust gas temperature is below the sulfuric acid condensation limit, and the Engine Mode is Tier III.

Please note that when the engine is stopped while Engine Mode is Tier III, the RSV and the RTV need to be closed, in order for the Standby heat system to work properly. Therefore the control air to the RSV and the RTV must never be removed while in a Tier III harbour, hence when Engine Mode is Tier III.

7.1.5 Starting from Tier III harbor with HP SCR

The SCR-CS handles this automatically.

The vessel is lying in harbor with stopped engine, Engine Mode Tier III and disengaged SCR system, but with a Standby heat system keeping the temperature of the SCR above the sulfuric acid condensation limit. As the engine load reaches a load so high that the exhaust gas temperature (T-turbine in) increases to above the sulfuric acid condensation limit, the SCR will automatically engage again, as described in section 2.1.2.

Please note that the SCR-CS will try to engage the SCR System, even if the exhaust gas temperature is so low that it is not possible to reach the temperature window for SCR operation. This is done to always make sure that the SCR System is as close to the desired state - in this case Dosing - as possible. If the engine load then increases just so much that full dosing is possible, the SCR System is ready.

7.1.6 Stopping HP SCR

The operator must manually stop the SCR system, see note below.

When the vessel is exiting the Tier III zone, the operator can change the Engine Mode to Tier II. When this is done, the SCR-CS will command flushing and then disengage the SCR System, as described in section 2.1.4. But instead of starting the Standby heat system as the RTV and RSV close, the external Venting system will be ordered to start, and the SCR System will be vented until it has to be used again.

Please note that when sailing into a Tier II harbor, the venting will stop as the engine stops.

Note: Stop SCR - Select Engine Mode Tier II on ECS MOP

7.2 Installation

Procedure

1. Unfasten the control unit from the transport position.
2. Carefully lift the control unit to the mounting position and fasten it with bolts.
3. Connect the electrical cables.
 - a) Connect the control cables and the power supply cables to the urea dosing units, the air unit and the pump unit.
 - b) Connect the power supply to the control unit.

7.3 Hardware

The SCR Control System consists of the following hardware:

- ERCS MOP
- MPCs (2-3 for HP SCR)
- EMS
- Sensors and cables

The ERCS MOP is the HMI and includes all the SCR screens. It is described in the following, where examples of screen shots are also found. The MPCs are the controllers, and they are all on the same network, and also the same network as the MOP. The MPCs are described after the section about the MOP and then it is described how the MPC and the MOP plays together.

The SCR Control System communicates with the Engine Control System via a Modbus connection. The Engine Control System consists of several MPCs and two MOPs, and has its own network, different from the ERCS network.

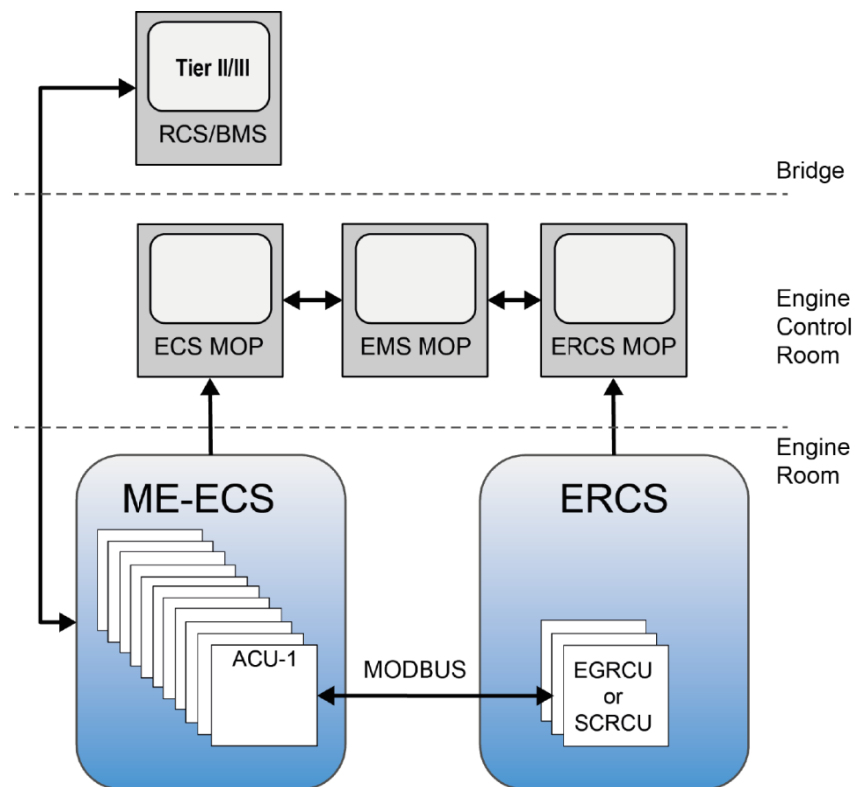


Figure 7.5 Interface between ME-ECS, ERCS and EMS.

For installations with ERCS-SW an EMS (Engine Management Services) must be included. It collects data from both the ERCS and ECS. The EMS is described separately in the 'EMS User guide' and 'EMS Software Install and Setup', found on the EMS-MOP:

1. Select the EMS icon in the bottom of the screen.
2. Select 'Documents'
3. Select the document and click 'open'



Furthermore the SCR Control System consists of cables and several sensors.

These are mainly standard equipment, and will not be described here.

7.4 Human Machine Interface (HMI)

This section will go into a detailed description of the HMI of the SCR. The HMI of the SCR System consists mainly of the ERCS MOP, but some interaction will also be with the ECS MOP and/or the bridge. Some indications/buttons are optional on the bridge, depending on the configuration.

For HP SCR, the ERCS MOP will have two screens: The SCR Main Screen and the Valve Info Screen.

7.4.1 Overview of modes and states

The following is an overview of all the Modes and States relevant for the SCR System.

7.4.1.1 SCR relevant info on ECS MOP / bridge (optional)

The following buttons/indication on the ECS MOP and optionally on the bridge, are relevant for the SCR System. This goes for both the HP and LP SCR Systems.

a) Engine Mode (button and indication):

Tier II: Engine running according to Tier II emission limits.

Tier III: Engine running according to Tier III emission limits if possible. This requires SCR to be engaged.

b-1) SCR (button)

- **Enable Prepare SCR:** Can only be selected if Engine Mode is Tier II. SCR will be heated, but reducing agent injection will not be started.
- **Disable Prepare SCR:** Stops the pre-heating of SCR.

b-2) SCR (indication) (ECS MOP only)

- **Not Ready:** SCR cannot be engaged due to SCR Mode is Stop or the system has a failure.
- **Standby:** SCR is disengaged, but ready to engage when ordered so and/or conditions are ok.
- **Heating:** SCR is in the process of being heated to a suitable level via the exhaust gas.
- **Reactor Ready:** SCR has reached suitable operation temperature and all flow is passing through the SCR.
- **Dosing Enabling:** The Dosing handle system is preparing reducing agent injection.
- **Dosing (SCR Active):** Injection of reducing agent in progress.
- **Flushing:** The Dosing handling system is performing its flushing sequence.

c) Tier III Status (indication) (bridge only)

- **Not Ready:** Reduction of NO_x to Tier III limits is not possible due to failure in Tier III

process or Tier III system is not in Auto Mode.

- **Not Activated:** Reduction of NO_x to Tier III limits is not requested.
- **Preparing:** The reduction of NO_x to Tier III limits is being prepared.
- **Prepared:** The reduction of NO_x to Tier III limits is prepared and ready to start when requested.
- **Activated:** The reduction of NO_x to Tier III limits is requested but not present due to preparing of Tier III process or conditions for the Tier III process are not OK.
- **NOx Reduction Active:** Reduction of NO_x to Tier III limits is active.

7.4.1.2 ERCS MOP: SCR Main Screen Information Common

The following buttons/indications on the SCR Main Screen are common for HP SCR.

a) SCR Selection (indication)

- **No SCR:** Engine Mode is Tier II and the prepare function is not enabled, so the SCR should be in Standby.
- **Prepare SCR:** Engine Mode is Tier II and the prepare function is enabled, so the SCR should be heated up, but injection of reducing agent is not started.
- **Tier III SCR:** Engine Mode is Tier III so SCR is heated and injection of reducing agent is started.

b-1) SCR Mode (button)

- **Auto:** The SCR System can be controlled automatically depending on selections on ECS MOP/bridge.
- **Stop:** The SCR System is stopped, and will not start, no matter what is chosen on ECS MOP/bridge.

b-2) SCR Mode (indication)

- **Auto:** The SCR System is automatically controlled.
- **Stop:** The SCR System is stopped because of manual selection from operator, or because a failure has been reset, without operator manually changing SCR Mode to Auto.
- **Failure:** The SCR System has a failure and must be closed down.
- **Manual:** The SCR valves can be controlled manually via the SCR Valve Info screen on the ERCS MOP.

c) SCR State (indication)

- **Not Ready:** SCR cannot be engaged due to SCR Mode is Stop or the system has a failure.
- **Standby:** SCR is disengaged, but ready to engage when ordered so and/or conditions are ok.
- **Heating:** SCR is in the process of being heated to a suitable level via the exhaust gas.

- **Reactor Ready:** SCR has reached suitable operation temperature and all flow is passing through the SCR.
- **Dosing Enabling:** The Dosing handle system is preparing reducing agent injection.
- **Dosing (SCR Active):** Injection of reducing agent in progress.
- **Flushing:** The Dosing handling system is performing its flushing sequence.

d) Tier III Status (indication)

- **Not Ready:** Reduction of NO_x to Tier III limits is not possible due to failure in Tier III process or Tier III system is not in Auto Mode.
- **Not Activated:** Reduction of NO_x to Tier III limits is not requested.
- **Preparing:** The reduction of NO_x to Tier III limits is being prepared.
- **Prepared:** The reduction of NO_x to Tier III limits is prepared and ready to start when requested.
- **Activated:** The reduction of NO_x to Tier III limits is requested but not present due to preparing of Tier III process or conditions for the Tier III process are not OK.
- **NO_x Reduction Active:** Reduction of NO_x to Tier III limits is active.

7.4.1.3 SCR Valve Info screen

The following buttons/indications on the SCR Valve Info screen are relevant for HP SCR.

a) Valve Mode (button and indication)

- **Auto:** Valves are following the set point given from the SCR-CS.
- **Manual:** Valves follow the manual set point given by the operator on the SCR Valve Info screen on the ERCS MOP. Please note that engine must be stopped and SCR Mode must be Stop before it is possible to select Valve Mode Manual.

b) Valve State (indication)

- **Valves in Fail Safe:** The RBV, RTV and RSV are ordered fully open and the CBV is ordered fully closed. This happens if a failure in the SCR System might result in risk of flow to the turbocharger, or if the engine is stopped in a Tier II harbour.
- **Stop:** The SCR is stopped, i.e. all flow is bypassed through the open RBV, RTV, RSV and CBV are closed.
- **SCR Line Min Open:** The RSV is fully open and RTV is open to its minimum opening position in order to get a small exhaust gas flow through the SCR line to stabilize the T-SCR in measurement during start up of SCR, or finish flushing during close down of SCR after a Shut Down failure.
- **Automatic:** The valves are controlled automatically via the temperature control in the SCR-CS.

- **Open SCR Bypass:** The SCR is being closed down: First step is to open the RBV and close CBV if it was open.
- **Close SCR Line:** The SCR is being closed down: Second step is to close the RSV and RTV.
- **Manual:** The SCR valves are controlled manually by the operator via the SCR Valve Info screen on the ERCS MOP.

7.4.2 Overview of other info on SCR screens

This section explains the buttons/indications on the ERCS MOP, which are not states and modes.

7.4.2.1 HeNO_x SCR Main Screen

- a) **Estimated Engine Load:** The estimated engine load received from the ME-ECS.
- b) **Actual Fuel Sulfur:** The actual fuel sulfur content entered on the cylinder lubrication screen on the ECS MOP.
- c) **Reducing Agent Flow:** The flow of reducing agent requested by the SCR-CS and dosed by the Dosing handling system.
- d) **Reducing Agent Concentration:** The concentration of the reducing agent. Must be updated by the operator. Chief level must be present in order to update the value.
- e) **T-reactor in:** Value of the temperature measurement of the sensor placed at the inlet of the SCR reactor.
- f) **T-SCR out:** Value of the temperature measurement of the sensor placed at the outlet of the SCR reactor, alternatively on the flange of RTV.
- g) **NO_x concentration:** Value of NO_x sensor 1 placed downstream the SCR reactor and turbocharger. The value of NO_x sensor 2 can be seen by selecting the Details view on the MOP. NO_x sensor 2 is used to supervise the value of NO_x sensor 1.
- h) **Minimum Dosing Temperature:** The minimum temperature that all the sensors in the SCR line must measure above for full dosing to start.
- b) **p-SCR:** Monitoring of the pressure in the SCR line.
- i) **dp-SCR:** The pressure difference over the SCR line, used to estimate if deposits are building up.
- j) **T-SCR in:** The average of two temperature sensors installed at the inlet to the SCR line. The value of the individual temperature measurements can be seen by selecting the Details view on the MOP.
- k) **T-turbine in:** Average of the temperature sensors installed at the turbine inlet. The value of the individual temperature measurements can be seen by selecting the Details view on the MOP. Please note that these might differ due to poor mixing between the SCR and the reactor bypass

line, or poor mixing between the SCR and the cylinder bypass line.

l) Soot Blowing: Shows information about the Soot blowing system actual state. Can be Not Ready/Enabled/Disabled. When it is Not Ready, it will not react on the command given by the SCR-CS. When it is Enabled, it has received the run command from the SCR-CS, and when it is Disabled, it has not received any run command from SCR-CS. It must be running when exhaust gas flows through the SCR line.

m) Standby Heat: Shows information about the Standby heat system actual state. Can be Disengaged/Engaged. When it is Disengaged, it has received no run command from the SCR-CS, and when it is Engaged it has received a run command from the SCR-CS. It must be engaged when Engine Mode is Tier III and load and/or temperature are too low for SCR engagement.

n) Venting System: Shows information about the Venting system actual state. Can be Disengaged/Engaged. When it is Disengaged, it has received no run command from the SCR-CS, and when it is Engaged it has received a run command from the SCR-CS. It must be engaged when Engine Mode is Tier II and engine is running.

o) Auxiliary blowers: Shows information about the auxiliary blowers actual state, received from the ME-ECS. Can be Stopped/Starting/Running/Failed.

7.4.2.2 HeNO_x SCR Valve Info Screen

a) Temperature difference: Shows the maximum allowed temperature difference and the actual temperature difference. It is shown by the graphic which temperature sensors are currently used for measuring the temperature difference.

b) Reactor Sealing Valve: Shows the set point and the actual angle position of the RSV. For indication of the individual switch positions, select the Details view on the MOP.

c) Reactor Throttle Valve: Shows the set point and the actual angle position of the RTV.

d) Reactor Bypass Valve: Shows the set point and the actual angle position of the RBV.

e) Cylinder Bypass Valve: Shows the set point and the actual angle position of the CBV.

7.5 SCR Failure

This section describes the various failures which can occur and the actions taken by the SCR-CS in order to correct the failure and protect the integrity of the SCR system.

Failure Handling

The SCR-CS monitors the SCR system and depending on the character and severity of the failure, SCR Stop or SCR Shut Down sequence is activated.

- **Alarm** (and continuous SCR operation) is triggered in situations where the actual operating conditions do not directly affect the SCR system or its control. The purpose of this alert is to warn the staff that an abnormal condition exists and that they are to correct the failure(s).
- **SCR Stop** sequence is activated in cases where a failure/situation arises that disables the SCR system and/or SCR control. The triggering failure/situation is not considered to be of a nature that will inflict damage upon the engine or reactor. Flushing will occur while the valves operate automatically and thereafter SCR operation will cease. RBV will open (if not already open) and RTV as well as RSV will close.
- **SCR Shut Down** sequence is used if a failure/situation arises which may directly lead to engine or reactor damage or breakdown. RBV, RTV and RSV open immediately and flushing will be initiated. When the failure is corrected, RTV and RSV will close. If the failure is corrected during flushing, RTV will be set at a minimum position so as to ensure a flow through the reactor during flushing.

Note: The actual differences between SCR Stop and SCR Shut Down as these terms seem very similar at first glance. SCR Stop is considered to be a less drastic occurrence and in such a case SCR can be resumed following remedial action. SCR Shut Down is the result of a more serious operating condition and is enacted to prevent damage to the engine. In this case SCR operation must only be resumed when the cause of the failure is pin-pointed, evaluated and corrected.

Concluding all the possible failures above, if multiple failures are active at the same time each failure will trigger an indication and alarm.

Safe fallback modes are: operating mode Stop and running mode Tier II.

In case of SCR Stop, SCR Shut Down and/or an alarm is released, the SCR-CS will inform the ship alarm system by means of 'SCR Common Alarm'

System/sensor/signal	Failure	SCR Shut Down	SCR Stop	Alarm	Remarks
External Dosing Handling System	External Dosing Handling system not ready		x	x	
	Dosing enabling timed out		x	x	

System/sensor/signal	Failure	SCR Shut Down	SCR Stop	Alarm	Remarks
	Dosing not available in Dosing State		x	x	
	Flushing sequence timed out		x	x	
Reducing agent feedback	Deviation between set-point and actual dosing amount		x	x	
	signal/cable failure		x	x	
External Soot Blowing System	Soot Blowing System not ready		x	x	
	Soot Blow.enable dev. time-out		x	x	
External Standby Heat System	Standby Heat engage deviation timeout			x	
External Venting System	Venting engage deviation timeout			x	
External Valve System	External Valve System not ready		x	x	
	External Valve System not ready		x	x	
Regeneration System	Regeneration active while SCR is running		x	x	
Auxiliary Blowers	Aux. Blowers not started		x	x	
SCR Reactor Sealing Valve	No valid detection of valve position	x *)	x *)	x	
	Unexpected closed	x *)	x *)	x	
	Unexpected open			x	

System/sensor/signal	Failure	SCR Shut Down	SCR Stop	Alarm	Remarks
SCR Reactor Throttle Valve	Deviation between set-point and actual position	x *)	x *)	x	
	Unexpected closed	x *)	x *)	x	
	Unexpected open			x	
	Feedback Signal failure (wire break)	x *)	x *)	x	
SCR Reactor Bypass Valve 1/2/3	Deviation between set-point and actual position	x		x	
	Unexpected closed	x		x	
	Unexpected open		x	x	
	Feedback Signal failure (wire break)	x		x	
Cylinder Bypass Valve	Deviation between set-point and actual position		x	x	
	Unexpected open/closed			x	
	Feedback Signal failure (wire break)		x	x	
Exhaust gas temperature	Exhaust gas temperature too high for SCR		x	x	
Exhaust gas temperature sensors	Exh. Gas Temperature at SCR inlet 1-2 signal/cable failure		x	x	
	T-SCR out signal/cable failure		x	x	
	T-turbine in #1-4 signal/cable failure		x	x	

System/sensor/signal	Failure	SCR Shut Down	SCR Stop	Alarm	Remarks
	T-SCR in sensors deviating		x	x	
	T-turbine in #1-4 deviating		x	x	
Scavenge air temperature sensor	Signal/cable failure		x	x	
Compressor Inlet Temperature sensor	Signal/cable failure		x	x	
Compressor Inlet Humidity sensor	Signal/cable failure		x	x	
Ambient Pressure Sensor	Signal/cable failure		x	x	
Pressure sensor in SCR	Signal/cable failure			x	
Pressure difference over SCR sensor	Signal/cable failure		x	x	
Pressure difference over SCR sensor	Signal/cable failure			x	
	Δp SCR too high			x	
NO _x Sensor	NO _x concentration after SCR 1 signal/cable failure		x	x	
	NO _x concentration after SCR 2 signal/cable failure			x	
	NO _x sensor 1 not ready		x	x	
	NO _x sensor 2 not ready			x	
	NO _x sensors deviating			x	
SCR process	NO _x SCR out too high alarm		x	x	

System/sensor/signal	Failure	SCR Shut Down	SCR Stop	Alarm	Remarks
	Limiter saturation timed out		x	x	
	Fuel sulfur content too high			x	
Modbus	RCS serial communication fail		x	x	
	Modbus Interface version mismatch		x	x	
	Modbus Configuration no. mismatch		x	x	
	Failure in Modbus signal from ECS		x	x	

Table 7.2 SCR Common Alarm

*) If the SCR Reactor by-pass valve(s) are completely open SCR stop failure is released.

If the SCR Reactor by-pass valve(s) are not completely open SCR shut down failure is released.

7.6 Main Operation Panel (MOP)

The MOP (Main Operating Panel) is the Human Machine Interface (HMI) through which the SCR control system is operated. The SCR-CS is separate from the control system for the engine. The MOP as such comprises a PC, with the SCR system software installed, a 15" touch screen and a keyboard with integrated mouse. The MOP unit is basically an integrated marine approved and certified PC with touch-screen. The touch screen needs bare skin contact in order to function. An actual installation comprises a MOP unit, and a standard designed PC with CoCoS EDS (optional).

Note: Within the literature, reference is made to both MOP and HMI. The MOP is defined as the actual physical panel and HMI can be regarded as the functional attributes as contained and made applicable.

The HMI consists of four fixed areas always shown. See figure 37.

1. An Alarm Status Bar showing the oldest non-Acknowledged alarm and Alarm status at the top of the screen.
2. A Navigation Bar at the right side of the screen.
3. A Toolbar at the bottom of the screen.
4. A Screen area (rest of the Screen)

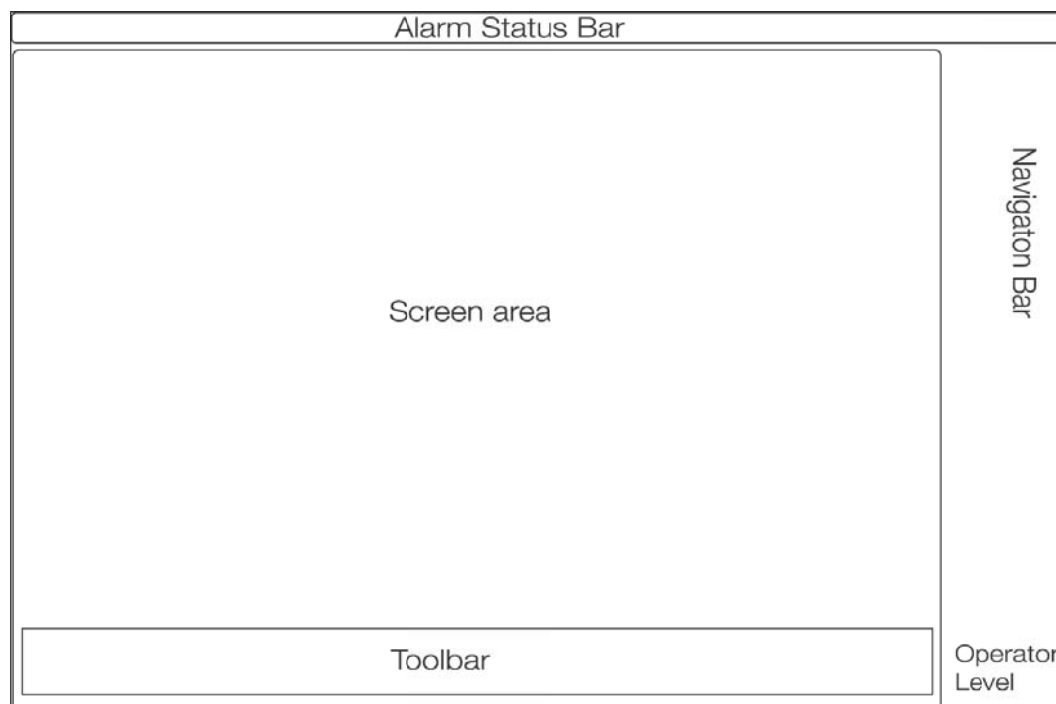


Figure 7.6 MOP Panel Showing HMI with Four Fixed Areas as Displayed on the MOP

The HMI operates with two password levels, which are Operator level and Chief level.

- **Operator level:** From the Operator level is it not possible to set any parameters. It is for normal operation and monitoring only.

- **Chief level:** In addition to the Operator level, this user level has privileges to set parameters (set-points, SCR modes). A password must be supplied in order to access Chief level.

Note: SCR modes can also be set at operator level. If, for example it is desired to cut - out alarms, it is necessary to be at chief level.

There is no limit in the number of unsuccessful attempts to enter the correct password. The password is hard coded in the system and can therefore not be changed.

The functional details as found in the HMI of the MOP are shown in Figure 7.2

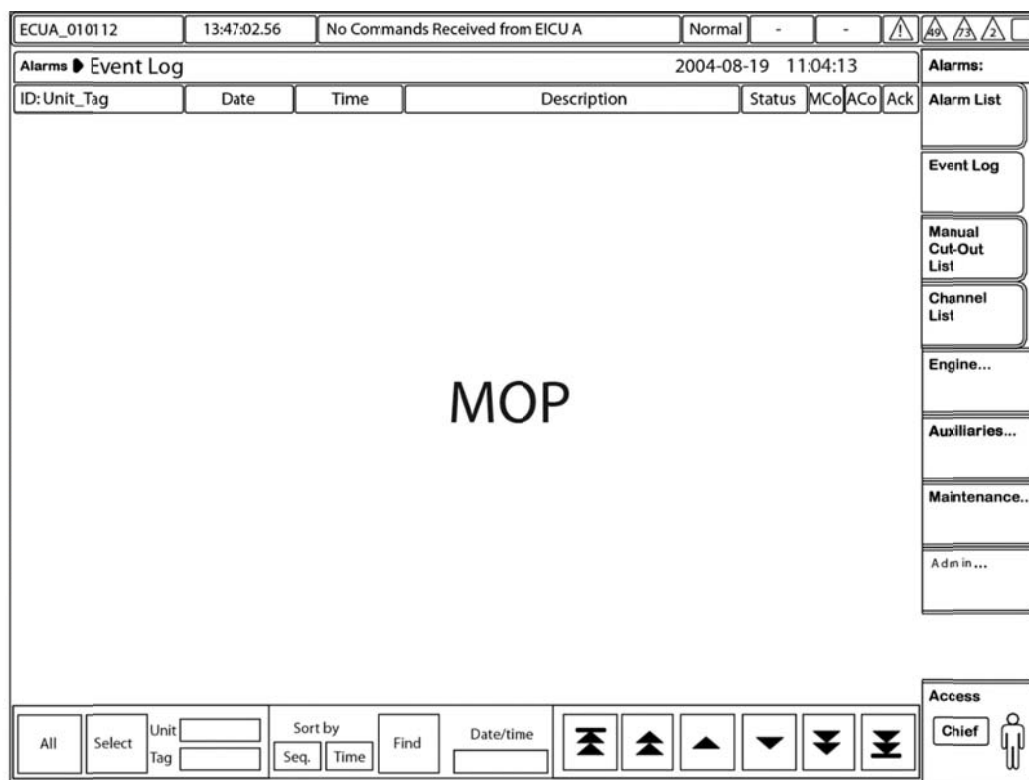


Figure 6.7 Functional Details as found in the HMI of the MOP.

7.6.1 SCR MOP Description

7.6.1.1 MOP Components

The operator can touch the graphic elements on the screen in order to interact with the SCR-CS. A USB connection is installed in the front panel, by the screen. Set-up of the MOP unit at commissioning is performed by use of USB plugs containing operating system and program software. The service keyboard and USB plugs are, under normal circumstances, only to be used by MAN Diesel personnel.

7.6.1.2 MOP Issues

Ethernet connections: The MOP is equipped with an Ethernet card for connection to other systems such as CoCoS-EDS. To avoid virus and worms on the MOP, special care must be taken

when connecting to networks of any kind.

Note: DISCLAIMER: HHM Diesel disclaims responsibility for any event or condition that originates from installation of unauthorized software. This includes, but is not limited to, virus.

To emphasize the disclaimer, yellow stickers are placed at suitable places on the MOP units.

7.6.1.3 Control Network

The MOP is connected to the SCR-CS by means of the Control Network that interconnects the nodes in the system. The Control Network is implemented as two independent networks for redundancy.

7.6.2 Selections and Indications on the MOP

Operation of the SCR-CS is performed at both the ME MOP as well as the "stand alone" SCR MOP. In addition, some of the selection choices can be performed at the Bridge.

7.6.2.1 ME MOP

The ME MOP provides the following functions regarding SCR control:

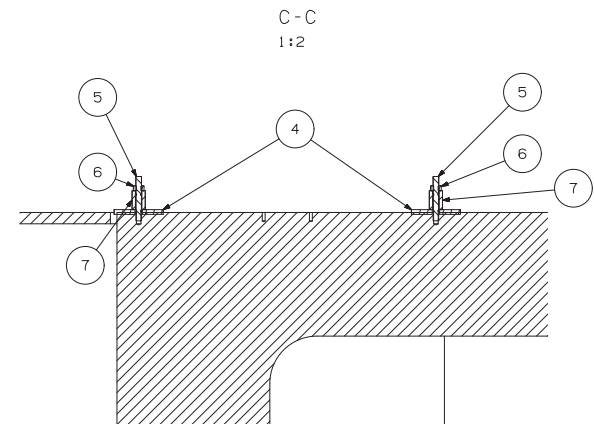
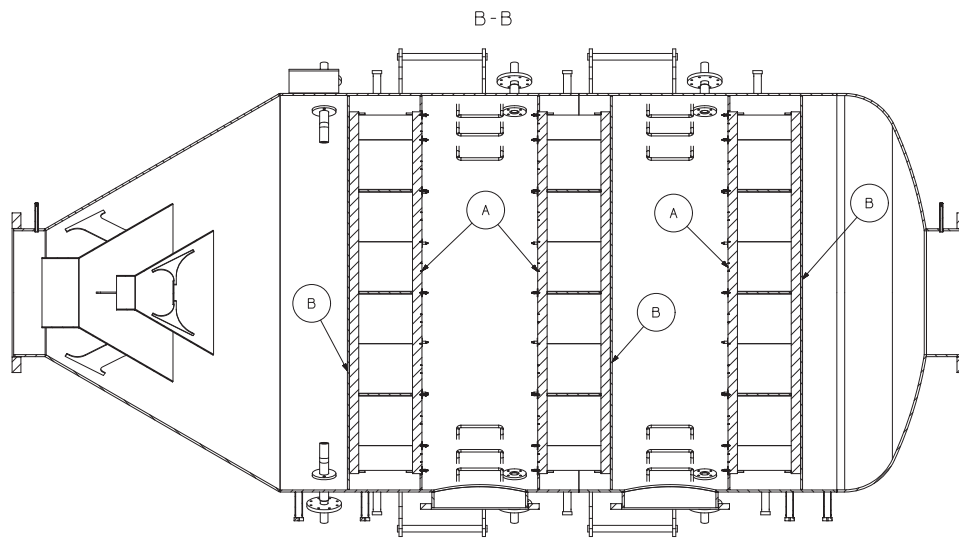
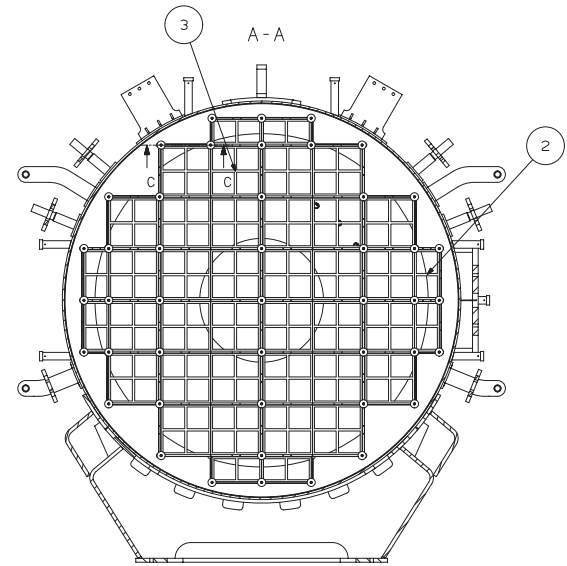
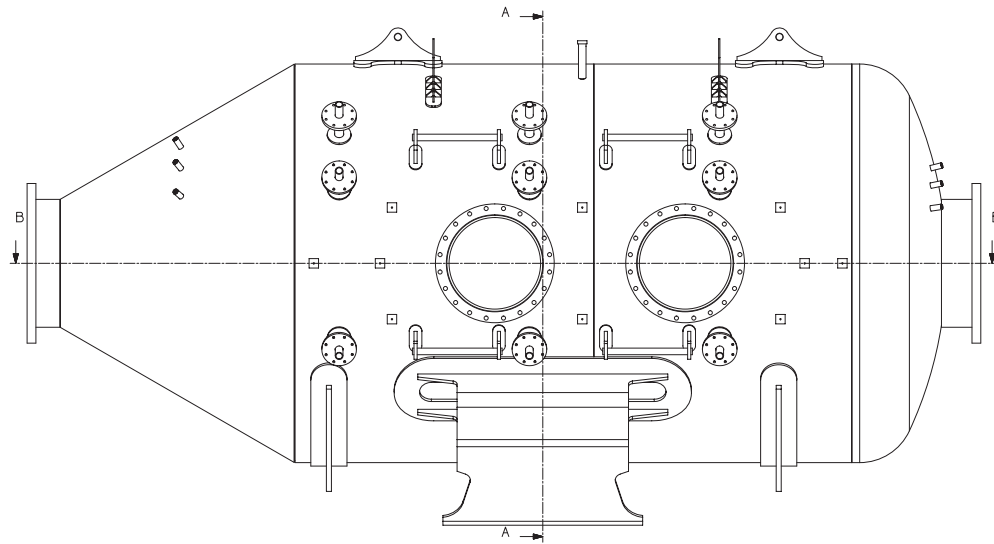
- Selection of of Engine Mode (Tier II/Tier III)
- Selection of of SCR: Prepare SCR (Enable/Disable)
- Indication of: Engine Mode
- Indication of: SCR State (Not Ready, Standby, Heating, Reactor Ready, Dosing Enabling, Dosing, Flushing)

7.6.2.2 SCR MOP

The SCR MOP provides the following facilities for SCR control:

- Selection of SCR Mode (Auto/Stop)
- Entrance of the used reducing agent concentration (wt%)
- Manual SCR control of valves (HP SCR only)

Besides these aspects, the SCR MOP displays indication of the process parameters and status conditions.



催化剂安装指导：

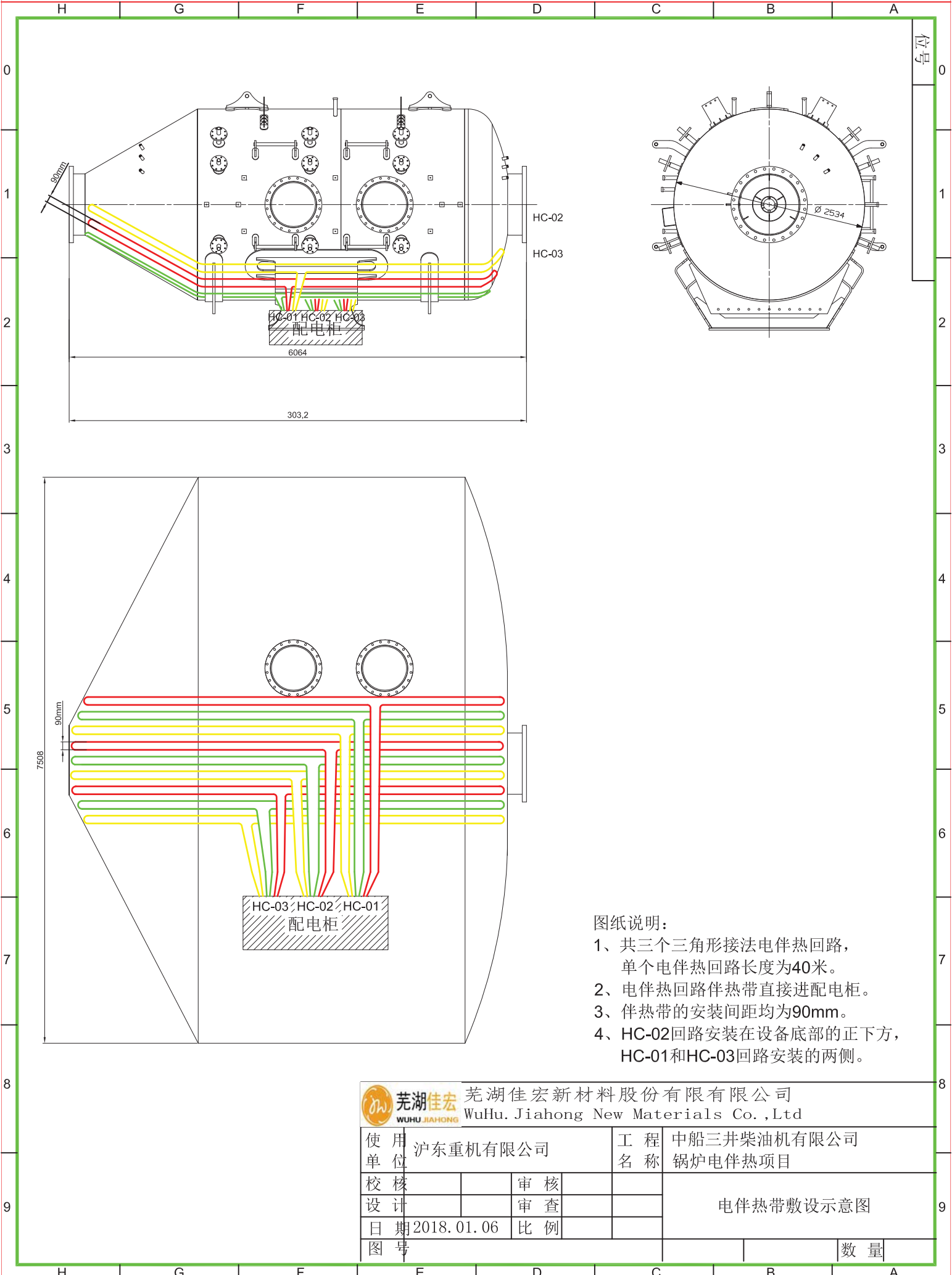
1. 将催化剂块〈件2, 3〉从A面插入催化剂床层。

2. 安装限位图片〈件4, 5, 6, 7〉以限制催化剂块轴向移动，紧固螺母

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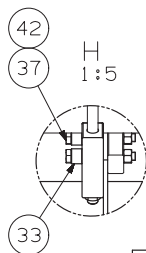
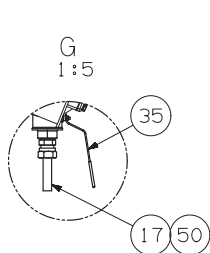
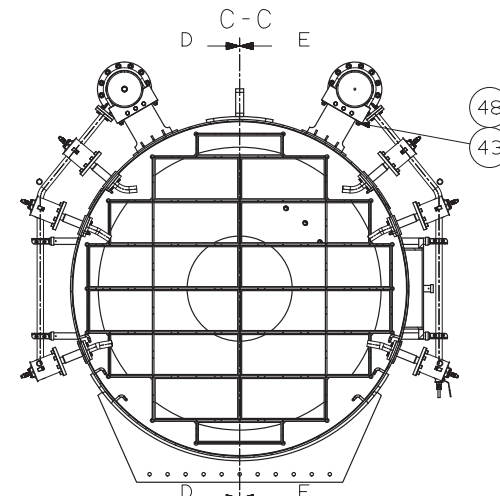
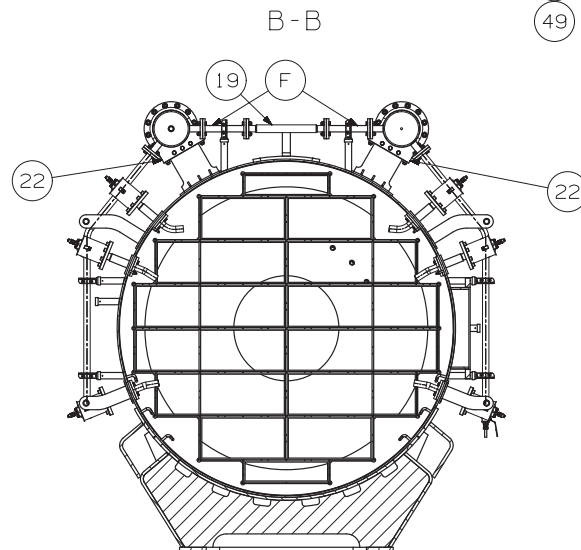
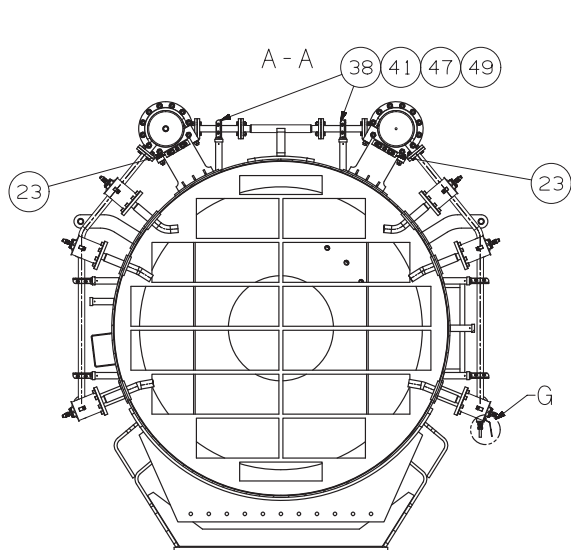
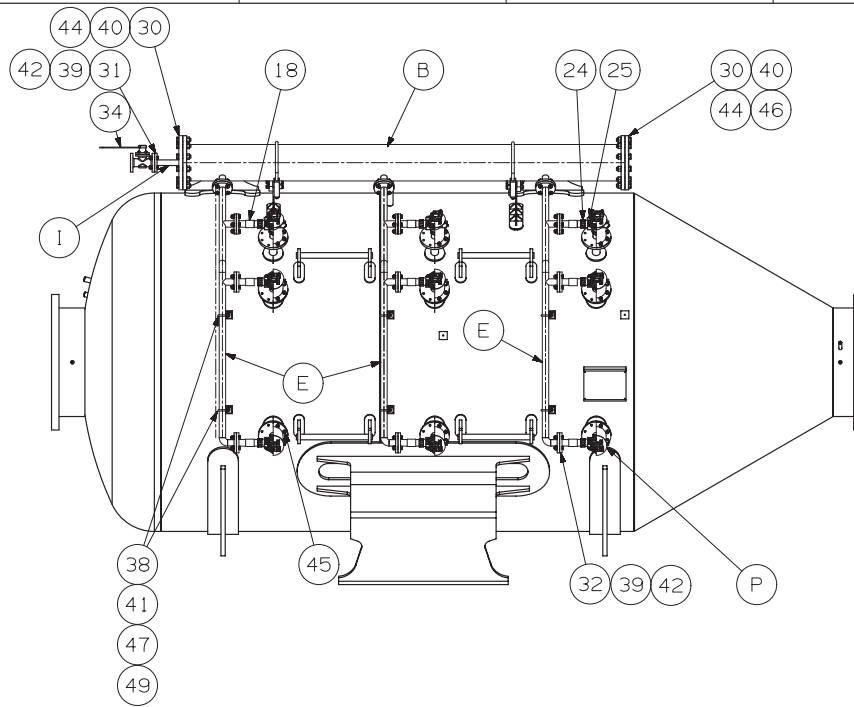
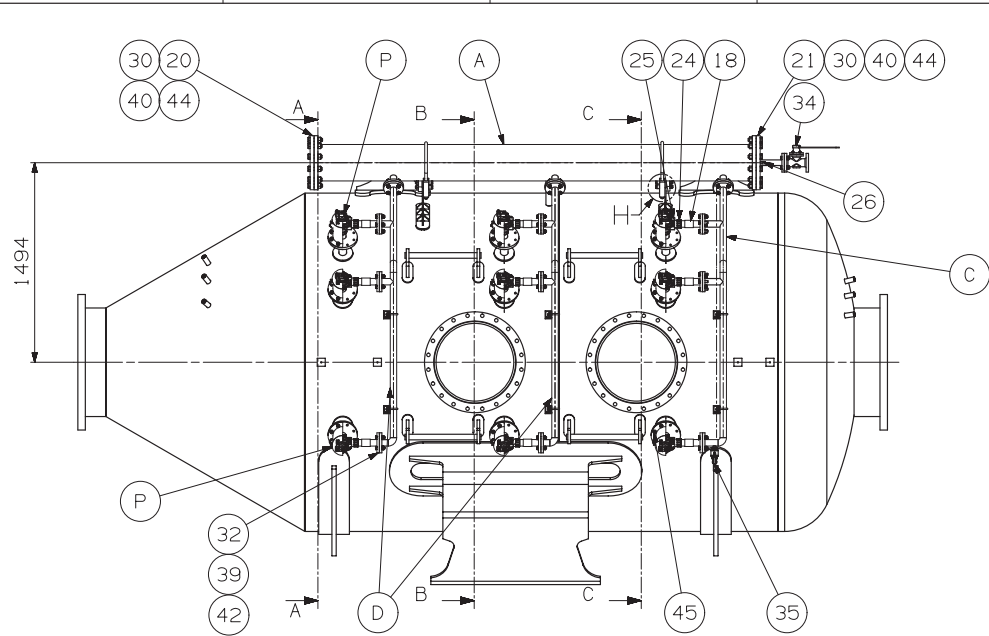


Date	Des.	Chg.	APRD.	A.C.	Revision change	CSD No.	Rev.
							03
							02
							01
							00
20171225 李冷面 欧宽							
Basic Standards: ISO 9001							01
EN121225 李冷面 欧宽							00
Basic Standards: ISO 9001							00
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Basic Standards: ISO 9001							00



- 图纸说明：
- 1、共三个三角形接法电伴热回路，
单个电伴热回路长度为40米。
 - 2、电伴热回路伴热带直接进配电柜。
 - 3、伴热带的安装间距均为90mm。
 - 4、HC-02回路安装在设备底部的正下方，
HC-01和HC-03回路安装的两侧。

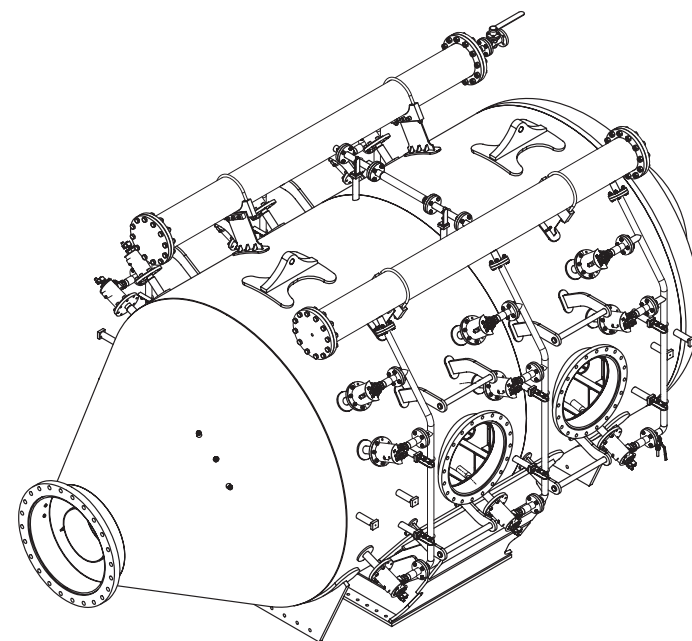
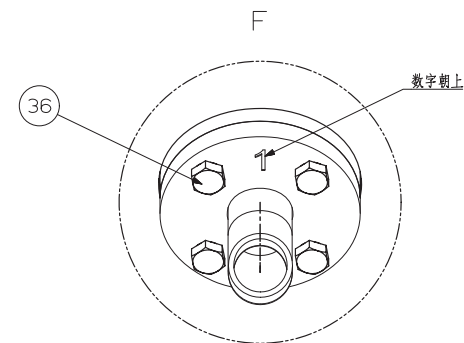
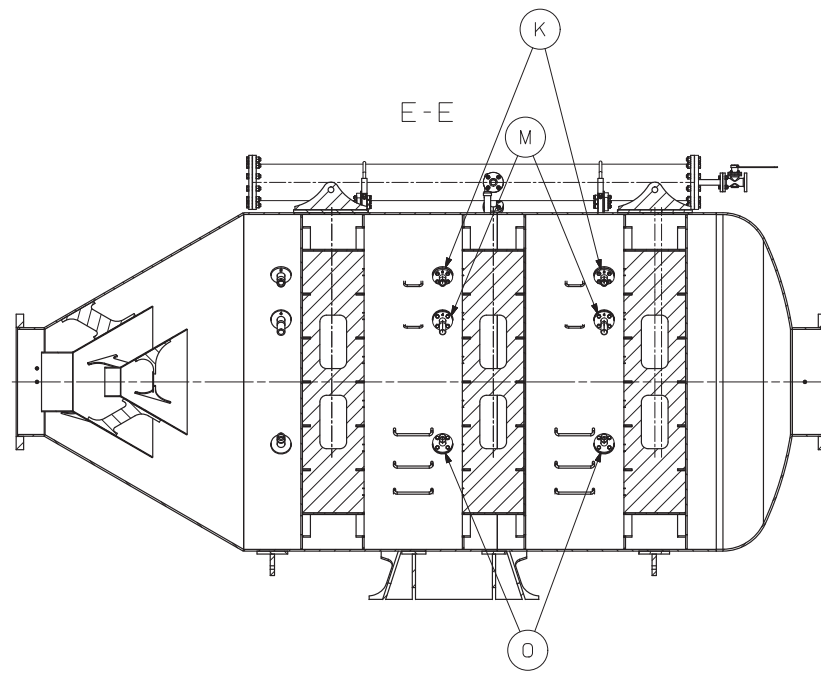
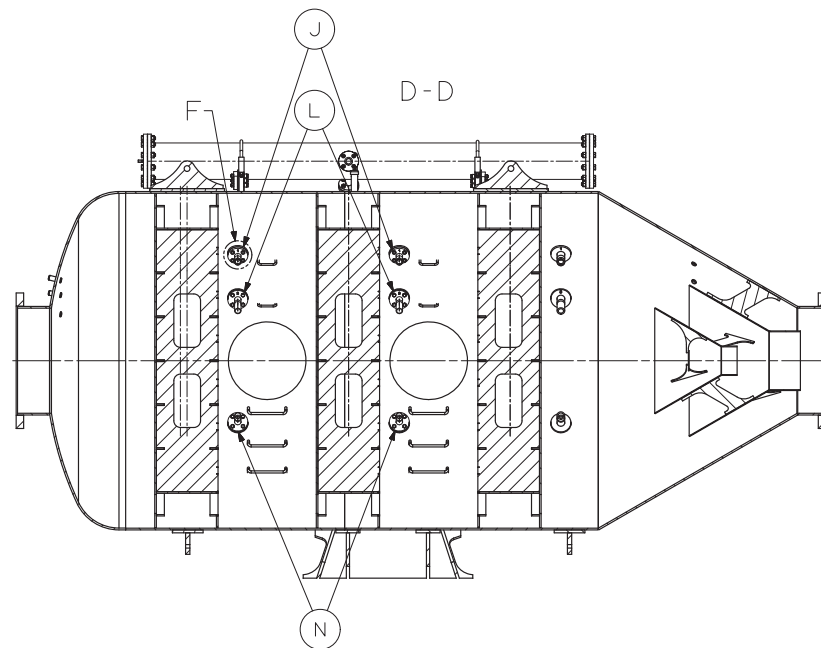
 芜湖佳宏 WUHU JIAHONG		芜湖佳宏新材料股份有限公司 WuHu. Jiahong New Materials Co., Ltd			
使用单位	沪东重机有限公司			工程名称	中船三井柴油机有限公司 锅炉电伴热项目
校核		审核		电伴热带敷设示意图	
设计		审查			
日期	2018.01.06	比例			
图号					数量



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Date	Des.	Chk.	APPD.	A.C.	Revision change	CSD No.	Rev.			
							03			
							02			
							01			
							00			
20171228 于怀先 耿直										
Basic Standards (MDS SB):					similar. Drawing No.:	5N-02612				
EN21F-m Tolerances			EN21C Surf. roughness							
Material / Blank:					Final User Material:	Mass (kg):				
Scale:	Sizes	Product Type:			Page No.:	Projection:				
1:20	A1				1 (2)					
Info. No.:	Item Name:					Item Id.:				
Final User Info. No.:	Final User Description:					Final User Ident. No.:				
801G	SCR吹灰系统					2N-06595				



Date	Des.	Chk.	APRD.	A.C.	Revision change	CSD No.	Rev.	
							03	
							02	
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20171228 于怀先 耿直								
Basic Standards (MBO SB):					similar. Drawing No.:	5N-02612		
EN21F-m Tolerances					EN21C Surf. roughness			
Material / Blank:					Final User Material:			Mass (kg):
Scale:	Size:	Product Type:			Page No.:	Projection:		
1:20	A1				2 (2)			
Info. No.:		Item Name:					Item Id.:	
Final User Info. No.:		Final User Description:					Final User Ident. No.:	
801G		SCR吹灰系统					2N-06595	

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HMI Operation Instruction



Project number	PJ-C8A1298-201/202
Manufacturing Date	DEC,2017
Manufacturing	No.21, Shulin Rd, Songjiang Industry Zone, Shanghai, China 201611
	Spraying Systems (China) Co., Ltd
	021-67600882
Customer Name	CSSC



0. CONTENT

0.	CONTENT	2
1.	SAFETY	3
2.	HMI GENERAL INFORMATION	4
2.1	Screen name list	4
2.2	Screen structure	5
2.3	Screen Toggle.....	5
3.	SCREENS DESCRIPTION	7
3.1	MAIN SCREEN.....	7
3.2	SELECTION	9
3.3	SETPOINT 1	14
3.4	SET 2-TIME.....	14
3.5	SET 3-ALARM VALUE	16
3.6	SETPOINT PID	17
3.7	MANUAL OPERATION	18
3.8	SIMULATOR VALUE	21
3.9	ALARM LIST	22
3.10	S1	23



1. SAFETY

See <<MARINE ENGINE SCR UREA SPRAY SYSTEM>> **Comply with local laws and regulations please.**



Spraying Systems Co.
Experts in Spray Technology



Spray
Nozzles



Spray
Control



Spray
Analysis



Spray
Fabrication

2. HMI GENERAL INFORMATION

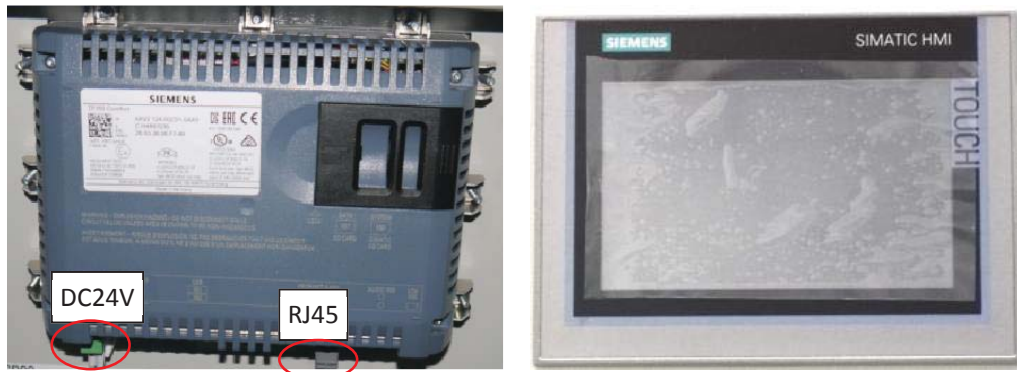
SIEMENS TP700 COMFORT 7" touch Panel has been used. See Pic. 2-1.

HMI work power: DC24V.,

Its Power Control Circuit Breaker is Q42 (See electrical drawing).

The screen edit software is TIA V13 SP1.

Communication type: Ethernet.



Pic. 2-1 HMI

2.1 Screen name list

<<Process>>;
<<Selection>>;
<<Setpoint 1>>;
<<Set 2-time>>;
<<Set 3 alarm value>>;
<< Setpoint PID >>;
<<Manual operation>>;
<<Simulator value>>;
<<Alarm list>>;
<<S1>>.

Default screen is <<Process>>. Many press-buttons are shown on the main screen. Every press-buttons is corresponding to its screen. Before operate the screen, see this operation menu please firstly.



NOTE: the person who does it must have the authorization.



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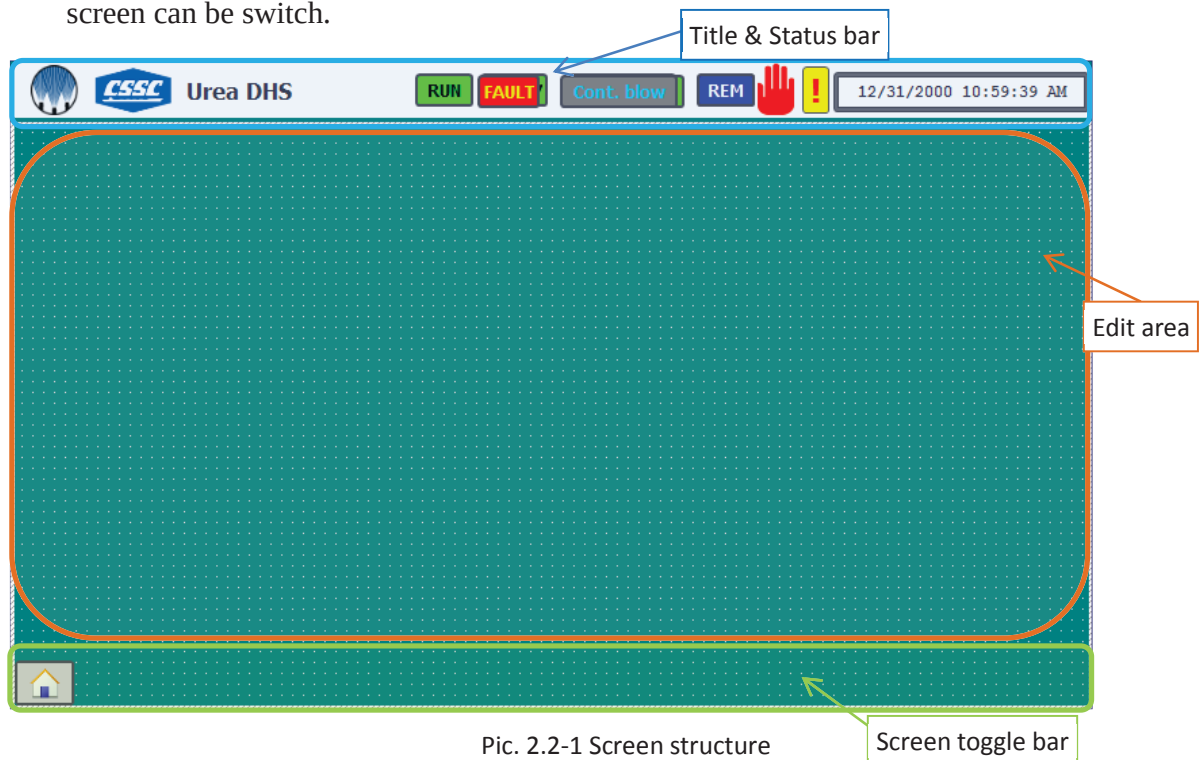


2.2 Screen structure

See Pic.2.2-1.

Every screen has been distributed into three function area.

- **Title & Status bar:** Shows LOGO/System Status /Date&Time.
Status description: Running, Alarm, Auto mode, Manual mode, Local mode, Remote mode, Safety mode, Run no cooling etc. (detailed see table3.1-1)
- **Edit area:** fill with parameters or sensor/actuator status or data sheet or parameter curve etc.
- **Screen toggle bar:** It also is button layout. By pressing these buttons, different screen can be switch.



Pic. 2.2-1 Screen structure

2.3 Screen Toggle

The Main screen is <<Process>>. All the toggle switch are located in the below of this screen.

Every screen has . Press  → <<Process>>.

- Screen toggle switch:



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• Toggle description:

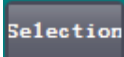
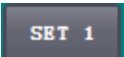
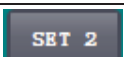
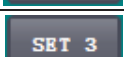
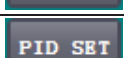
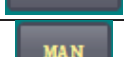
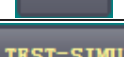
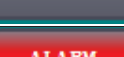
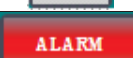
TOGGLE SWITCH	SCREEN	REMARK
Main screen (Process)		Process (Main screen) Parameters/status display
		Selection Pumps/zones/sensors/time unit select
		Setpoint 1 Process parameters setpoint
		Set 2-time Alarm tolerance time setpoint
		Set 3 alarm value Temp./pressure/flow etc alarm value setpoint
		Setpoint PID P I setpoint for flow/air PID
		Manual operation Manual
		Simulator value Process value simulator for testing
		Alarm list Show alarm information
		S1 System screen
		Process (Main screen) See above
		Alarm list See above
		Exit running. back to HMI control panel
		Log on/off
		Language toggle: EN/CH

Table 2.3-1 Toggle Switch description



The detailed description of contents on each screen will be shown in this section.

Pic. 3.1-1 Main Screen--Process

- Process status

What's the means of status icon? Here is the reference table 3.1-1.

STATUS ICON		When does it show?	Description
STATUS BAR (TEMPLATE PROPERTIES)		In LOCAL mode	Local mode: start/stop spraying on the cabinet control panel.
		In REMOTE MODE	Remote mode: start/stop spraying in customer CCR.
		No fault	System available: no serious mistake. System start is allowed.
		Running	Running mode: system is running (include normal running, cont. purge1/flush purge1, etc).
		Fault occurs, system stop.	Fault: there has serious mistake like no pumps feedback/not enough liquid pressure/not enough air pressure/emergency stop, etc. system stopped.

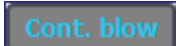
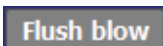
		General alarm	General alarm: include fault and warning. For warning, system still allowed running.
		Continuously purge	At system running beginning, Cont. blow 1 is on; and when system stop, Cont. blow 2 is on. Air purge process on
		Flush purge	When system running and after Cont. blow 1, Flush blow1 is on; after Cont. blow 2, and system stop, Flush blow 2 is on. Air purge process is on
		MANUAL mode	Manual mode: manual operator only is available in local mode. Just for commissioning.
Main screen	 A1-PS1	Air pressure switch on	 Inlet air pressure switch is on. Compressed air is ready for use.
	 A4-B1	Air shut-off SOV is on.	 Air purge or provide atomize air to lance
	 A5-B1	Air purge SOV is on	 Air purge for liquid pipe to lance
	 L3-P1 (up)	Pump1 is running.	 Pump1 is running, provide liquid to lance
	 L3-P2 (down)	Pump2 is running.	 Pump2 is running., provide liquid to lance

Table 3.1-1 Status icon description

- Process parameters

These parameters are read-only. Parameters list is shown as Table3.1-2.

Parameter 		Range	Unit
Main Screen	PDT of reactor	-	bar
	Inlet temperature of reactor	-	°C
	Inlet pressure of reactor	-	bar
	Lance liquid pressure	0-16	bar
	Lance air pressure	0-16	bar
	Liquid flow	0-400	l/h
	Air flow	0-225	Nm3/h
	Pump 1 VFD output	0-100	%
	Pump 2 VFD output	0-100	%
	Air proportional valve opening	0-100	%
	Pump 1 pressure	0-25	bar
	Pump 2 pressure	0-25	bar
	Ari pressure setpoint		
	Liquid pressure setpoint	Remote Locale	0-120 l/h

Table 3.1-2 Parameters on the main screen



- Local safety start button (Reserved)

Local safety start button **LOC-Safety Start** is located in the bottom-right on this screen.

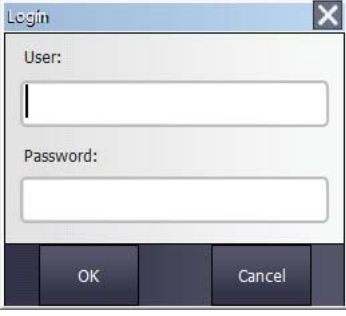
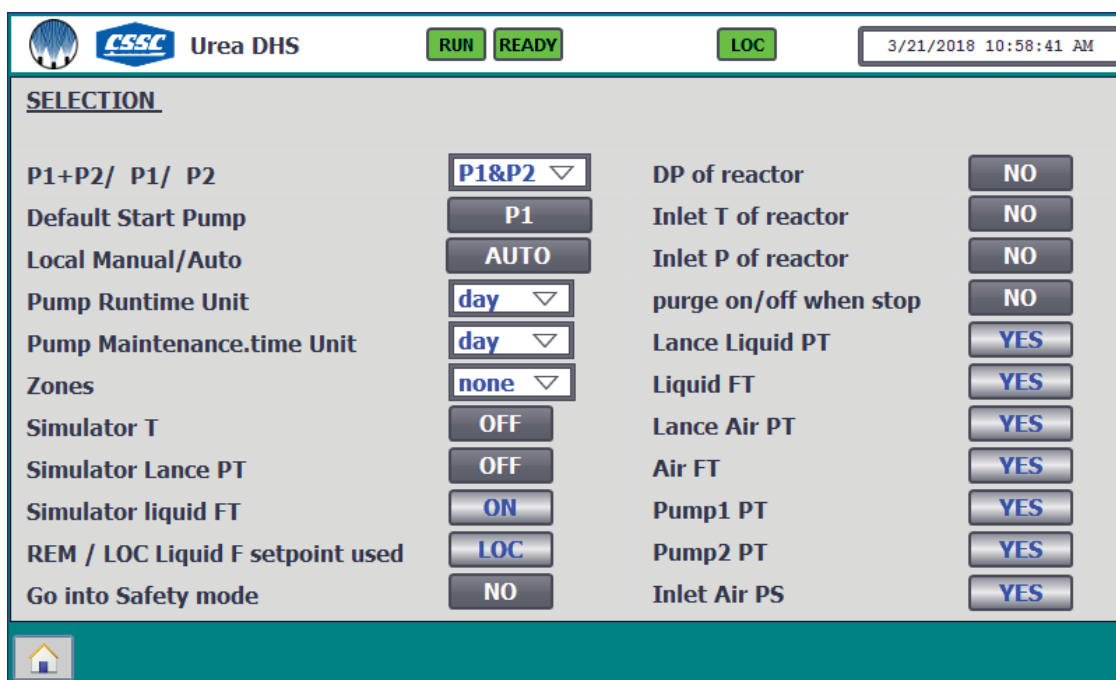
Button name	Function	How to operate?	Signal type
Local safety start	Start safety (constant flow) running mode on local mode.	 Press LOC-Safety Start input User name and Password, press 'OK' Press LOC-Safety Start again.	pulse

Table 3.1-3 LOC-Safety Start push-button description

3.2 SELECTION



SELECTION	
P1+P2/ P1/ P2	P1&P2 ▼
Default Start Pump	P1
Local Manual/Auto	AUTO
Pump Runtime Unit	day ▼
Pump Maintenance.time Unit	day ▼
Zones	none ▼
Simulator T	OFF
Simulator Lance PT	OFF
Simulator liquid FT	ON
REM / LOC Liquid F setpoint used	LOC
Go into Safety mode	NO
DP of reactor	NO
Inlet T of reactor	NO
Inlet P of reactor	NO
purge on/off when stop	NO
Lance Liquid PT	YES
Liquid FT	YES
Lance Air PT	YES
Air FT	YES
Pump1 PT	YES
Pump2 PT	YES
Inlet Air PS	YES

Pic. 3.2-1 Selection

In this screen, we define the content of these choices for three types. They are 1.system configuration, 2.sensors on/off, 3.simulator process value. See Table3.2-1-1/2/3.

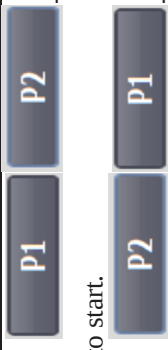
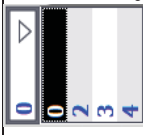
Type	Switch name	Icon	Optional	Description	How to operate?
System configuration	Pump1+2/ Pump1/ Pump2		P1+P2 (default) P1 P2	Two pumps selected. One use, one stand by. Single pump1 selected Single pump2 selected	 Click on the drop-down menu you need. select what you need.
	Default Start Pump		P1(default) P2	System startup, pump1 priority to start immediately. System startup, pump2 priority to start immediately.	 Click on P1 --pump2 is priority to start. Click on P2 --pump1 is priority to start.
	Local Manual/Auto		AUTO (default) MANUAL	Auto running mode. Local manual mode	On local mode, Click on  appears. Pumps and valves could be start/stop manually.
	Pump Runtime Unit		min hour(default) day	Different time unit. Following Pump Maintenance time unit.	 select the time unit in program.
	Pump Maintenance time unit		min(default) hour day	Different time unit.	
	Zones (NA)		0(default) 2 3 4	Select zone2 Select zone3 Select zone4	 Click on the drop-down menu quantity corresponds with process. select the zone

Table 3.2-1-1 SELECTION SWITCH 1



Type	Switch name	Icon	Optional	Description	How to operate?
Sensor on/off	DPT of reactor	NO	no yes	Don't selected DPT DPT selected	Click on NO YES --outlet temperature 1 is selected for spraying control. Click on YES
	Inlet T of reactor	NO	no yes	Don't selected Reactor T selected	Same way as select T1
	Inlet P of reactor	NO	no yes	Don't selected Reactor P selected	Same way as select T1
	Purge on/off when stop	NO	no yes	Don't purge when stop Purge on when stop	Same way as select T1
	Lance liquid PT	NO	no yes	Don't selected Select LLPT	Same way as select T1
	Liquid FT	NO	no yes	Don't selected Select LFT	Same way as T1
	Lance Air PT	NO	no yes	Don't selected Select LAPT	Same way as T1
	Air FT	NO	no yes	Don't selected Select AFT	Same way as T1
	Pump 1 PT	NO	no yes	Don't selected Select pump1 PT	Same way as T1
	Pump 2 PT	NO	no yes	Don't selected Select pump2 PT	Same way as T1
	Inlet Air PS	NO	no yes	Don't selected Inlet air PS selected	Same way as T1

Table 3.2-1-2 SELECTION SWITCH 2

Type	Switch name	Icon	Optional	Description	How to operate?
Simulator process value (just for commissioning)	Simulator T (NA)		Off(default) on	Do not use simulator value of T Simulator T selected	Click on  to  --simulator temperature 1/2/3/4 is used for spraying control. Click on  to 
	Simulator lance PT		Off(default) on	Do not use simulator value of L/A PT Simulator L/APT selected	Same way as T1. It is not only for lance liquid PT, but also lance air PT.
	Simulator Liquid FT		Off(default) on	Do not use simulator value of LFT Simulator LFT selected	Same way as T1
	REM/LOC liquid flow setpoint used		 	Select remote liquid flow setpoint Select local liquid flow setpoint	Click  to  Click  to 

Table 3.2-1-3 SELECTION SWITCH 3

The status bar is the same as Main screen and others, so no longer do.

Parameter Setpoint 0			Range	Unit	Suggestion value
Range	Sensor	Lance liquid pressure	Follow the value of transmitter name plate	bar	16
		Liquid flow		l/h	400
		Lance air pressure		bar	16
		Air flow		Nm3/h	225
		Pump1 outlet liquid pressure		bar	25
		Pump2 outlet liquid pressure		bar	25
		PDT of reactor		bar	-
		Inlet temperature of reactor		°C	-
		Inlet pressure of reactor		bar	-
		Air Proportion pressure		bar	10
Setpoint		Liquid flow	0-400	l/h	50
		Liquid flow setpoint max.	0-120	l/h	120
		Liquid flow setpoint main	0-120	l/h	0
		Air pressure setpoint max.	0-10	bar	7
		Air pressure setpoint min	0-10	bar	0.3
		Atomizing air pressure	0-10	bar	4.5
		Atomizing air start pressure	0-10	bar	3
		Cont. purge air pressure	0-6	bar	1.5
		Flush purge air pressure	0-6	bar	2
Dev.		Liquid flow deviation	0-400	l/h	0

Table 3.3-1 Parameters on Screen Setpoint 1


Urea DHS
RUN READY LOC
3/21/2018 11:04:01 AM

Setpoint 1

Lance Liquid Pres. Range	16.0 bar	PDT of reactor Range	10.0 bar
Liquid Flow Range	400.0 l/hr	Inlet T Range of reactor	200.0 °C
Lance Air Pressure Range	16.0 bar	Inlet P Range of reactor	10.0 bar
Air Flow Range	225.0 NM3/hr	Air_proportional_P_range	10.0 bar
Pump1 outlet Pres. Range	25.0 bar	spare	0 °C
Pump2 outlet Pres. Range	25.0 bar	Air P setpoint max	7.0 bar
		Air P setpoint min	0.5 bar
Liquid Flow Setpoint (test)	30 l/hr	Atomizing Air P	4.5 bar
Liquid Flow Setpoint Max.	120 l/hr	Atomizing Air start P	3.3 bar
Liquid Flow Setpoint Min.	10.0 l/hr	Cont. Purge airP setpoint	0.0 bar
Liquid Flow diviation	0 l/hr	Flush Purge airP setpoint	3.5 bar

Pic. 3.3-1 Setpoint 1

3.3 SETPOINT 1

Here are process transmitter ranges / process target value / deviation value set point

(Pic.3.3-1). The setup step is: click  →  → input the right value → press  → save it → .

Parameters detailed descriptions see Table 3.3-1.



NOTE: Don't set the parameters frequently when the system is running!

3.4 SET 2-TIME

See Pic.3.4-1.

There are the main alarm time setpoint. Different item, different time unit.



Urea DHS

RUN

READY

LOC

3/21/2018 11:08:39 AM

Set 2 - Time

Temperature alarm	60	s	Cont. Purge 1	2	s
Liquid Pressure alarm	60	s	Cont. Purge 2	1	s
Liquid Flow alarm	60	s	Flush Purge 1	6	s
Air Pressure alarm	30	s	Flush Purge off	1	s
Pump Pressure alarm	30	s	Flush Purge on	2	s
Air Flow alarm	90	s	Flush Purge 2	3	s
Safety mode Acknowledge	0	min	Flush Purge 2 off	1	s
Air PS alarm	30	s	Flush Purge 2 on	2	s
Pump change time	120	hour	Flush Purge 3 off	5	s
Pump maintenance time	2880	hour	Flush Purge 3 on	2	s
-	0	s	-	0	s



Pic. 3.4-1 Set 2-Time

Time range and suggestion value is shown in Table 3.4-1.



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Parameter Setpoint 		Normal Set Range	Unit	Suggestion value
Set 2-Time	Temperature Alarm	10-99	s	60
	Liquid Pressure Alarm	10-99	s	60
	Liquid Flow Alarm	10-99	s	60
	Air Pressure Alarm	5-99	s	30
	Pump Pressure Alarm	5-60	s	30
	Air Flow Alarm	10-99	s	30
	Safety Mode Acknowledge	1-99	min	0
	Air PS Alarm	5-60	s	30
	Pump Maintenance	0-99999/7200/300	Minute	2880hour
	Pumps change time	0-14400/240/10	/hour /day	120hour
	Cont. purge 1	0-1800	s	5
	Cont. purge 2	0-1800	s	10
	Flush Purge 1	0-1800	s	300
	Flush Purge 1 off	0-1200	s	20
	Flush Purge 1 on	0-600	s	10
	Flush Purge 2	0-1800	s	600
	Flush Purge 2 off	0-1200	s	20
	Flush Purge 2 on	0-600	s	10
	Flush Purge 3 off	0-3600	s	1800
	Flush Purge 3 on	0-300	s	60
	spare	--	s	--

Table 3.4-1 Alarm time range and suggestion value

-  Cont. purge 1__it is on as soon as system starts.
-  Cont. purge 2__it is on when system statue is from on to off.
-  Flush Purge 1__it is on when system is running and Cont. purge 1 is from on to off.
Flush Purge 1 off: When Flush Purge 1 is on, air shut-off SOV and purge SOV off.
Flush Purge 1 on: When Flush Purge 1 is on, air shut-off SOV and purge SOV on.
-  Flush Purge 2__it is on when system is off and Cont. purge 2 is from on to off.
Flush Purge 2 off: When Flush Purge 2 is on, air shut-off SOV and purge SOV off.
Flush Purge 2 on: When Flush Purge 2 is on, air shut-off SOV and purge SOV on.
-  Flush Purge 3 off__ "Purge on/off when stop"=1, air shut-off SOV and purge SOV off.
Flush Purge 3 on__ "Purge on/off when stop"=1, air shut-off SOV and purge SOV on.



3.5 SET 3-ALARM VALUE

See Pic. 3.5-1.

Normal process value of temperature /flow /pressure range is limited by the Min. and Max. . Alarm should be on if process value exceed its range. Reference Table.3.5-1.

Pic. 3.5-1 Set 3-Alarm value

Parameter Setpoint 0		Normal Set Range	Unit	Suggestion value
Set 3-Alarm value	Lance Liquid Pressure Max.	0-16	bar	12.0
	Lance Liquid Pressure Min.	0-5	bar	0.3
	Liquid Flow Max.	0-400	l/h	130.0
	Liquid Flow Min.	0-5	l/h	0.5
	Lance Air Pressure Max.	0-10	bar	8.5
	Lance Air Pressure Min.	0-3.5	bar	1.5
	Pump Pressure Max.	0-25	bar	15.0
	Pump Pressure Min.	0-6	bar	0.3
	Air Flow Max.	0-225	Nm3/h	210.0
	Air Flow Min.	0-10	Nm3/h	0.2
	PDT of reactor Max.	Need confirmed on site	bar	--
	PDT of reactor Min.	Need confirmed on site	bar	--
	Inlet T of reactor Max.	Need confirmed on site	°C	--
	Inlet T of reactor Min.	Need confirmed on site	°C	--
	Inlet P of reactor Max.	Need confirmed on site	bar	--
	Inlet P of reactor Min.	Need confirmed on site	bar	--

Table 3.5-1 Parameters on Screen Set 3-Alarm value



3.6 SETPOINT PID

Liquid flow and air pressure PID control system. It is very important to set the suitable P&I value for PI control.



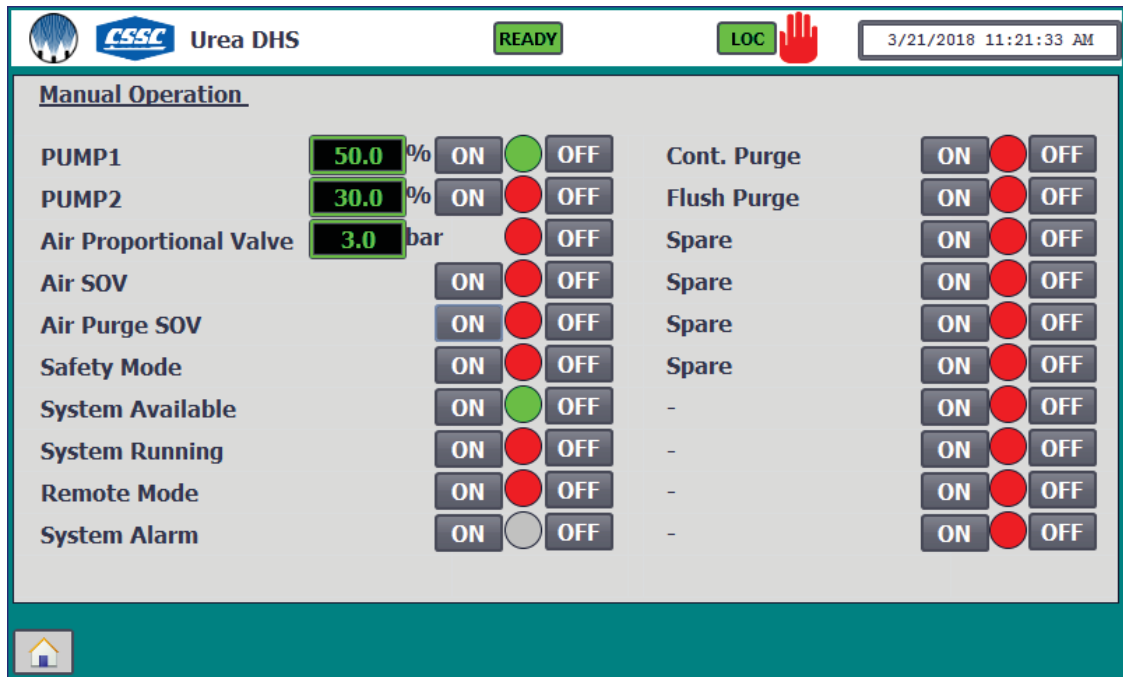
NOTE: Once the adjustment is in stable condition, please do not arbitrarily change the value of P&I!

Parameter Setpoint		Normal Set Range	Unit	Suggestion value
Simulator Value	LF pid out preset value	0-130	l/h	10.0
	Pump min. output	0-90	%	20.0
	Pump max. output	0-100	%	100.0
	Pump rated flow	120 (following pump name plate)	l/h	120
	PID_Flow_P	0.000-999.999	-	0.8
	PID_Flow_I	0.00-999	s	20
	PID_Pressure_P (air)	0.000-999.999	-	2.0
	PID_Pressure_I (air)	0.00-999.999	s	0.8

Table 3.6-1 Parameters for P&I control



3.7 MANUAL OPERATION



Pic. 3.7-1 Manual Operation

In Manual Operation, Pump and valve can be switched on the MANUAL OPERATION SCREEN one by one.

Before start pump, make sure  is appearing and set the frequency percentage. Its value range is 0~100% but suggestion minimum value is not lower than 20%.



NOTE: Manual operation is just for testing and urgency using. Please pay more attention to actuator status when system is manually running for prevent accident occur!



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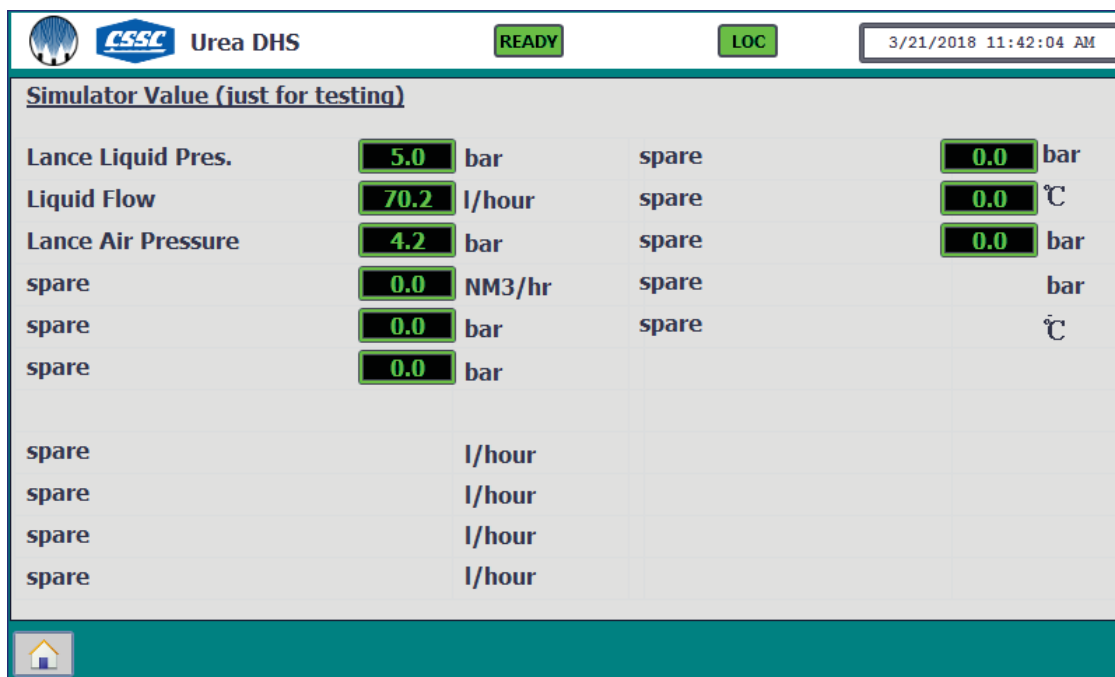
Screen	Manual Item	Parameter	Button	Status	Description	How to operate?
 Manual Operation	Pump 1	60 %			The percentage of the frequency values.	Reference section 3.3. Range suggestion: 50-100 %.
			ON OFF		Manually start, stop button and status display. Button type: pulse. Status:  =off;  =on	Manual mode  , press →  → pump1 start; press OFF  → pump1 stop.
	Pump 2	80 %			Same as pump1.	
			ON OFF			
	Air SOV		ON OFF		Manually start, stop button and status display. Button type: pulse. Status:  =off;  =on	Manual mode  , press →  → air SOV ON; press OFF  → air SOV OFF.
	Air Purge SOV		ON OFF		Same as Air SOV.	
	Safety mode		ON OFF		Manually start, stop button and status display. Button type: pulse. Status:  =off;  =on	Manual mode  , press →  → safety mode ON; press OFF  → safety mode OFF. (just for testing)
	System available		ON OFF		Same as Air SOV. system available (just for testing)	
	System running		ON OFF		Same as Air SOV. System running (just for testing)	

Remote mode		ON OFF		Manually start, stop button and status display. Button type: pulse. Status:  =off;  =on	Manual mode , press  → remote mode ON; press OFF → remote mode OFF. (just for testing)	ON
System alarm		ON OFF		Manually start, stop button and status display. Button type: pulse. Status:  =off;  =on	Manual mode , press  → alarm ON; press  → alarm OFF. (just for testing)	ON OFF
Cont. Purge		ON OFF		Same as Air SOV.		
Flush Purge		ON OFF		Same as Air SOV		
Air Proportional Valve	3.0 bar			Air pressure setpoint in manual mode	Range suggestion: <u>0-9</u> bar	

Table 3.7-1 Manual operation description



3.8 SIMULATOR VALUE



Pic. 3.8-1 Simulator value

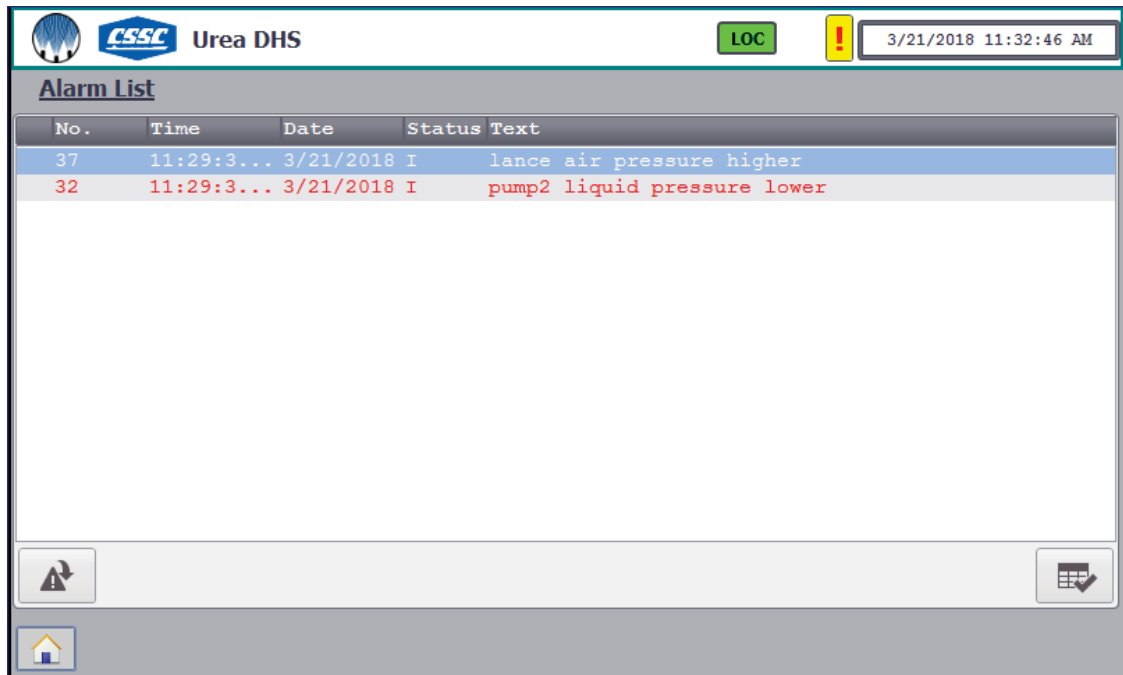
Parameter Setpoint		Normal Set Range	Unit	Suggestion value
Simulator Value	Lance Liquid Pressure	0-16	bar	5.0
	Liquid Flow	0-400	l/h	70.2
	Lance Air Pressure	0-16	bar	4.2
	Spare	~	-	--
	Spare	~	-	--
	Spare	~	-	--
	Spare	~	-	--

Table 3.8-1 Simulator parameters

 **NOTE:** This simulator value is just for system testing and commissioning. Don't use it if system is running normally. It means that turn off all simulator switch on screen <<SELECTION>>.

All of red value can be modified on site.

3.9 ALARM LIST



No.	Time	Date	Status	Text
37	11:29:3...	3/21/2018	I	lance air pressure higher
32	11:29:3...	3/21/2018	I	pump2 liquid pressure lower

Pic. 3.9-1 Alarm List

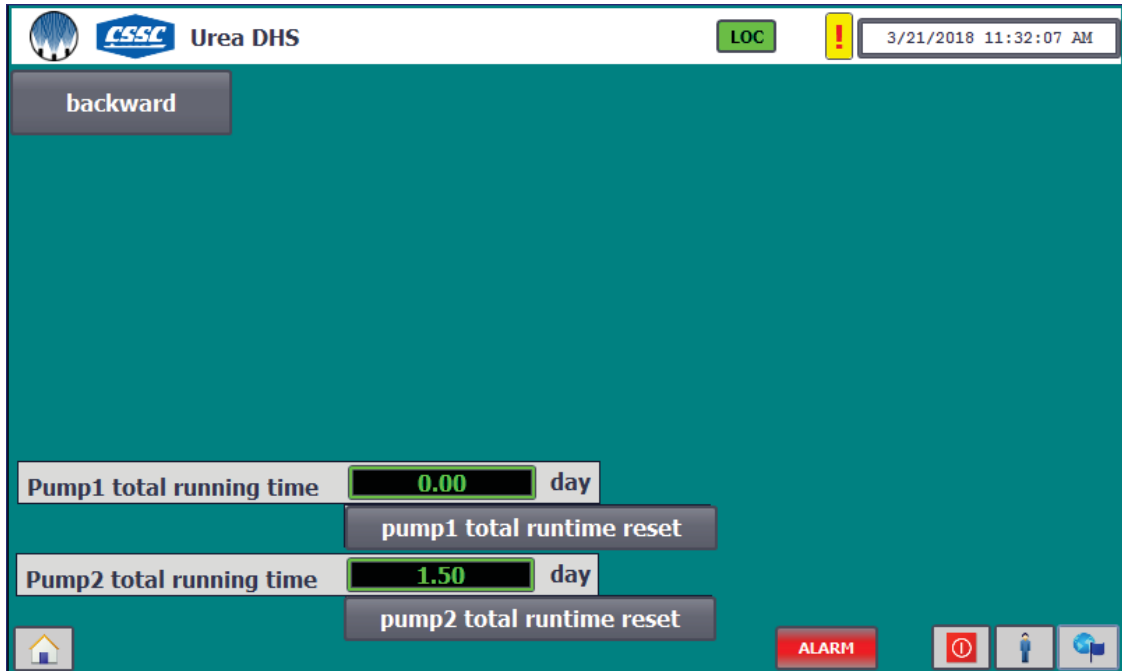
This is alarm list on the screen. It will remind operator to be care of the parts status of spraying system. It is helpful for minimize downtime.



NOTE: Before reset the alarm, make sure the cause of alarm disappeared!

Detailed alarm list, the cause of alarm, how to maintenance, please reference to <<MARINE ENGINE SCR UREA SPRAY SYSTEM>>.

3.10 S1



Pic. 3.10-1 S1

Pumps total running time is shown on <<S1>>.

In addition, pumps runtime reset buttons are list on the screen. If pump runtime exceed the maximum value , press pump runtime reset button, timer counter from 0.



----press it: exit HMI running. Setup can be down on HMI control panel.



----log in/off: Input 'user name' and 'password', safety mode start is available (safety mode start button is on the main screen).



----language toggle: Press it once, switching between English and Chinese.



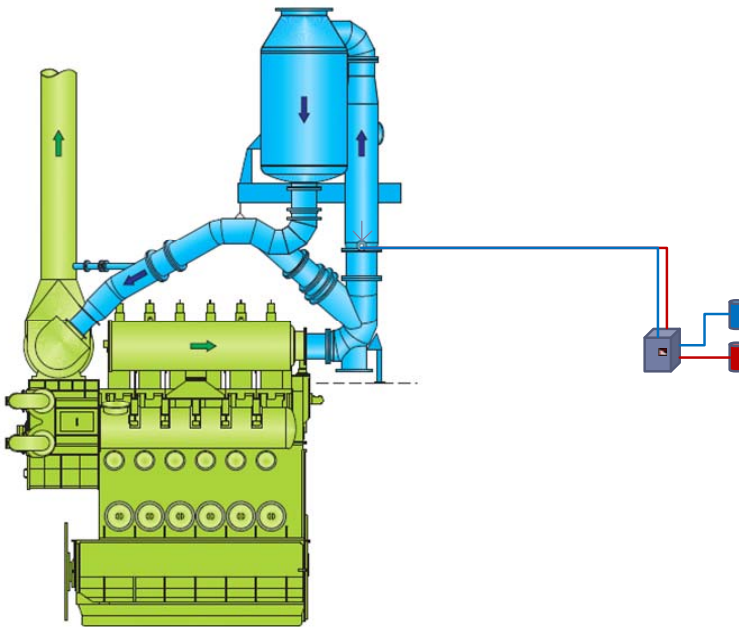


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USER MANUAL

MARINE ENGINE OFFGAS SCR

UREA SPRAY SYSTEM



SPRAYING SYSTEMS (CHINA) CO., LTD.



Spray Nozzles



Spray Control



Spray Analysis



Spray Fabrication

TABLE OF CONTENT

PREFACE.....	1
1. SAFTTY INSTRUCTION	2
2. PROCESS INTRODUCTION	5
3. STRUCTURES.....	7
4. FUNCTIONAL DESCRIPTIONS.....	16
5. OPERATING INSTRUCTIONS	22
6. STORAGE AND HANDLING INSTRUCTION	25
7. INSTALLATION.....	27
8. MAINTEMANCE	28
9. TROUBLE SHOOTING	29
10. SPRAY LANCE AND NOZZLE INSTRUCTIONS	31
11. SUSTAINABILITY AND ENVIRONMENTAL CARE.....	33

Revision Sheet

Release No.	Date	Revision Description
R00	2018-03-18	First Release

PREFACE

1. General Information

This manual accompanies a machine or an installation, designed and manufactured by Spraying Systems (China) Co., Ltd.

The machine is produced very carefully and is tested and checked in the factory. It is designed for use in an industrial application. However, it can be very dangerous if not used in a correct way. Therefore, read this manual carefully and pay special attention to the safety instructions.

Beside these instructions, operators must always follow the general safety instructions in the working area and aim to prevent accidents.

2. How to use this manual?

The intention of this manual is to serve the operator in his daily job and to help the technical service to keep the machine in a good condition. It contains all technical information customer needs to operate and maintain the installation.

Important safety warnings are positioned ON the machine and repeated in this manual.

The different chapters contain references to chapters in addition. Read them carefully, they contain important information.



NOTE

Make sure you read and understand this manual before working on the system.

3. Description of symbols and indications

	Tip: Suggestions and advices for the user to make some tasks easier.
	Attention: Supplementary information for the user, drawing attention to possible problems
	Carefully: Product, process or environment can be damaged or be in danger if the instructions are not followed correctly.
	Warning: The <u>user</u> can be injured (seriously) or his health can be damaged. Or the <u>machine</u> can be seriously damaged
	NOTE or INFO: Some useful information to draw attention to possible problems

1. SAFETY INSTRUCTION



WARNING

Each customer should establish and implement its own safety procedures and instructions and make them known to the operators in order to assure a correct and safe operation of the equipment.

1.1. General Instructions

These procedures shall include, but be not limited to the followings:

1. Before using the equipment, the operator has to check if the equipment is in good condition and can be used safely. If not, the equipment cannot be used.
2. The area, in which the equipment is installed, should be sized to allow a safe operation, and should meet all local or company safety codes.
3. All required original spare parts must be readily available to the equipment at all times for a correct and safe operation. Only genuine parts are allowed for repair and service.
4. The utilities supply (electricity, compressed air, urea, water ...) to the equipment should meet all company and local regulations and must be properly routed and connected to the equipment. All utilities and connections must meet the specified requirements.
5. Equipment built for normal operation in ambient temperature between 5 and 40°C.
6. The equipment should be operated only by properly trained, qualified personnel. They must have proven their skills in the operation of the equipment.
7. Children are not allowed to operate this installation and system.
8. The maintenance and operating instructions shall be rigidly observed and followed.
9. The operator should have full information on the nature and the quantity of the material to be sprayed.
10. The safety procedures made by the customer should be posted close to the equipment and clearly visible to and legible by the operator. Safety procedures should meet all company and local regulations, as well as MSDS-requirements.
11. All necessary Personal Protective Equipment (PPE) must be readily available to the operator at all times.
12. A complete manual for the equipment must be available to the operator or maintenance technician at all times.
13. Important warnings for the safe use of the equipment are indicated on the equipment.
14. The operator has to use the equipment according to this manual. The operator has to follow the general safety prescriptions of the factory and has to anticipate in order preventing accidents. He has to take into account the local circumstances and the presence of other people.
15. Only qualified experts are allowed to repair or maintain the installation. They must be familiar with this manual.

16. Before starting work at any particular component, make sure that all power supplies have been switched off and that they cannot be accidentally switched on.
17. Filters can only be opened when the manual valves in front of and behind the filter are in closed position. If any appliance has to be taken out of the piping, manual valves in front of and behind this appliance have to be in closed position. If they are reinstalled, make sure that this happens correctly, that this apparatus is well aligned, and that all connections are tight.
18. It is advised to drain and purge the liquid train when the equipment shall not be used for a longer period of time or at customer needs.
19. Any waste product or disposal should be treated according to the prescriptions in the MSDS data-sheets and the company and local regulations.
20. Systems have a risk of electric shock due to residual voltage. It is not permissible to open the equipment neither to disconnect the system or any quick connection until 5 minutes after the power has been removed.

**WARNING**

It is not allowed to start the machine before it is checked if all valves are in the correct position and if all parts are in good condition and can be used safely.

1.2. Product Specifics

1.2.1. Electrical Cabinet: Shock hazard



- To reduce the risk of electric shock, the Operator should not open the cover of the Electrical Cabinet.
- If it is really required to access internal electrical components, this should be done by a qualified electrician from the Maintenance Staff and power should be fully isolated before and while the work is carried out.
- Only authorized qualified personnel from the user/Spraying Systems Co. should attempt to repair this unit.
- Service by unauthorized personnel will void any and all warranties.

1.2.2. Power Supply



Control system should be operated only from correct type of power supply. If you are not sure, please consult an electrician or qualified service personnel.

1.2.3. Polarizing/grounding



The unit should be properly grounded at all times. Please ensure that appropriate plugs and supply are used.

1.2.4. Water and moisture



DO NOT flush the system and electrical cabinet with water or any other liquid. Keep moisture away.

1.2.5. Servicing



DO NOT attempt to service the system unless you have been trained or authorized to attempt repairs:

- For service or repair, please contact Spraying Systems Co.
- Only authorized qualified service personnel from Spraying Systems Co. should attempt to service this unit.
- Service by unauthorized personnel will void any and all warranties.

1.2.6. Others



IF THE SYSTEM IS UNDER PRESSURE

Never open any connection



SOME PARTS MAY BECOME VERY HOT

Do not touch heated parts



CHECK MSDS OF SPRAYED LIQUID

Use adequate PPE when cleaning, maintaining...

2. PROCESS INTRODUCTION

2.1. Process Introduction

SCR is based on the chemical reduction of the NO_x molecule into molecular nitrogen (N₂) and water vapor (H₂O). A nitrogen based reducing agent (reagent), such as urea, is injected into the post combustion flue gas. The reagent can react with a number of flue gas components. However, the NO_x reduction reaction is favored over other chemical reaction process for a specific temperature range and in the presence of oxygen and at the presence of proper catalyst, therefore, it is considered a selective catalytic chemical process.

The SCR process occurs within catalyst unit which acts as the reaction chamber. Figure 2.1-1 shows a schematic of marine diesel engine off-gas system with SCR. Reagent (urea solution) is injected into flue gas through spray nozzle mounted on the wall of flue gas duct before catalyst unit. Urea solution is sprayed into flue gas and evaporate completely then urea will decompose into ammonia gas. A static mixer is set before catalyst for the purpose of mixing ammonia with flue gas evenly. Inside catalyst unit, NO_x molecules react with ammonia and thus NO_x level of flue gas is reduced. Urea Smart Spray (USS) system is to make sure urea solution is properly sprayed into flue gas and evaporate properly. More details on USS is provided in the following sections.

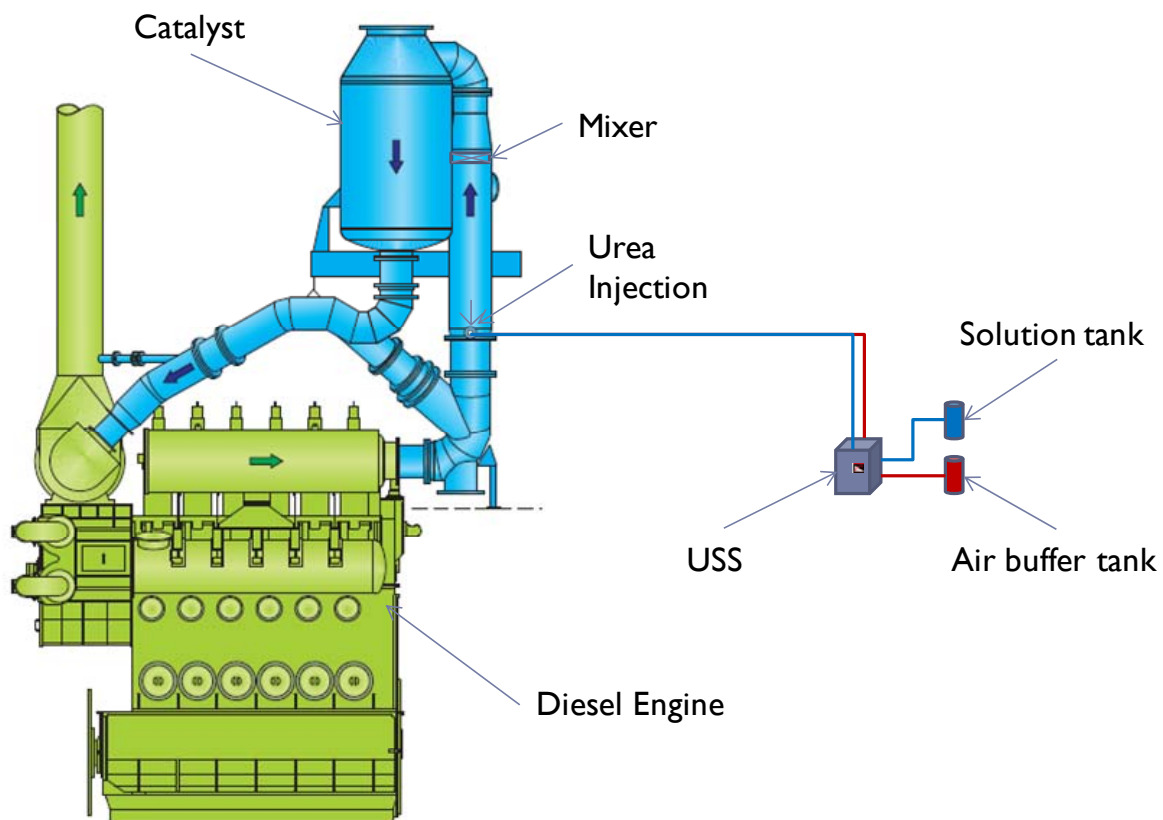


Figure 2.1-1 Typical SCR system for marine engine off gas

2.2. Urea Spray System

Following diagram shows a typical urea spray system for marine engine off gas SCR.

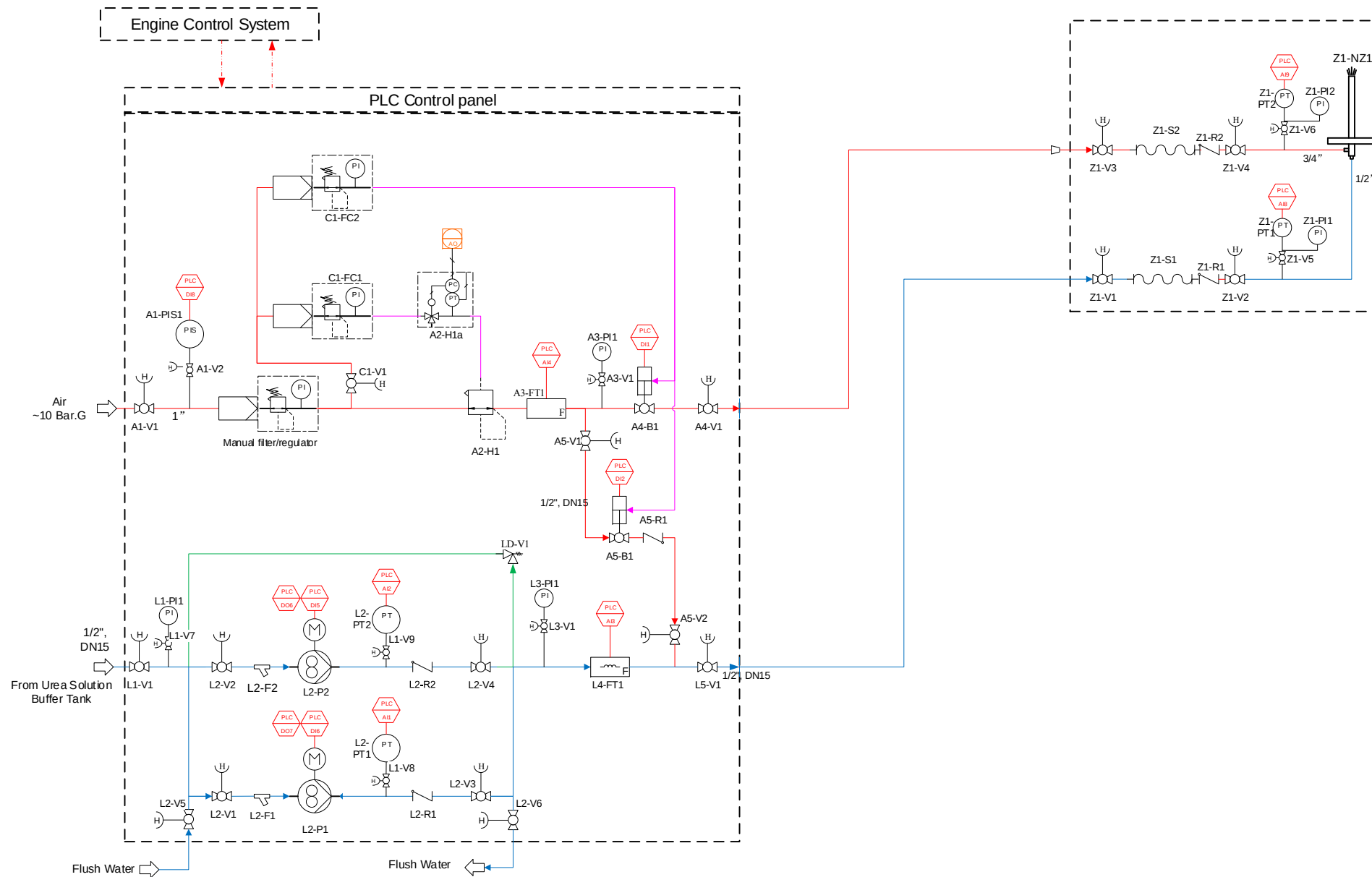
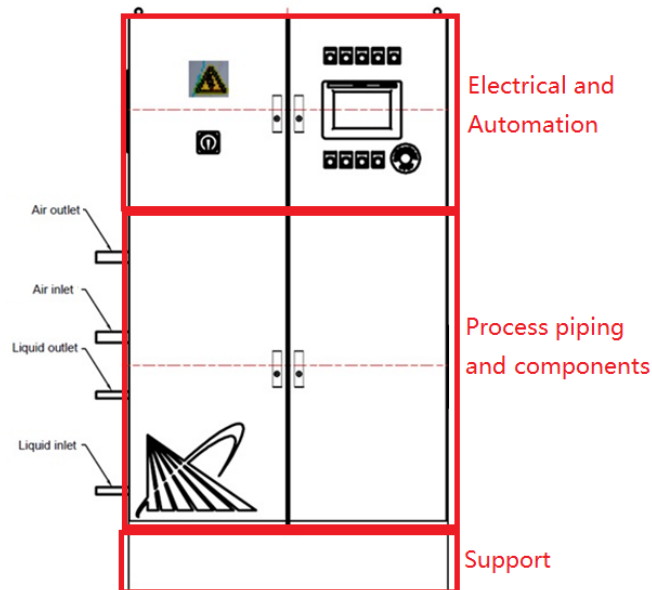


Figure 2.2-2 Urea Smart Spray System Process Diagram

For detailed P&I diagram, please refer to project related documents and drawings.

3. STRUCTURES

3.1. Encapsulated Urea Spray System

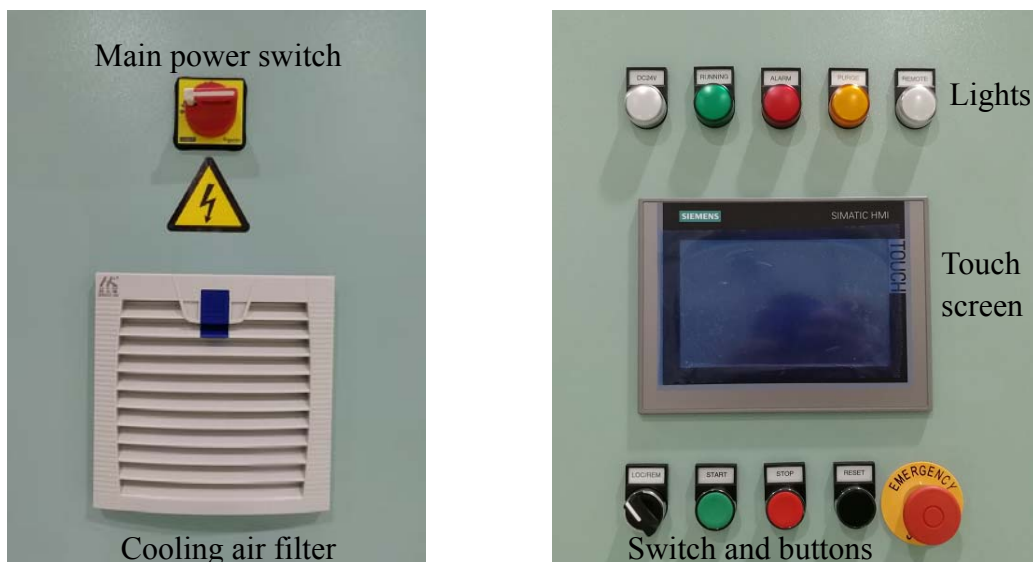


Generally, it consists of three parts:

- Electrical and Automation
- Process piping and components
- Support

3.1.1. Electrical and Automation

Following picture shows the electrical control panel. The system uses a Siemens S7-1200 PLC with an operating touch panel. All parameters can be set on the interface.



If there is something wrong with the system, consequences may be serious. However, most of the failures will be detected by the controller and will be displayed. The machine will try to take measures to continue spraying anyway. Nevertheless, it is very important to find the causes of failures to remove both the causes and the failures.

Operating display

Operating display	Touch panel for visualizing process information and for setting as well as other process parameters
--------------------------	---

Switches and buttons

MAINS	Isolation switch To switch ON/OFF the electrical power
Local-remote switch	A selection switch for local/remote mode selection - In local mode, the system can be started/stopped from the operating display - In remote mode, the system can be started/stopped from the central control room by remote start/stop signals
START	Press this button to start system running
STOP	Press this button to stop system running
RESET	Press this button to reset any warning or alarm
EMERGENCY	Mushroom push button Stops immediately the complete process; no more spraying

Indicator lights

DC24V POWER ON	White light Lights when DC24V power is present in the control panel.
RUNNING	Green light Lights when system is in RUNNING mode.
ALARM	Red light - Lights when warning or alarm is detected. - For more information please refer to operating display.
PULSE PURGE	Yellow light Lights when pulse purge function is active.
REMOTE MODE	White light Lights when system is working at remote mode.

Feedback signals to customer

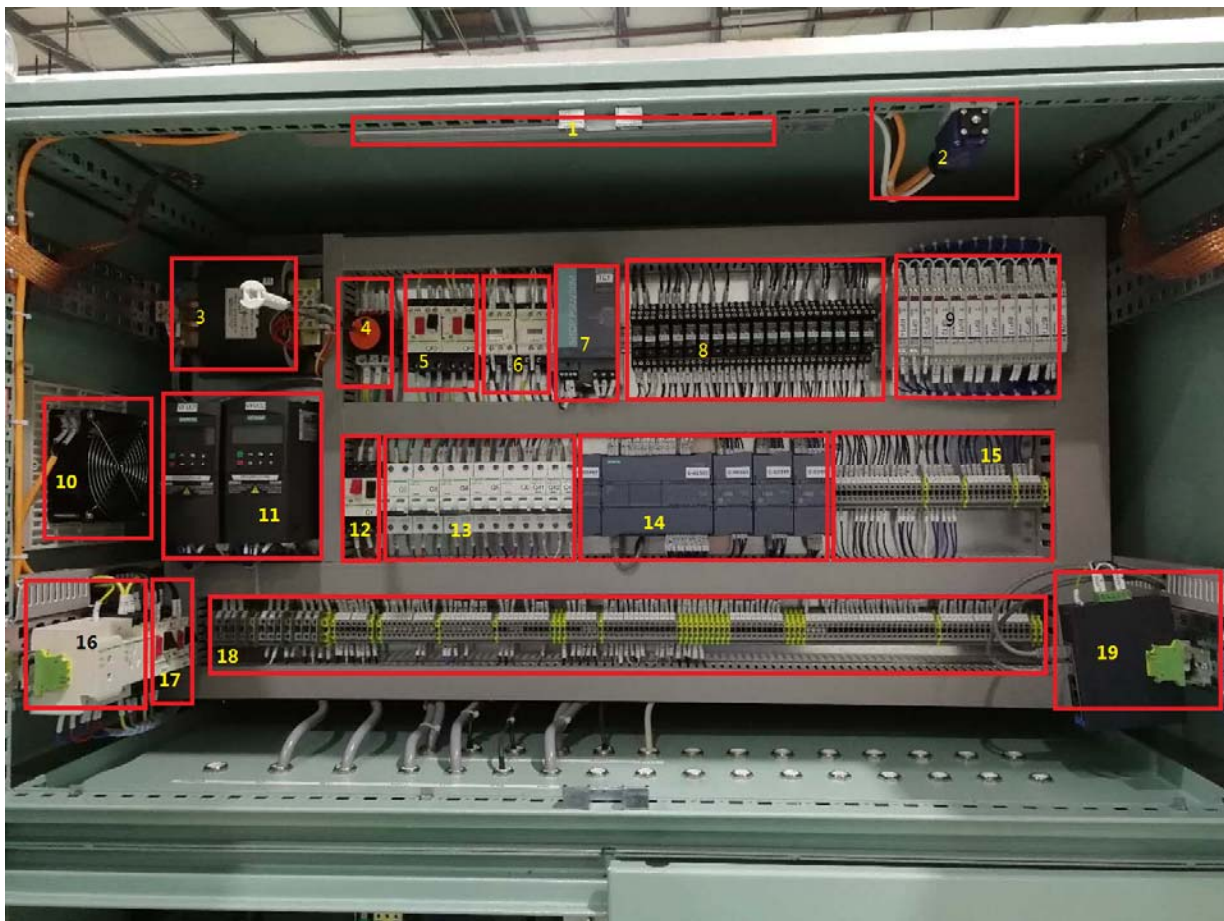
Dosing System Ready	Feedback to CCR that dosing system is ready for start-up and there's no major fault. 0 (contact open) = not ready 1 (contact closed) = ready
Reducing agent injection ready	Feedback to CCR that reagent injection is available. 0 (contact open) = not available 1 (contact closed) = available
Pulse purging	Feedback to CCR that pulse purging is in active. 0 (contact open) = pulse purging function not active 1 (contact closed) = pulse purging function active
Reducing agent FB	Liquid flow feedback to CCR. 4 – 20mA

Signals from customer

Communication can be hardwired or by network.

Enable reducing agent injection	The user can start/stop the system remotely when reducing agent injection ready and system is in remote mode. • 0 (contact open) = stop system • 1 (contact closed) = start system
Reducing agent SP	The user can remotely modify liquid flow setpoint when system runs at remote mode. • Signal : 4-20 mA • An alarm is created in case of a sensor error.
Pulse purge	The user can start/stop pulse purge remotely. • 0 (contact open) = stop system • 1 (contact closed) = start system

Following picture shows the inside of control panel.



1	Light	6	Contactor	11	Inverters	16	Power Socket
2	limit switch	7	Power supply	12	Motor circuit breaker	17	Motor Circuit breaker
3	Transformer	8	Relay	13	Circuit Breaker	18	terminals
4	Disconnecter	9	Signal isolator	14	PLC and modules	19	Exchange board (Switch)
5	Motor circuit breaker	10	Fan	15	Terminals		

For more details, please refer to electrical drawings.

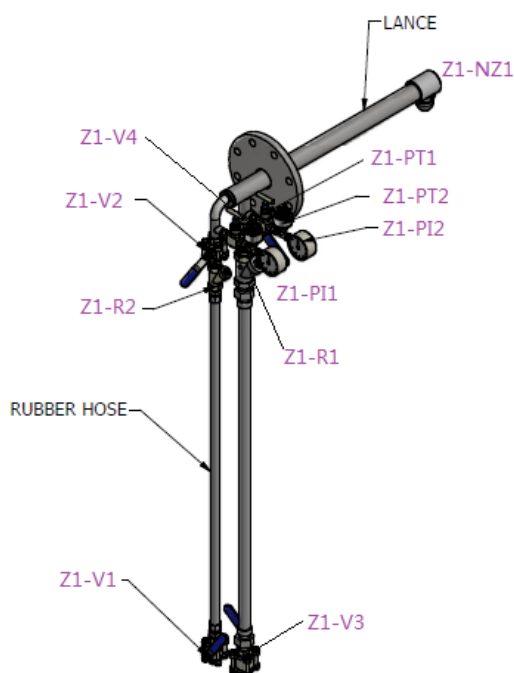
S/N	Code	Part/components	Description
1	L1-V1	Manual ball valve	System liquid inlet manual on/off
2	L1-PI1	Pressure gauge	Visual check of the inlet pressure of the liquid
3	L2-V1	Manual ball valve	Work together with L2-V3 for maintenance of liquid filter L2-F1 or liquid pump L2-P1
4	L2-V2	Manual ball valve	Work together with L2-V4 for maintenance of liquid filter L2-F2 or liquid pump L2-P2
5	L2-V3	Manual ball valve	Work together with L2-V1 for maintenance of liquid filter L2-F1 or liquid pump L2-P1
6	L2-V4	Manual ball valve	Work together with L2-V2 for maintenance of liquid filter L2-F2 or liquid pump L2-P2
7	L2-F1	Liquid filter	Y type filter for preparing clean liquid for pump L2-P1
8	L2-F2	Liquid filter	Y type filter for preparing clean liquid for pump L2-P2
9	L2-P1	Liquid pump	• For liquid pressure boosting and liquid regulation. • Equipped with external VFD • Is controlled by the PID algorithm, percentage of speed visible on operating display • Different alarms are created in case of pump failure. • Automatic switch-over to other pump in case of pump failure. • At regular time intervals, the system will automatically switch to the other pump. • A warning is created when the pump keeps on running at maximum speed.
10	L2-P2	Liquid pump	• For liquid pressure boosting and regulation. • Equipped with external VFD • Is controlled by the PID algorithm, percentage of speed visible on operating display • Different alarms are created in case of pump failure. • Automatic switch-over to other pump in case of pump failure. • At regular time intervals, the system will automatically switch to the other pump. • A warning is created when the pump keeps on running at maximum speed.
11	L2-R1	Check valve	To prevent back-flow when pump is stopped
12	L2-R2	Check valve	To prevent back-flow when pump is stopped

13	L2-PT1	Pressure transmitter	• Visual check pump outlet pressure • To measure pump outlet pressure and send signal to controller • A warning is created when measured value is lower than setpoint. • Shift to the other pump when measured value is lower than setpoint. • System will stop when both L2-PT1 and L2-PT2 measured values are lower than setpoint. • A warning is created in case of a sensor error.
14	L2-PT2	Pressure transmitter	• Visual check pump outlet pressure • To measure pump outlet pressure and send signal to controller • A warning is created when measured value is lower than setpoint. • Shift to the other pump when measured value is lower than setpoint. • System will stop when L2-PT1 and L2-PT2 measured values are lower than setpoint. • A warning is created in case of a sensor error.
15	L2-V5	Manual ball valve	• For drain. • Work with L2-V6 for fresh water flushing
16	L2-V6	Manual ball valve	• For drain. • Work with L2-V5 for fresh water flushing
17	L3-PI1	Pressure gauge	Visual check pump outlet pressure
18	LD-V1	Safety relief valve	Open when pump outlet pressure is higher than safety pressure setting.
19	L4-FT1	Liquid flow meter	• To measure liquid flow fed to spray nozzle. • As a feedback in liquid flow PID regulation. • An alarm is created in case of a sensor error. The system stops.
20	L5-V1	Manual ball valve	System liquid outlet manual on/off
21	A1-V1	Manual ball valve	System air inlet manual on/off
22	A1-PIS1	Pressure switch/indicator	• Air inlet pressure visual check • An alarm is created when air inlet pressure is too low (set-point can be set). • The pressure switch is used to avoid spraying without air or without enough air.
23	A1-FC1	Manual filter/regulator	• Air Filter: to filter the air from the air supply • Air regulator: to regulate air pressure to a certain value.

24	A2-H1	Pilot regulator	- Pressure regulator is controlled by pilot air of pilot valve A2-H1a - Pressure level can be read on the air pressure gauge A3-PI1 - Pressure level is also monitored on display of control panel, measured by pressure sensor Z1-PT1
25	A2-H1a	Pilot air proportional valve	Adjusting the line outlet pressure automatically to the required setpoint by a PID algorithm
26	A3-PI1	Pressure gauge	Visual check air pressure after A2-H1
27	A3-FT1	Air flow meter	- To measure system air consumption. - A warning is created when the measured value is lower than setpoint. - A warning is created in case of a sensor error.
28	A4-B1	Pneumatic ball valve	Auto on/off control
29	A4-V1	Manual ball valve	Air outlet manual on/off control
30	A5-V1	Manual ball valve	Purge air inlet manual on/off control
31	A5-B1	Pneumatic ball valve	Purge air auto on/off control
32	A5-R1	Check valve	To prevent pressure water from entering into purge air line.
33	A5-V2	Manual ball valve	Purge air to liquid line manual on/off control
34	C1-V1	Manual ball valve	Instrument air inlet manual on/off control
35	C1-FC1	Manual filter/regulator	To filter air from main air line to generate pilot air for A2-H1a.
36	C1-FC2	Manual filter/regulator	To filter air from main air line to generate instrument air for pneumatic valve air actuator.

3.2. Urea Injection Lance assembly

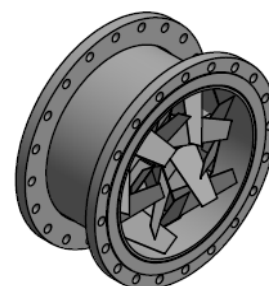
Urea injection lance assembly is as this picture.



S/N	Code	Part/components	Description
1	Z1-NZ1	Spray nozzle	To generate fine spray droplets
2	Z1-V1	Manual ball valve	Liquid manual on/off control for spray lance.
3	Z1-V2	Manual ball valve	• Manual isolation valve at spray lance liquid inlet. • To be closed in case of liquid hose or check valve maintenance.
4	Z1-V3	Manual ball valve	Air manual on/off control for spray lance.
5	Z1-V4	Manual ball valve	• Manual isolation valve at spray lance air inlet. • To be closed in case of air hose or check valve maintenance.
6	Z1-R1	Check valve	To prevent air or hot flue gas from entering into liquid line.
7	Z1-R2	Check valve	To prevent liquid or hot flue gas from entering into liquid line.
8	Z1-PI1	Pressure gauge	Spray lance inlet liquid pressure visual check
9	Z1-PI2	Pressure gauge	Spray lance inlet air pressure visual check
10	Z1-PT1	Pressure transmitter	• Spray lance inlet liquid pressure measurement. • To provide measured liquid pressure value to controller.
11	Z1-PT2	Pressure transmitter	• Spray lance inlet air pressure measurement. • To provide measured air pressure value to controller.

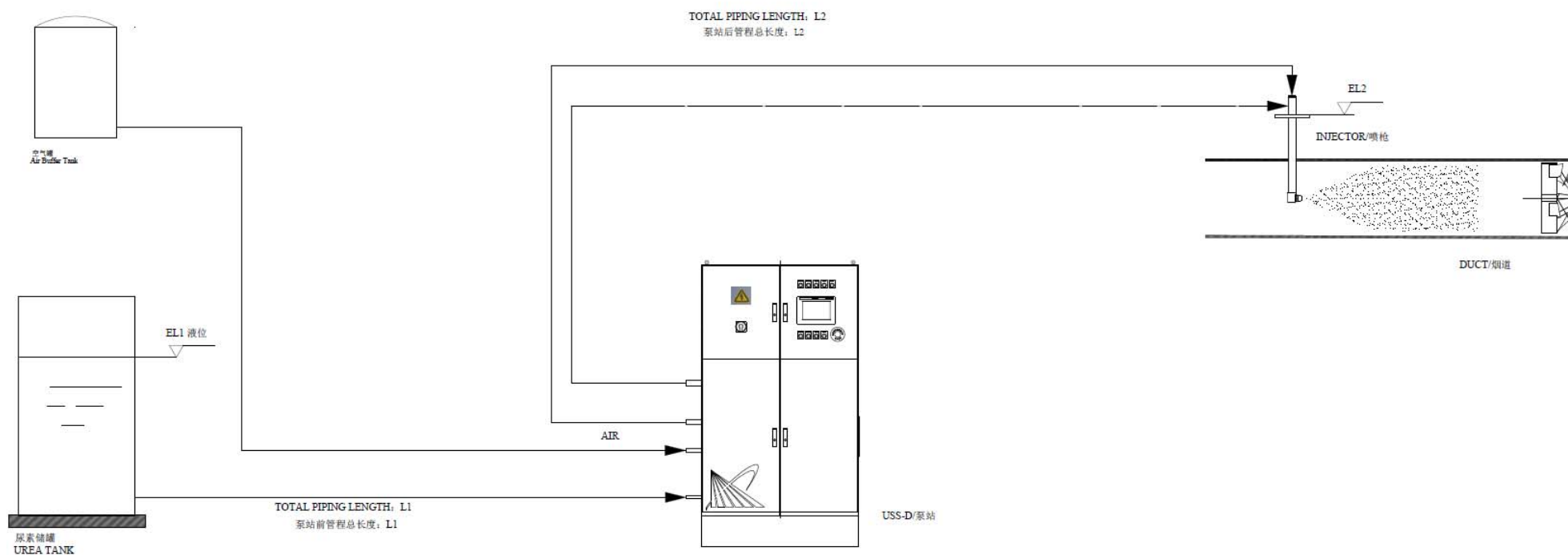
3.3. Static mixer assembly

Static mixer is a patent pending design for marine engine offgas in-duct mixing. It is to be installed in flue gas duct. It will help to generate several local swirl gas currents so as to intensify mixing effect. The purpose is to mix flue gas and vaporized reagent evenly before entering into catalyst unit.



3.4. How to work together

Follow diagram shows how they work together.



4. FUNCTIONAL DESCRIPTIONS

In this section, we will describe functions of each functional block based on system diagram and corresponding pictures. Please refer to Figure 2.1-2 for [system diagram](#).

4.1. Encapsulated Urea Spray System

4.1.1. Liquid Inlet

Liquid inlet unit includes an inlet isolation valve and an inlet pressure gauge. Please refer to the diagram (Figure 4.1.1). Inlet isolation valve is for the purpose of cutting off liquid from liquid supply in case of maintenance or others. Liquid pressure gauge measures liquid pressure at inlet to show if liquid supply is in normal status.

4.1.2. Liquid filter and pump unit

The purpose of this unit is to boost liquid pressure up to a certain high pressure and regulate liquid pressure and flow based on regulation logic. Two gear pumps are equipped (parallel). One pump runs while the other one is standby. Before each pump there is a Y-filter to keep liquid clean before entering into gear pump. There is also a check valve at each pump outlet to prevent liquid from working pump outlet back to standby pump. A pressure transmitter is set at each pump outlet to measure pump outlet pressure for system control system monitoring.

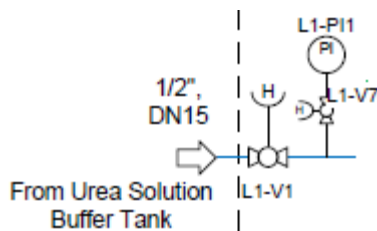


Figure 4.1.1

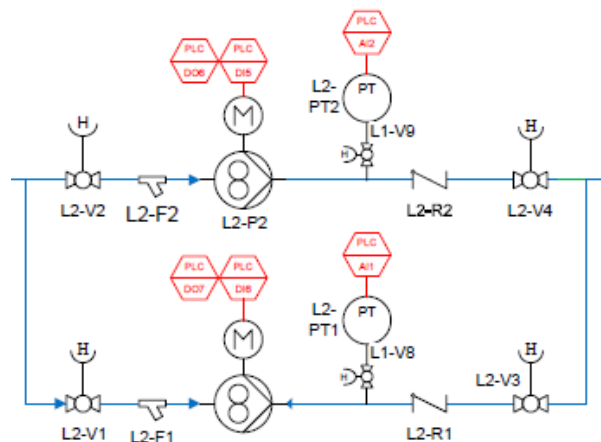


Figure 4.1.2

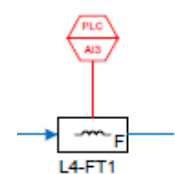


Figure 4.1.3

4.1.3. Liquid flowmeter

A high precision liquid flow meter is set after pump unit in order to measure liquid flow rate to spray nozzle(s). 4-20mA signal is sent to control system for purpose of liquid monitoring and liquid regulation.

4.1.4. Liquid regulation

Liquid flow meter L4-FT1 measured value are used in liquid flow PID algorithm. Please refer to

follow diagram.

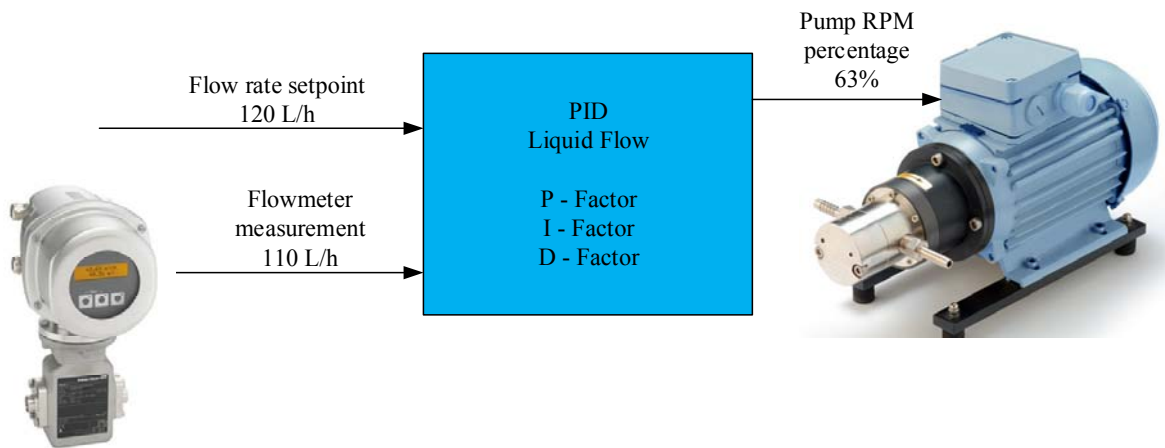
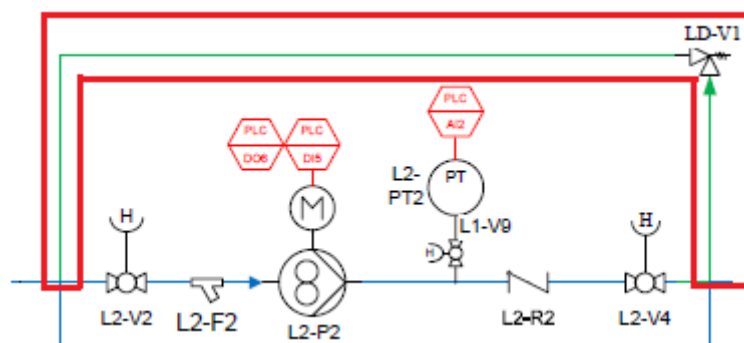


Figure 4.1.4. Liquid PID control

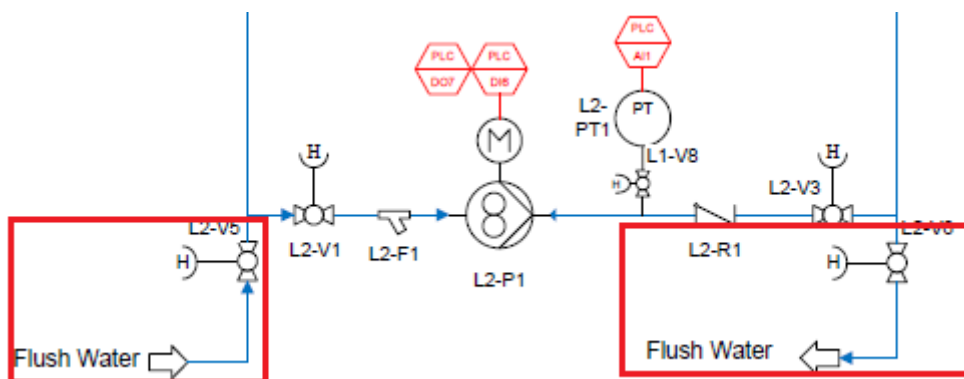
4.1.5. Liquid safety relief

A safety relief valve is installed at pump unit outlet. Safety relief valve can prevent liquid at pump outlet from going too high. This can avoid high pressure damages to the system.



4.1.6. Flushing unit

Fresh water can be connected to pump system to flush pump unit in case of long time system stop.



4.1.7. Liquid purging unit

When system is in status of no spraying, purging will happen to both air and liquid line. In order to

blow off liquid inside liquid piping from encapsulated system to liquid nozzle, compressive air is connected to liquid pipe. An auto shut off valve is set for automatic control of purge air. Purge can be continuous or pulse. Please refer to Figure 4.1.7.

The purpose of purging is as follows:

- To blow off any liquid that may remain in liquid pipeline and spray lance;
- To prevent flue gas from entering into nozzle and lance;
- Anti-clogging.

During purging, valve A4-B1 stays open to keep compressive air go through air pipeline and valve A5-B1 will open to let compressive air blow liquid in liquid pipeline off.

4.1.8. Air Inlet and filter unit

Air inlet unit includes an inlet isolation valve, an inlet pressure switch and a manual filter/regulator. Please refer to the diagram (Figure 4.1.8).

Inlet isolation valve is for the purpose of cutting off air supply to the system in case of maintenance or others. Pressure switch measures air feed-in pressure at inlet to show if air supply is enough and in normal status. In case of air inlet pressure too low (lower than setpoint), a warning will be generated. Manual filter/regulator can filter inlet air clean and regulate air pressure to a certain level.

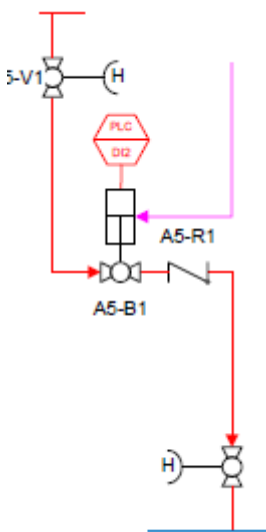


Figure 4.1.7

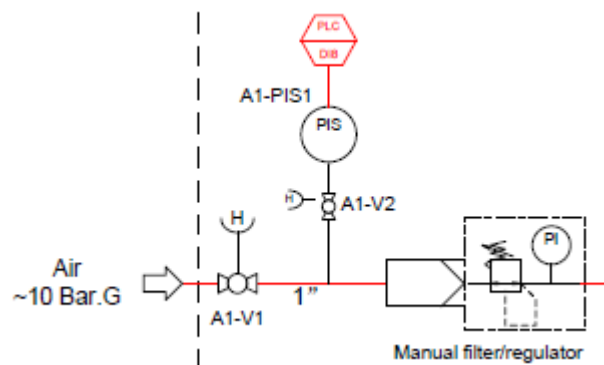


Figure 4.1.8

4.1.9. Air regulation unit

Air regulation unit includes a pilot air regulation on main air line and an electronic proportional regulating valve on pilot air line. Please refer to the diagram (Figure 4.1.9-1).

Atomizing air pressure is controlled by an electronic proportional regulating valve. As long as the measured pressure differs from the target pressure, control system will adjust the regulating valve in order to reach the target pressure. System uses the measured air pressure close to the lances as a feedback in the PID-regulation (Figure 4.1.9-2). A warning is generated when the valve stays fully open at 100%.

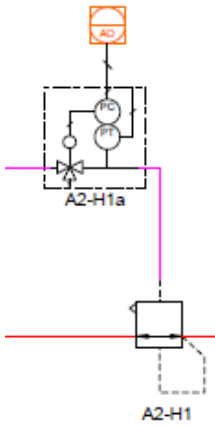


Figure 4.1.9-1

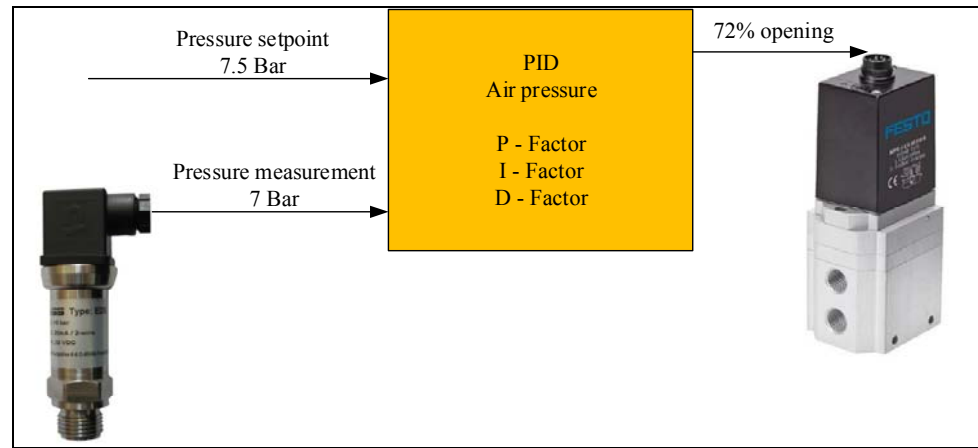


Figure 4.1.9-2

4.1.10. Air flow measurement

An air flow meter is equipped in order to measure system air consumption. 4-20mA signal is sent to control system. You can either read air flow on flowmeter or on HMI.

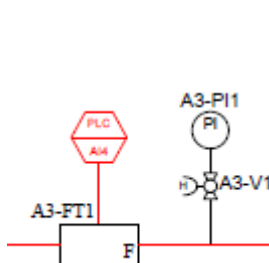


Figure 4.1.10

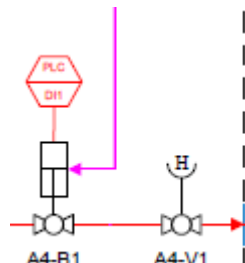


Figure 4.1.11

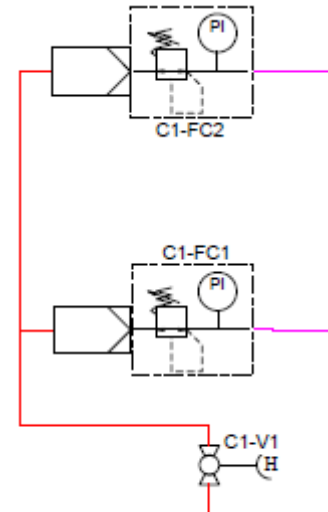


Figure 4.1.12

4.1.11. Air outlet unit

Air outlet unit includes a manual outlet isolation valve and an automatic pneumatic ball valve. Please refer to the diagram (Figure 4.1.11).

When system is in spray status, A4-B1 keeps open to let atomizing air go to spray nozzle for liquid atomization. When system is in purging status, A4-B1 keeps open to let compressive air go through air pipe line to blow air pipe and nozzle.

4.1.12. Instrument air unit

Please refer to Figure 4.1.12. Instrument air unit gets compressive air from main air pipe. Two filter/regulator units are equipped to prepare instrument air for pilot air and for pneumatic actuator.

4.2. Spray lance Assembly

4.2.1. Hose assembly

Hose assembly includes both air hose assembly and liquid hose assembly. Each assembly has two manual isolation valves, a high pressure flexible hose and a check valve. Hose assembly is to connect air/liquid pipe to spray lance air/liquid with a flexible connection.

4.2.2. Pressure measurement assembly

Pressure measurement assembly includes both air pressure assembly and liquid pressure assembly. Each assembly has a manual isolation valve, a pressure gauge and a pressure transmitter. Pressure gauge can let users visually check air/liquid pressure at spray lance air/liquid inlet. Pressure transmitter can measure air/liquid pressure at spray lance air/liquid inlet so as to let control system monitor spray lance inlet pressures and provide air pressure measured value to air regulation PID control logic.

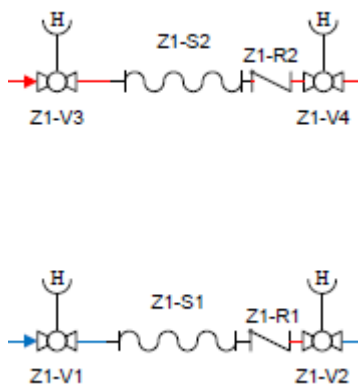


Figure 4.2.1

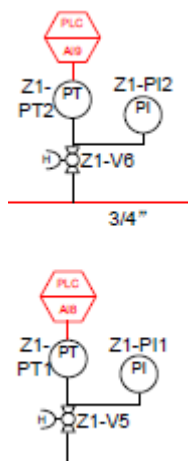
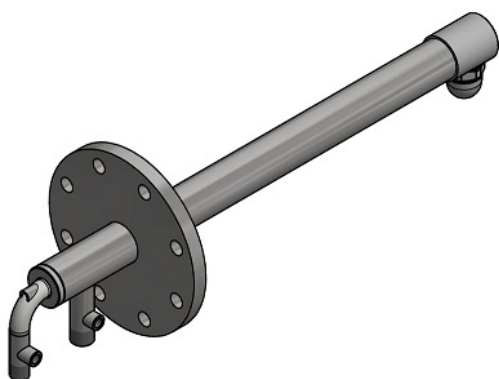


Figure 4.2.2



Figure 4.2.3

4.2.3. Spray Lance



The Spraying Systems patent pending 137420 series air atomizing nozzle is specially designed for marine engine off gas SCR application. It can generate very fine spray droplets with assistance of compressive air (or other gases). It needs a minimum pressure and minimum flow of liquid and air to work correctly. If the air pressure is too low, there will be insufficient atomization and large spray droplets will be formed which might not evaporate in a sufficient manner. If there is not enough liquid (urea solution), chemical reaction in catalyst unit will not be sufficient.

Spray lance will be installed at the place of customer specified in marine engine offgas duct. Please refer to Figure 4.2.3.

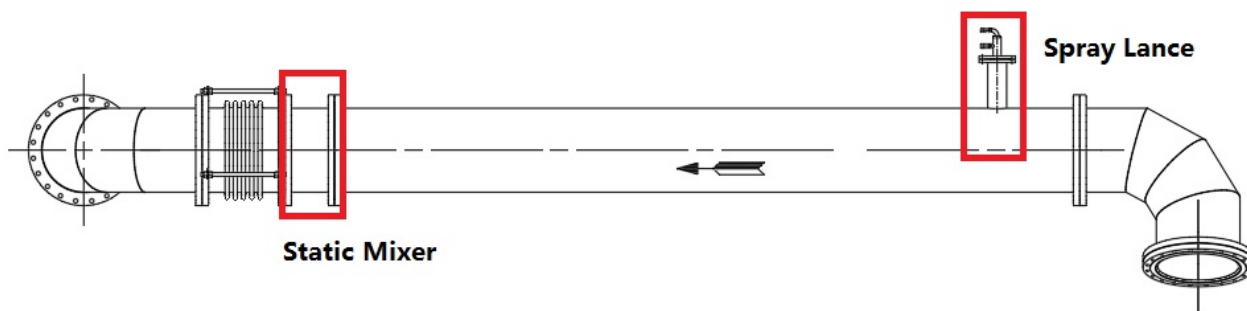


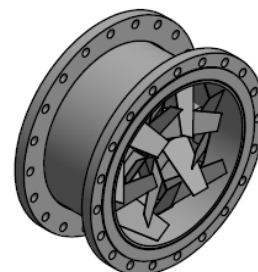
Figure 4.2.3.

iNOTE

- IT IS IMPORTANT TO ALWAYS KEEP SPRAY LANCES FEEDED WITH ATOMIZING AIR BEFORE FEEDED WITH UREA.
- IT IS IMPORTANT TO ALWAYS STOP LIQUID SUPPLY TO SPRAY LANCE BEFORE STOPPING ATOMIZING AIR SUPPLY TO SPRAY LANCE.

4.3. Static Mixer

Static mixer is a patent pending design for marine engine offgas in-duct mixing. It is to be installed in flue gas duct. It will help to generate several local swirl gas currents so as to intensify mixing effect. The purpose is to mix flue gas and vaporized reagent evenly before entering into catalyst unit.



5. OPERATING INSTRUCTIONS

This section provides general information and the basic guidelines for starting the system. These instructions should be used with your owner/operator plant-specific operating procedures. Operating checks and adjustments are performed to maintain efficient operation of the plant and prevent any unscheduled plant shutdowns.

It is important to operate the system under following restrictions:

- The machine has to be used according to this manual.
- The used liquid is urea solution/water, it has a minimum conductivity of $>25\mu\text{S}/\text{cm}$ and is clean.
- The area where the system is placed is 5 - 40°C, is clean and is not humid.
- The operators are educated to operate the machine and are authorized to do so.

5.1. General instructions

5.1.1. Before Start

Following steps have to be executed before starting up the system:

- Check and make sure all equipment, piping, wiring etc are finished.
- System and piping leakage is already checked.
- Check and make sure all piping and components/equipment are flushed and clean.
- Urea tank is not at low low level.
- Urea solution is fed to system correctly. Use clean water for first running and site commissioning before using urea solution.
- Make sure urea solution temperature is above its saturation temperature.
- Compressive air is supplied correctly.
- Power supply is already set correctly.
- All valves are in correct status.
- Check if the emergency stops are out. If activated, check why it is activated and by whom. Make sure it is safe to deactivate the emergency stop.

5.1.2. First Running

Following steps have to be executed:

- Before switching on the main power switch, verify the input voltage and check if the phases are not short-circuited.
- Check the electrical connection of interface signals and installed components. The signals can be monitored onto the controller or DCS.
- Verify the configuration of the control system according to the available sensors and actuators in the system.
- Verify the calibration of all sensors and actuators in the control system. Verify especially the calibration of the interface signals.
- Set up all parameters in the control system:
- Set status of valves according to P&I diagrams.
- Use clean water to replace urea solution for first running and site commissioning, if possible.

5.1.3. Daily use



Cautions: See paragraph 1.2 for details on PPE and required training.

5.1.4. Before running the system

Please refer to [Before Start](#) part.

5.1.5. Normal running

Please refer to [Normal Operation](#).

5.1.6. Emergency situations

In case of an emergency, press the emergency stop button:

- The pumps will stop running.
- The nozzle(s) will stop spraying.
- All regulations will stop
- An alarm message will appear on HMI.



USE THE EMERGENCY STOP ONLY IN CASE OF EMERGENCY

5.2. Normal Operation

5.2.1. Valve Status

Please refer to [Process Diagram](#) while reading following table for valve status.

S/N	Code	Operation	Status in normal operation
1	L1-V1	Manual	Open
2	L2-V1	Manual	Open
3	L2-V2	Manual	Open
4	L2-V3	Manual	Open
5	L2-V4	Manual	Open
6	L2-V5	Manual	Close
7	L2-V6	Manual	Close
8	L5-V1	Manual	Open
9	A1-V1	Manual	Open
10	A1-FC1	Manual	Open
11	A2-H1	Auto/Pilot	Based on pilot air
12	A2-H1a	Auto	Signal control
13	A4-B1	Auto	Open during spray and purging Close during stop
14	A4-V1	Manual	Open
15	A5-V1	Manual	Open
16	A5-B1	Auto	Close during spray Open during purging
17	A5-V2	Manual	Open

18	C1-V1	Manual	Open
19	C1-FC1	Manual	Open
20	C1-FC2	Manual	Open
21	Z1-V1	Manual	Open
22	Z1-V2	Manual	Open
23	Z1-V3	Manual	Open
24	Z1-V4	Manual	Open

5.2.2. Parameters and HMI

Please refer to *HMI Operation Instruction* (separate document).

5.3. Inspections, cleaning, replacement of parts



Maintenance/repair other than described hereafter is intended to be performed by skilled and authorized personnel.

5.3.1. System Inspection

Step	Description
1	Daily check operating air and liquid pressures on the lances.
2	Check nozzle/lance according to nozzle/lance instruction if necessary.

5.3.2. Cleaning of the liquid filter

Step	Description
1	Make sure cleaning liquid filter doesn't impact on system operation.
2	Shift to the other pump if the corresponding pump is in running.
3	Close manual ball valves before liquid filter and after pump.
4	Open liquid filter. Take out filter screen.
5	Clean or replace the filter screen.
6	Set cleaned screen back. Make sure screw is tightened.
7	Open manual ball valves before liquid filter and after pump. Make sure no leakage.

5.3.3. Cleaning of the air filter

Step	Description
1	Make sure cleaning air filter doesn't impact on system operation.
2	Refer to air filter/regulator manual for cleaning operation.
3	Clean and replace the filter according to vendor instructions.

5.3.4. Spare parts

Please check with Spraying Systems China for necessary spare parts or any other parts you need.

5.4. Troubleshooting

Please refer to [Trouble shooting](#)

6. STORAGE AND HANDLING INSTRUCTION

6.1. Transportation

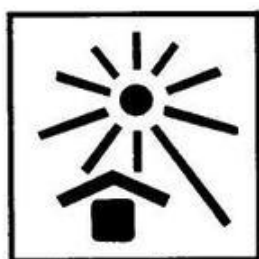
- 6.1.1. Transportation should only be executed by skilled professionals.
- 6.1.2. Handle with care for all packages and all goods.
- 6.1.3. Avoid shock damage.

6.2. Lances Storage

- 6.2.1. Rain proof storage is needed.
- 6.2.2. Protection from weather, such as rain, is required to avoid deterioration of the packing material.
- 6.2.3. Keep product in the packing material until ready for installation to reduce the possibility of product damage.
- 6.2.4. Handle with care to avoid damage to the lance components.
- 6.2.5. DO NOT keep goods in stack of packaging.
- 6.2.6. Hoses and hose assemblies are prone to a natural aging process even when stored under optimum conditions. Therefore the product life time is limited. It is recommended that the life time of a hose assembly shall not exceed a period of three years including a possible storage period of two years.

6.3. System Storage

- 6.3.1. Rain proof storage is needed.
- 6.3.2. It is preferable to store skids indoors in a dry place between 0°C - 40°C.
- 6.3.3. Keep product in the packing material until ready for installation to reduce the possibility of product damage.
- 6.3.4. Skids should be wiped clean with wet wiper and dried with compressive air after cleaning.



禁止堆放
No stocking



禁止冲水



注意防火



WARNING

DO NOT flush outside of system and its components with water at any time.

6.3.5. Follow component instructions.

6.3.6. When skids are taken out of wooden case package, all end connections should be covered with caps, blind flanges, tape or other proper methods.

6.4. Lifting/Handling

6.4.1. Handled by qualified or licensed personnel.

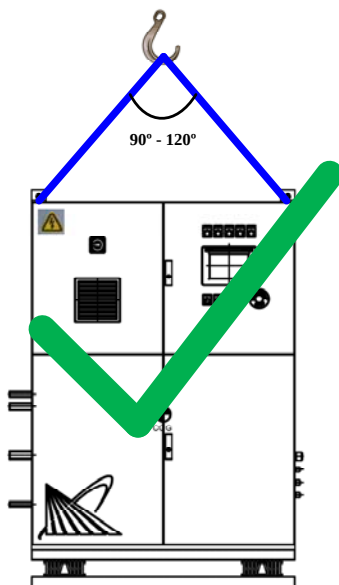
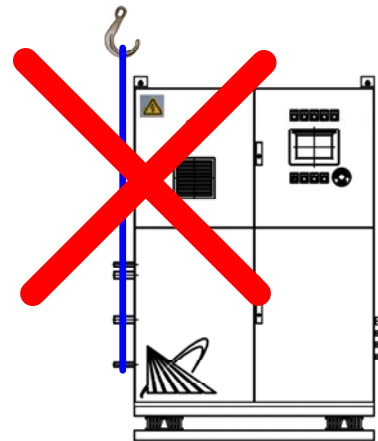
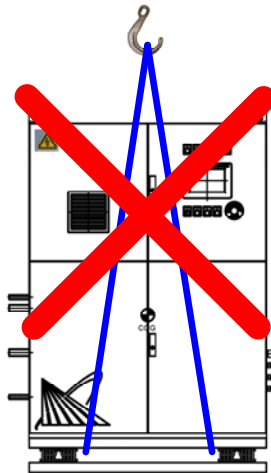
6.4.2. A proper handling plan should be created by certified personnel prior to lifting.

6.4.3. User proper handling machine.



WARNING

NEVER lift equipment by strapping it at any of the components or piping!



7. INSTALLATION



ATTENTION

- **IT IS REQUIRED TO HAVE TRAINED PROFESSIONAL WORKERS TO DO INSTALLATION.**
- **PLEASE READ ENGINEERING DRAWINGS AND DOCUMENTS AND MAKE SURE YOU UNDERSTAND THE DRAWINGS AND DOCUMENTS BEFORE EQUIPMENT INSTALLATION.**

Following steps have to be executed:

- Install equipment and injector and related accessories properly. Equipment must be handled with an appropriate lifting device. Please refer to [Lifting/Handling](#).
- Fix equipment by means of anchor bolts or other proper ways.
- Connect the electrical power supply, urea supply, compressed air supply and instrument air supply according to the required specifications.
- Install piping between urea tanks and system unit. Pressure drop across the piping at maximum flow should be minimized.
- Install recirculation piping between pump skid and urea tank, if any.
- Install piping between system unit and injector. Pressure drop across the piping at maximum flow should be minimized.
- Purge and clean all the piping and make sure all piping is clean before connection to equipment.
- Connect the electrical components according to the electrical drawings. Use an appropriate wire size depending on the distance between DCS, control panel and particular component. Plug or cover the unused cable glands with blank plugs.
- Connect the interface signals according to the electrical drawings.
- Execute a pressure test for air and liquid piping. Check for leakages.



ATTENTION

The Buyer or the User needs to provide anti-freezing measures in case of need.

8. MAINTENANCE



IMPORTANT NOTE

- ◆ Regular maintenance and cleaning of the machine is very important to make sure the machine will always operate correctly.
- ◆ Please refer to manual of each individual component before you check it.

8.1. Weekly

- Check liquid strainers and air filters. Remove dirt, if any.
- Check if water is accumulated and collected in the air filters. If yes: remove it.



ATTENTION

- ☞ Make sure your maintenance action doesn't impact system operation.
- ☞ Do not forget to open the valves again after cleaning strainers or filters.

8.2. Monthly

When the system is not in service:

- Do all weekly maintenance (refer to [Weekly](#)).
- Check if injector is free of dirt and in good condition.

8.3. Every 3 months

When the system is not in service; actuate all valves manually once. This prevents them from not opening and closing at all after a period of not using them.



ATTENTION

Make sure to set valve status back in the same way as they are before.

8.4. Every 6 months

- Verify the proper working of all individual components (Pumps, valves, pressure regulator, pressure switches, sensors ...).
- Clean and dedust the installation.
- Equipment should be wiped clean with wet wiper during cleaning and dried with compressive air after cleaning.



WARNING

DO NOT flush outside of system and its components with water at any time.

8.5. Spare parts

Please check with Spraying Systems China for necessary spare parts or any other parts you need.

9. TROUBLE SHOOTING

Dosing Unit

	故障 Damage/Error/Failure	对 SCR 系统的影响 Effect on SCR system	对主机的影响 Effect on Engine	现象/Phenomena (Alarm, Indication)	对策 Countermeasures
1	进气压力低 Air inlet pressure low	● 泵站系统可能不工作 Dosing system may not work	● NOx排放超标 NOx emission higher than limitation	🔊 泵站气体入口压力低报警 Dosing unit air inlet pressure low	📄 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation 👉 检查气路入口压力开关 Check air inlet pressure switch 👉 检查气源及开关阀 Check air supply and on/off valve
2	主气体减压阀故障 Main air regulator failure	● 泵站系统可能不工作 Dosing system may not work ● 喷雾效果差 Bad spray performance ● 脱硝效率低 NOx reduction efficiency low	● NOx排放超标 NOx emission higher than limitation	🔊 喷枪气压低报警 Injector air inlet pressure low ● 泵站出口气体压力表读数偏低或为0 Dosing unit outlet air pressure gauge reading low	📄 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation 👉 检查主气体减压阀 Check main air regulator 👉 检查先导气体回路 Check pilot air line
3	尿素溶液断供或不足 No or insufficient urea solution feed in	● 泵站系统可能不工作 Dosing system may not work ● 脱硝效率低 NOx reduction efficiency low	● NOx排放超标 NOx emission higher than limitation	🔊 喷枪液压低报警 Injector liquid inlet pressure reading low ● 泵站出口液体压力比读数低 Dosing unit outlet liquid pressure low	📄 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation 👉 检查尿素储罐液位、供液系统和管路系统 Check urea buffer tank liquid level, feeding system and piping system.
4	单泵故障 Single pump failure	● 双泵中的一个泵发生故障时，切换到另一个泵工作 Working pump shift to the other		🔊 单泵故障报警 Pump failure alarm	👉 检查并修复故障泵 Check and repair pump
5	双泵故障 Both pumps failure	● 泵站系统不能工作 Dosing system doesn't work	● NOx排放超标 NOx emission higher than limitation	🔊 泵故障报警 Pump failure alarm 🔊 系统停机 System Stop	👉 检查并修复泵 Check and repair pump
6	液体流量计故障 Liquid flowmeter failure	● 泵站系统可能不工作 Dosing system may not work	● NOx排放超标 NOx emission higher than limitation	🔊 液体流量计故障或报警 Liquid flowmeter error/alarm	👉 检查并修复液体流量计 Check and recover liquid flowmeter
7	喷枪入口无供气或供气不足(入口气压低) No air supply or insufficient air supply at injector inlet (inlet air pressure low)	● 泵站系统可能不工作 Dosing system may not work ● 喷雾效果差 Bad spray performance ● 脱硝效率低 NOx reduction efficiency low	● NOx排放超标 NOx emission higher than limitation	🔊 喷枪气压低报警 Injector air inlet pressure low	📄 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation 👉 检查喷枪入口前的所有气路及元件 Check all air line and components before injector inlet
8	喷枪入口无供液或供液不足(喷枪入口液压低) No liquid supply or insufficient liquid supply at injector inlet (inlet liquid pressure low)	● 泵站系统可能不工作 Dosing system may not work ● 脱硝效率低 NOx reduction efficiency low	● NOx排放超标 NOx emission higher than limitation	🔊 喷枪液压低报警 Injector liquid inlet pressure low	📄 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation 👉 检测泵及泵的调节 Check pump and its regulation 👉 检查喷枪入口前的所有液路及元件 Check all liquid line and components before injector inlet
9		● 尿素消耗量过大 Too much urea consumption	●	🔊 喷枪液压高报警 Injector liquid inlet pressure high	📄 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation

		- 喷雾效果差 Bad spray performance - 氨逃逸过高 Ammonia slip high		 液体流量高报警 Liquid flow high	 检测喷枪前所有系统和元件 Check all the system and components before injector  检测喷雾系统外的仪表 Check all instruments out of spray system
10	喷枪入口液压过高	- 尿素消耗量过低 Too low urea consumption - 脱硝效率低 NOx reduction efficiency low	NOx排放超标 NOx emission higher than limitation	 喷枪液压高报警 Injector liquid inlet pressure high  液体流量低报警 Liquid flow low	 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation  检查喷嘴/喷枪是否堵塞 Check the Nozzle/injector
11	喷枪入口气压过高	- 尿素消耗量低 Low urea consumption - 气体无调节 No air regulation - 脱硝效率低 NOx reduction efficiency low	NOx排放超标 NOx emission higher than limitation	 喷枪气压高报警 Injector air inlet pressure high	 切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation  检查主气体减压阀 Check main air regulator  检查先导气体回路 Check pilot air line  检查气体压力检测元件 Check air instruments

Injection and mixing duct

	故障 Damage/Error/Failure	对 SCR 系统的影响 Effect on SCR System	对主机的影响 Effect on Engine	现象/Phenomena (Alarm, Indication)	对策 Countermeasures
1	喷嘴/喷枪气路堵塞 Nozzle/Injector gas blocked	NOx脱除率低 NOx reduction efficiency low	NOx排放超标 NOx emission higher than limitation	 气体流量低报警 Air flow low - 在喷枪入口气压正常的情况下气体无流量或极低流量 No liquid flow or very low liquid flow while injector air inlet pressure remains normal. - 尿素流量无报警情况下脱硝效率极低 NOx reduction efficiency very low while no urea flow alarm	 检查喷嘴/喷枪 Check the Nozzle/injector
2	喷嘴/喷枪液路堵塞 Nozzle/Injector liquid blocked	- 没有尿素溶液喷雾或尿素溶液喷雾量少 No Urea solution or less sprayed - 脱硝效率低 NOx reduction efficiency low	NOx排放超标 NOx emission higher than limitation	 液体流量偏差过大报警 Flow deviation alarm - 在喷枪入口液压高的情况下液体无流量或极低流量 No liquid flow or very low flow while injector inlet pressure high - 脱硝效率低 NOx reduction efficiency low	 检查喷嘴/喷枪 Check the Nozzle/injector
3	喷枪安装不紧固导致烟气泄漏 Injector not well installed and cause gas leakage	SCR系统脱硝效率可能低 NOx reduction efficiency may low	NOx排放超标 NOx emission higher than limitation	烟气泄漏 Flue gas leakage	 目视检查 Visual check  其他必要检查 Other necessary inspection  切换到标准的Tier II模式，SCR系统停止运行 Switch to standard TIER II mode without SCR operation

10. SPRAY LANCE AND NOZZLE INSTRUCTIONS

(INSTALLATION, OPERATION AND MAINTENANCE)

INSTALLATION

On systems that are new, or have been extensively modified, it is advisable to flush all the supply piping to the Air Atomizing Assembly before making the final connections. Some of the nozzle passages are small and could become plugged with welded slag or other construction debris.

DISASSEMBLY

It is strongly recommended that the entire lance be allowed to cool to ambient temperature before attempting to remove the nozzle assembly. The outside of the nozzle will cool more rapidly than the internal portions of the nozzle. This can result in temporary distortion of the nozzle components. Movement of the threads under these conditions will cause severe galling.

ASSEMBLY

Cleaning

Before assembly, all of the mating surfaces should be thoroughly cleaned of debris, corrosion, and/or oxide build up.

Thread Lubricant

All threads should be coated with a high temperature anti-seize lubricant. SS Co recommends the following (or equal):

**JET LUBE
NIKAL
-56 F to 2600 F
Pure Nickel
Extreme Temperature
Anti-Seize Lubricant**

The male thread and leading thread of the female component should both be coated with lubricant. This will ensure even coating of the contact surfaces.

A regular commercial thread sealer (i.e. Teflon based paste) is sufficient for the pressure gauge connection (if provided).

NOZZLE

The following is the suggested method of assembling the nozzles (See Figure 1):

Coat the thread with anti-seize compound and place a small amount of anti-seize compound in the lead thread of the nozzle holder.

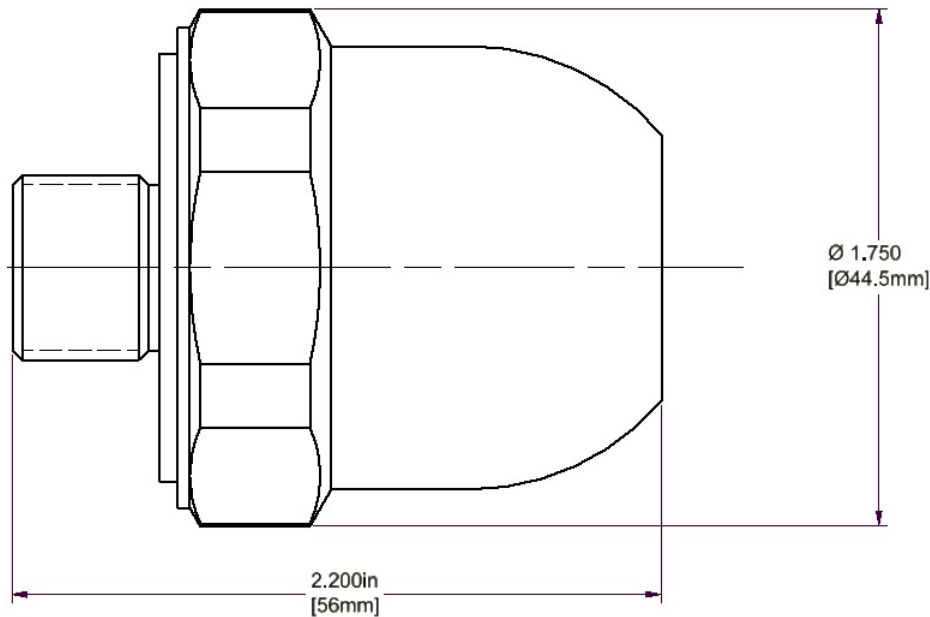


Figure 1

NOZZLE OPERATION

Nozzle operation is required to follow spray performance curve or datasheet.

iNOTE

- IT IS IMPORTANT TO ALWAYS KEEP SPRAY LANCES FEEDED WITH ATOMIZING AIR BEFORE FEEDED WITH UREA.
- IT IS IMPORTANT TO ALWAYS STOP LIQUID SUPPLY BEFORE STOPING ATOMIZING AIR SUPPLY TO SPRAY LANCE.

11. SUSTAINABILITY AND ENVIRONMENTAL CARE



Spraying For the Future

Sustainability and Environmental Care

1. Declaration of Sustainability

Spraying Systems China has been keeping philosophy of sustainability and environmental care. We design to use environmental-friendly materials. For some materials that may contain environmental impact substances, the amount of it will be controlled within a limitation by relative laws/regulations of China. For those of no law or regulation, we will control it to the lowest impact to our environment.

2. Following table shows substances that may be contained in this product or components of this product

Equipment/ components/ parts	Six Hazardous Substance						Note
	Pb	Hg	Cd	Cr (VI)	PBB	PBDE	
Pipe	○	○	○	○	○	○	
Flange	○	○	○	○	○	○	
Gasket	○	○	○	○	○	○	
Fasteners	○	○	○	○	○	○	
valve	○	○	○	○	○	○	
Liquid strainer	○	○	○	○	○	○	
Pump Motor	×	○	○	○	○	○	PCB
Lube oil/grease	○	○	○	○	○	○	
Pump body	○	○	○	○	○	○	
Pump shaft seal	○	○	○	○	○	○	
OF pressure gauge	○	○	○	○	○	○	
flowmeter	×	○	○	○	○	○	PCB
transmitter	×	○	○	○	○	○	PCB
Gas filter	○	○	○	○	○	○	
Gas regulator	○	○	○	○	○	○	
Solenoid valve	○	○	○	○	○	○	
Solenoid coil	○	○	○	○	○	○	
Cables/wires	○	○	○	○	○	○	
Controller/board	×	○	○	○	○	○	PCB
Inverter/board	×	○	○	○	○	○	PCB
Cabinet/box	○	○	○	○	○	○	
Fluorescent lamp	○	×	○	○	○	○	
Frame/Base	○	○	○	○	○	○	
Spray gun	○	○	○	○	○	○	

Nozzle	○	○	○	○	○	○	
Packing	○	○	○	○	○	○	
Rubber hose	○	○	○	○	○	○	
Metal hose	○	○	○	○	○	○	
Battery	×	○	○	○	○	○	

Y: Contained.

N: Not contained.

○: Contained. But within limitations by GB/T26572.

×: Contained. May out of limitations by GB/T26572. But no existing substitution. The substances will be controlled to lowest impact.

3. Disposal treatment suggestions

Disposals	Treatment
Electronic components. PCBs	Collected and sent to certified organizations for treatment.
Iron/steel products	Recycle
Plastic products	● Consult local government or related organizations before treatment. ● Recycle, if possible.
Graphite packing and related products	Recycle
Lamp, bubble and related products	Treat according to local laws and/ regulations.
Batteries or related products	Treat according to local laws and/ regulations.
Mineral lube oil/grease	Treat according to local laws and/ regulations.

Note:

- 1) In case there's any local regulations or laws special for above listed disposals, please refer to the laws and regulations.
- 2) For the material/disposal that is not hazardous itself but may contaminated with substances listed in *The National Hazardous Waste List*, please treat it as hazardous waste/disposal.

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Due to continuous development of our product data, those
are subject to change or modify without prior notice.



Operating & Maintenance Instructions

EPT-SERIES | PNEUMATIC ACTUATORS

Contents

1. Introduction

- 1.1. General Information
- 1.2. Safety Information
- 1.3. Maintenance
- 1.4. Lubrication
- 1.5. Required Tools
- 1.6. Expanded view of EPT-Series

2. Actuator Disassembly

- 2.1. General Information
- 2.2. Double Acting Actuator
; Pneumatic Power and Drive Module
- 2.3. Spring Return Actuator
; Pneumatic Power, Drive and Spring Module
- 2.4. Manual Override Disassembly

3. Actuator Reassembly

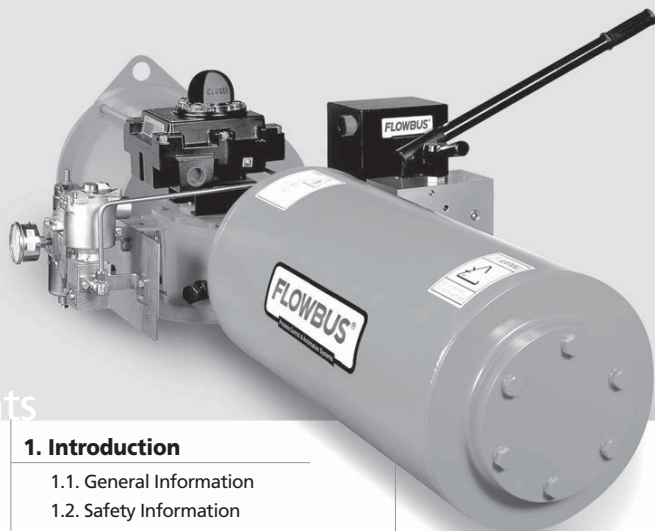
- 3.1. General Information
- 3.2. Double Acting Actuator
; Pneumatic Power and Drive Module
- 3.3. Spring Return Actuator
; Pneumatic Power, Drive and Spring Module
- 3.4. Actuator Testing

4. Troubleshooting Guide

- 4.1. Irregular Movement
- 4.2. Incomplete Stroke
- 4.3. Insufficient Power

5. Bolt & Nut Torque Tables

6. Actuator Module Weights



The following procedures cover the maintenance and inspection of Flowbus EPT Series actuators. All work should be undertaken by a competent, trained technician, using the correct tools and equipment, and following good working practice. Where procedures in this manual conflict with local legislation, statutory provisions or plant safe working practices all differences should be reviewed and resolved by authorized representatives of the customer and Flowbus.

1.1 General Information

Service Interval

The normal recommended service interval for the EPT-Series Actuator is every three years. To maintain the normal recommended service interval, operating conditions should be as follows.

- The air supply should not exceed the maximum operating pressure indicated in the technical data.
- The operating temperature should be between -20° & 80°.
- The air supply clean, dry instrument air.
- All operating & maintenance instructions should be followed.

CAUTION The normal service interval cannot be guaranteed if these conditions are not followed.

Regular actuator inspection should be carried out according to the customer's maintenance regime.

Preparation for Work

Confirm all electrical and pneumatic power supplies have been isolated and removed from the actuator before commencing any work.

Also remove any piping or ancillary equipment that may interfere with or reduce access to the actuator modules that are to be worked on.

WARNING EPT Series actuators should be earthed during installation to meet local plant and national safety requirements.

Correct Equipment

To prevent damage a commercial seal removing tool or a small screwdriver with sharp corners rounded off should be used to remove seals from seal grooves. All pipe threads should be sealed using a non-hardening thread sealant.

CAUTION Care should be taken to follow all instructions supplied by the sealants manufacturer.

Work Area

Flowbus recommends that where possible actuator disassembly should be performed in a clean area on a workbench.

Introduction

01

1.2 Safety Information

Important Information

Where the following procedures contain safety critical information this is highlighted with the following text :

DANGER This is the signal word used to indicate an imminently hazardous situation that, if not avoided, will result in death or severe injury. This signal word is to be limited to the most extreme situations.

WARNING This is the signal word used to indicate a potentially hazardous situation which, if not avoided, could result in death or severe injury.

CAUTION This is the signal word used to indicate a potentially hazardous situation which, if not avoided, could result in moderate or minor injury. It may also be used to alert against unsafe practices.

Abbreviations

The following abbreviations are used :

SA : Stroke Adjuster

JO : Jackscrew Override

HO : Hydraulic Override

WARNING During transportation, installation and assembly the actuator should be moved using lifting eyes.

1.3 Maintenance

The following checks should be made as part of a regular preventative maintenance schedule. The period between checks will depend on the frequency of operation and service conditions.

1. Ensure the actuator operates smoothly and in the required cycle time.

The actuator should be tested using all existing control methods e.g. manual override, local and remote controls, particularly if the actuator is not frequently operated.

2. Check the supply pressure of the operating media is at the required range.

3. Visually inspect the actuator and ancillary equipment for signs of physical damage or corrosion.

4. Check all pneumatic connections for leaks.

Service Tools

The following items may be useful during regular maintenance checks

1. Flowbus Service Kit 2. Leak Detector Spray

1.4 Lubrication

CAUTION Alternative lubricants should not be used without prior written approval of Flowbus. This is to ensure that the lubricants used are compatible with the actuator materials and suitable for use over the actuators working range.

Lubrication Position

- | | |
|---------------------------------|-------------------------------------|
| 1. Piston, Cylinder Tube, Seals | 2. Guide Block, Bars |
| 3. Bushing, Yoke Seals | 4. Yoke, Sliding Block, Sliding Pin |

Grease Specification

Manufacturer: Shell

Model No. Gadus S2 V220

Color: Brown

Additional grease is required in the following conditions

- Moisture found inside pipeline (Water ingress and/or condensation)
- Frequency of operation
 - Over 100,000 cycle time per year
 - Less than 3 cycle time per year
- Over 100°C ambient temperature

CAUTION This is the standard grease specification for Flowbus EPT Series actuators. If an alternative was supplied to customer requirements for special service applications this will be noted in the job specific documentation. This is available on request.

1.5 Required Tools

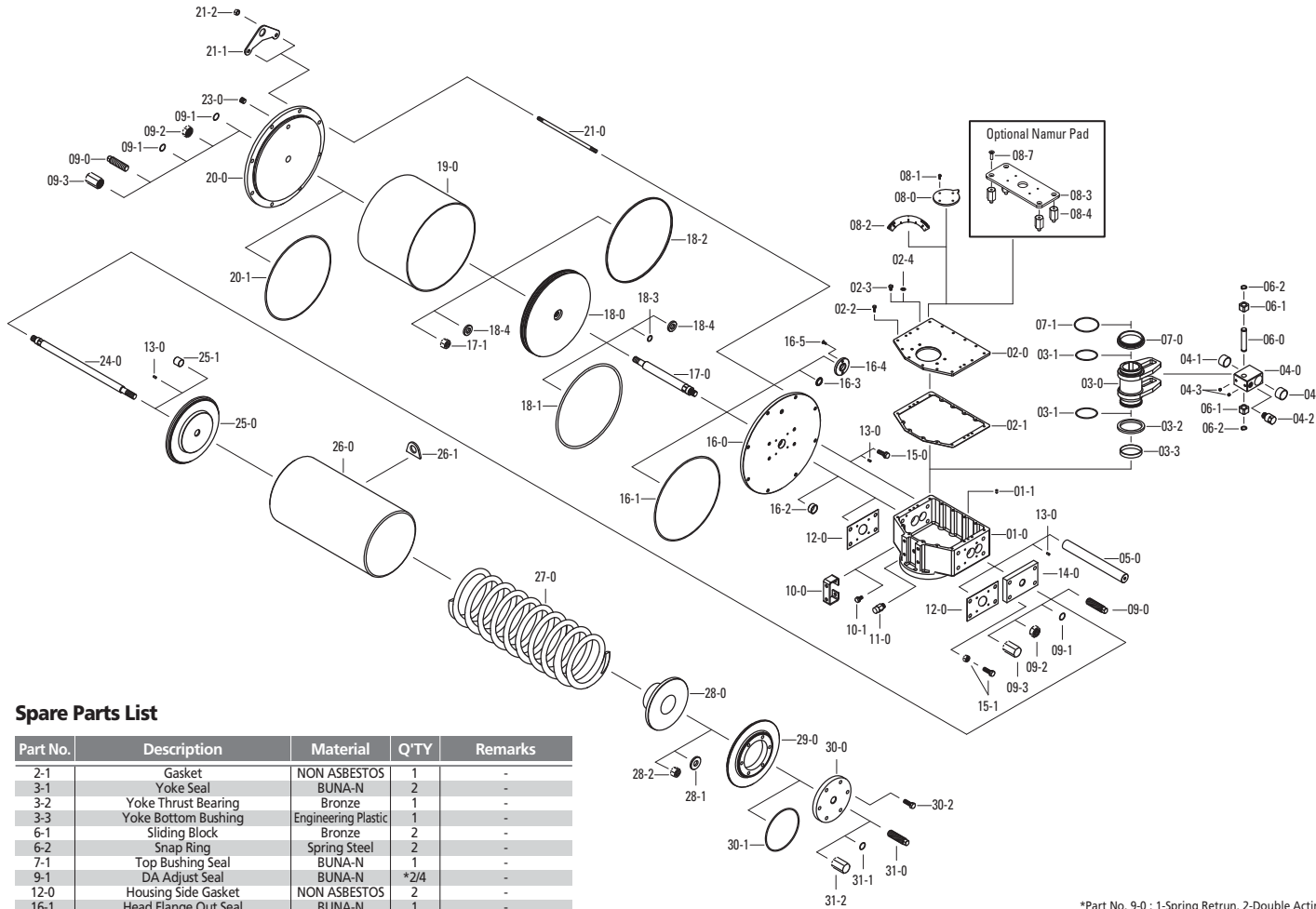
All tools/hexagons are metric standard. The following tools are required for maintenance work

Large adjustable wrench	Two large screwdrivers	Seal removing tool
Allen wrench set	Set of open/box-end wrenches	
Rubber or leather mallet	Torque wrench	

If available the following tools can aid with maintenance work.

Air driver	Air driver wrench set
------------	-----------------------

1.6 Expanded view of EPT106~160 models



Spare Parts List

Part No.	Description	Material	Q'TY	Remarks
2-1	Gasket	NON ASBESTOS	1	-
3-1	Yoke Seal	BUNA-N	2	-
3-2	Yoke Thrust Bearing	Bronze	1	-
3-3	Yoke Bottom Bushing	Engineering Plastic	1	-
6-1	Sliding Block	Bronze	2	-
6-2	Snap Ring	Spring Steel	2	-
7-1	Top Bushing Seal	BUNA-N	1	-
9-1	DA Adjust Seal	BUNA-N	*2/4	-
12-0	Housing Side Gasket	NON ASBESTOS	2	-
16-1	Head Flange Out Seal	BUNA-N	1	-
16-3	Head Flange Seal	PTFE+BUNA-N	2SET	-
18-1	Piston Seal	BUNA-N	1	-
18-2	Back Up Ring	RTFE	1	PTFE(Bronze)
18-3	Piston Inner Seal	BUNA-N	1	-
20-1	Bottom Flange Seal	BUNA-N	1	-
30-1	Spring End Cover Seal	BUNA-N	1	Spring Module Only
31-1	SR Adjust Seal	BUNA-N	1	Spring Module Only

*Part No. 9-1 : 2-Spring Retrun, 4-Double Acting

*Part No. 9-0 : 1-Spring Retrun, 2-Double Acting
9-1 : 2-Spring Return, 4-Double Acting
9-2 : 1-Spring Return, 2-Double Acting
9-3 : 1-Spring Return, 2-Double Acting

*Part No. 15-0 : 4-Double Acting, 8-Spring Return

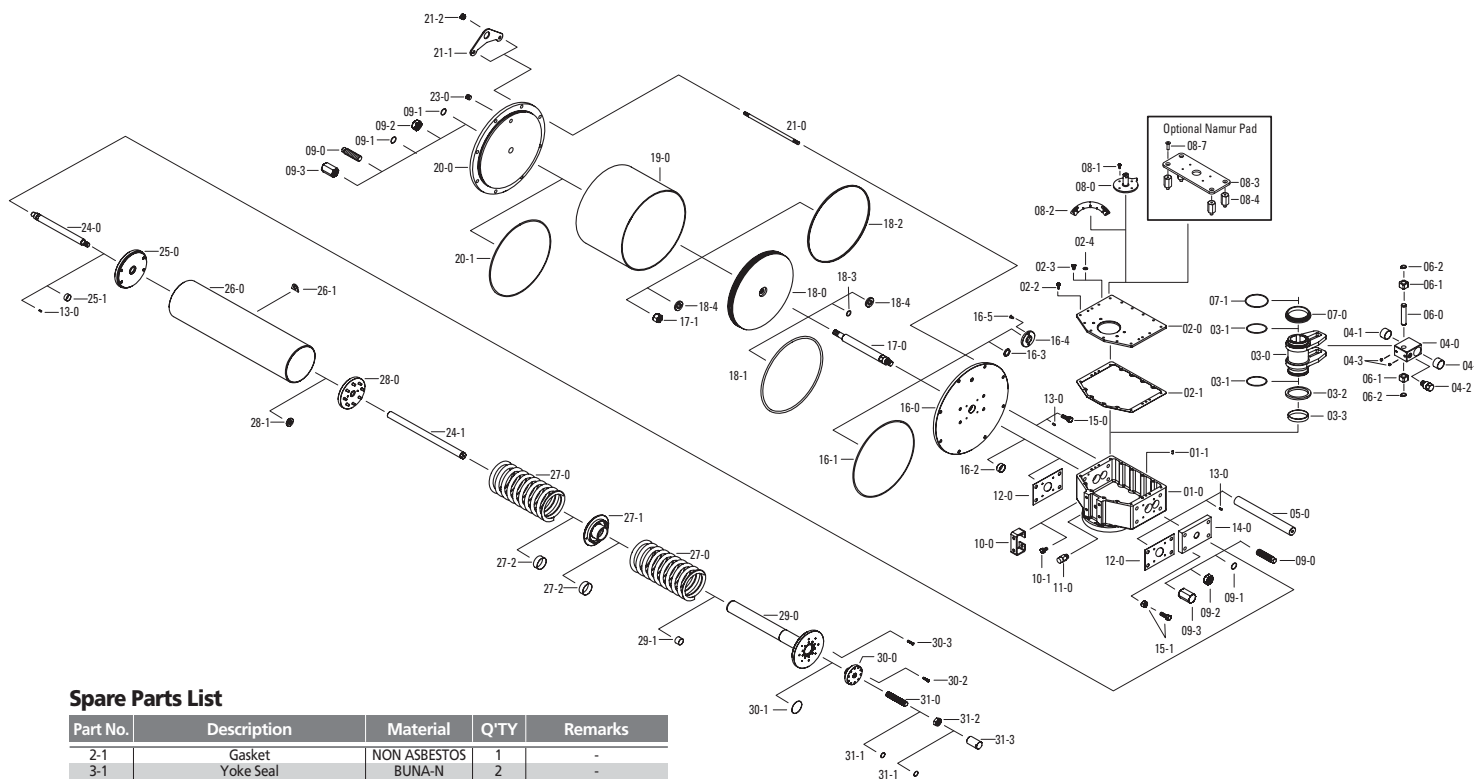
*Part No. 16-5 : 2-EPT 106~108 Model
4-EPT 110~160 Model

*Part No. 30-2 : 6-EPT 106~108 Model
8-EPT 110~160 Model

Parts List

Part No.	Description	Material	Q'TY	Remarks
1-0	Housing	Ductile Iron	1	-
1-1	Dowel Pin	Carbon Steel	2	-
2-0	Cover	Carbon Steel	1	-
2-1	Gasket	NON ASBESTOS	1	-
2-2	Bolt	Carbon Steel	16	-
2-3	Bolt	Carbon Steel	4	-
2-4	Cover Protection	Carbon Steel	4	-
3-0	Yoke	Carbon Steel	1	-
3-1	Yoke Seal	BUNA-N	2	-
3-2	Yoke Thrust Bearing	Bronze	1	-
3-3	Yoke Bottom Bushing	Engineering Plastic	1	-
4-0	Guide Block	Carbon Steel	1	Nitriding Applied
4-1	Guide Block Bushing	ASTM B427	2	Steel, Bronze, Teflon
4-2	Guide Block Stopper	Alloy Steel	1	DA Only
4-3	Setting Screw	Alloy Steel	2	-
5-0	Guide Rod	Alloy Steel	1	Heat Treatment
6-0	Sliding Block Pin	Alloy Steel	2	Heat Treatment
6-1	Sliding Block	Bronze	2	-
6-2	Snap Ring	Spring Steel	2	-
7-0	Yoke Top Bushing	Bronze	1	-
7-1	Top Bushing Seal	BUNA-N	1	-
8-0	Indicator / Namur Indicator	Carbon Steel	1	-
8-1	Bolt	Carbon Steel	4	-
8-2	Visual Indicator	-	1	Sticker
8-3	Namur Plate	Stainless Steel	1	-
8-4	Support Bar	Stainless Steel	4	-
8-7	Thrust W/Bolt	Stainless Steel	4	-
9-0	DA Adjust Bolt	Carbon Steel	*1/2	-
9-1	DA Adjust Seal	BUNA-N	*2/4	-
9-2	DA Adjust Nut	Carbon Steel	*1/2	-
9-3	DA Adjust Cap	Carbon Steel	*1/2	-
10-0	A'SSY Bracket	Carbon Steel	2	-
10-1	Bolt & S/Washer	Carbon Steel	4	-
11-0	Check V/V Vent	Stainless Steel	1Set	-
12-0	Housing Side Gasket	NON ASBESTOS	2	-
13-0	Dowel Pin	Carbon Steel	4	-
14-0	Double Acting End Cover	Carbon Steel	1	DA Only
15-0	Bolt & S/Washer	Alloy Steel	*4/8	-
15-1	Bolt & Nut & S/Washer	Alloy Steel	4	DA Only
16-0	Head Flange	Carbon Steel	1	-
16-1	Head Flange Out Seal	BUNA-N	1	-
16-2	Bushing Head Flange	ASTM B 427	1	Steel, Bronze, Teflon
16-3	Head Flange Seal	PTFE+BUNA-N	2SET	-
16-4	Head Flange Seal Cover	Carbon Steel	1	-
16-5	Thrust W/Bolt	Stainless Steel	*2/4	-
17-0	Piston Rod	Alloy Steel	1	Heat Treatment
17-1	Piston Rod Nut	Carbon Steel	1	-
18-0	Piston	Carbon Steel	1	-
18-1	Piston Seal	BUNA-N	1	-
18-2	Back Up Ring	RTFE	1	BRONZE+PTFE
18-3	Piston Inner Seal	BUNA-N	1	-
18-4	Piston Washer	Alloy Steel	2	Nitriding Applied
19-0	Cylinder Tube	Carbon Steel	1	Hard Chrome Plated
20-0	Bottom Flange	Carbon Steel	1	-
20-1	Bottom Flange Seal	BUNA-N	1	-
21-0	Tie Rod	Carbon Steel	6~20	-
21-1	Eye Plate	Carbon Steel	1	-
21-2	Tie Rod Hex Nut	Carbon Steel	6~20	-
23-0	Air Plug	Carbon Steel	2	-
24-0	Spring Rod	Alloy Steel	1	Heat Treatment
25-0	Top Cover	Carbon Steel	1	-
25-1	Top Cover Bushing	ASTM B427	1	Steel, Bronze, Teflon
26-0	Spring Tube	Carbon Steel	1	-
26-1	Eye Plate	Carbon Steel	1	-
27-0	Spring	Spring Steel	1	-
28-0	Retainer	Carbon Steel	1	-
28-1	Spring Rod Plan Washer	Alloy Steel	1	-
28-2	Lock Nut	Alloy Steel	1	-
29-0	Bottom Cover	Carbon Steel	1	-
30-0	Spring End Cover	Carbon Steel	1	-
30-1	Spring End Cover Seal	BUNA-N	1	-
30-2	Bolt	Alloy Steel	*6/8	-
31-0	SR Adjust Bolt	Carbon Steel	1	-
31-1	SR Adjust Seal	BUNA-N	1	-
31-2	SR Adjust Cap	Carbon Steel	1	-

1.6 Expanded view of EPT200 and above models



Spare Parts List

Part No.	Description	Material	Q'TY	Remarks
2-1	Gasket	NON ASBESTOS	1	-
3-1	Yoke Seal	BUNA-N	2	-
3-2	Yoke Thrust Bearing	Bronze	1	-
3-3	Yoke Bottom Bushing	Engineering Plastic	1	-
6-1	Sliding Block	Bronze	2	-
6-2	Snap Ring	Spring Steel	2	-
7-1	Top Bushing Seal	BUNA-N	1	-
9-1	DA Adjust Seal	BUNA-N	*2/4	-
12-0	Housing Side Gasket	NON ASBESTOS	2	-
16-1	Head Flange Out Seal	BUNA-N	1	-
16-3	Head Flange Seal	PTFE+BUNA-N	2SET	-
18-1	Piston Seal	BUNA-N	1	-
18-2	Back Up Ring	RTFE	1	PTFE(Bronze)
18-3	Piston Inner Seal	BUNA-N	1	-
20-1	Bottom Flange Seal	BUNA-N	1	-
30-1	Spring End Cover Seal	BUNA-N	1	Spring Module Only
31-1	SR Adjust Seal	BUNA-N	1	Spring Module Only

*Part No. 9-1 : 2-Spring Return, 4-Double Acting

*Part No. 9-0 : 1-Spring Return, 2-Double Acting
 9-1 : 2-Spring Return, 4-Double Acting
 9-2 : 1-Spring Return, 2-Double Acting
 9-3 : 1-Spring Return, 2-Double Acting

*Part No. 15-0 : 4-Double Acting, 8-Spring Return

*Part No. 16-5 : 2-EPT 200 Model, 4-EPT 270 Model

*Part No. 30-2 : 8-EPT 200 Model, 10-EPT 270 Model

Parts List

Part No.	Description	Material	Q'TY	Remarks
1-0	Housing	Ductile Iron	1	-
1-1	Dowel Pin	Carbon Steel	2	-
2-0	Cover	Carbon Steel	1	-
2-1	Gasket	NON ASBESTOS	1	-
2-2	Bolt	Carbon Steel	16/24	-
2-3	Bolt	Carbon Steel	4	-
2-4	Cover Protection	Carbon Steel	4	-
3-0	Yoke	Carbon Steel	1	-
3-1	Yoke Seal	BUNA-N	2	-
3-2	Yoke Thrust Bearing	Bronze	1	-
3-3	Yoke Bottom Bushing	Engineering Plastic	1	-
4-0	Guide Block	Carbon Steel	1	Nitriding Applied
4-1	Guide Block Bushing	ASTM B427	2	Steel, Bronze, Teflon
4-2	Guide Block Stopper	Alloy Steel	1	DA Only
4-3	Setting Screw	Alloy Steel	2	-
5-0	Guide Rod	Alloy Steel	1	Heat Treatment
6-0	Sliding Block Pin	Alloy Steel	2	Heat Treatment
6-1	Sliding Block	Bronze	2	-
6-2	Snap Ring	Spring Steel	2	-
7-0	Yoke Top Bushing	Bronze	1	-
7-1	Top Bushing Seal	BUNA-N	1	-
8-0	Indicator / Namur Indicator	Carbon Steel	1	-
8-1	Bolt	Carbon Steel	4	-
8-2	Visual Indicator	-	1	Sticker
8-3	Namur Plate	Stainless Steel	1	-
8-4	Support Bar	Stainless Steel	4	-
8-7	Thrust W/Bolt	Stainless Steel	4	-
9-0	DA Adjust Bolt	Carbon Steel	*1/2	-
9-1	DA Adjust Seal	BUNA-N	*2/4	-
9-2	DA Adjust Nut	Carbon Steel	*1/2	-
9-3	DA Adjust Cap	Carbon Steel	*1/2	-
10-0	A/SSY Bracket	Carbon Steel	2	-
10-1	Bolt & S/Washer	Carbon Steel	4	-
11-0	Check V/V Vent	Stainless Steel	1Set	-
12-0	Housing Side Gasket	NON ASBESTOS	2	-
13-0	Dowel Pin	Carbon Steel	4/8	-
14-0	Double Acting End Cover	Carbon Steel	1	DA Only
15-0	Bolt & S/Washer	Alloy Steel	*4/8	-
15-1	Bolt & Nut & S/Washer	Alloy Steel	4	DA Only
16-0	Head Flange	Carbon Steel	1	-
16-1	Head Flange Out Seal	BUNA-N	1	-
16-2	Bushing Head Flange	ASTM B 427	1	Steel, Bronze, Teflon
16-3	Head Flange Seal	PTFE+BUNA-N	2SET	-
16-4	Head Flange Seal Cover	Carbon Steel	1	-
16-5	Thrust W/Bolt	Stainless Steel	*2/4	-
17-0	Piston Rod	Alloy Steel	1	Heat Treatment
17-1	Piston Rod Nut	Carbon Steel	1	-
18-0	Piston	Carbon Steel	1	-
18-1	Piston Seal	BUNA-N	1	-
18-2	Back Up Ring	RTFE	1	BRONZE+PTFE
18-3	Piston Inner Seal	BUNA-N	1	-
18-4	Piston Washer	Alloy Steel	2	Nitriding Applied
19-0	Cylinder Tube	Carbon Steel	1	Hard Chrome Plated
20-0	Bottom Flange	Carbon Steel	1	-
20-1	Bottom Flange Seal	BUNA-N	1	-
21-0	Tie Rod	Carbon Steel	16-28	-
21-1	Eye Plate	Carbon Steel	1	-
21-2	Tie Rod Hex Nut	Alloy Steel	16-28	-
23-0	Air Plug	Carbon Steel	2	-
24-0	Spring Rod A	Alloy Steel	1	Heat Treatment
24-1	Spring Rod B	Alloy Steel	1	Heat Treatment
25-0	Top Cover	Carbon Steel	1	-
25-1	Spring Rod Bushing	ASTM B 427	1	-
26-0	Spring Tube	Carbon Steel	1	-
26-1	Spring Tube Eye Plate	Carbon Steel	4	-
27-0	Spring	Spring Steel	2	-
27-1	Retainer Plate	Carbon Steel	1	-
27-2	Retainer Plate Bushing	ASTM B 427	2	Steel, Bronze, Teflon
28-0	Retainer	Carbon Steel	1	-
28-1	Retainer Washer	Carbon Steel	1	-
29-0	Bottom Cover	Carbon Steel	1	-
29-1	Bottom Cover Bushing	ASTM B 427	1	-
30-0	Spring END Cover	Carbon Steel	1	-
30-1	Spring END Cover Seal	BUNA-N	1	-
30-2	Bolt	Alloy Steel	*8/10	-
30-3	Bolt & P/Washer	Carbon Steel	4	-
31-0	SR Adjust Bolt	Carbon Steel	1	-
31-1	SR Adjust Seal	BUNA-N	2	-
31-2	SR Adjust Nut	Carbon Steel	1	-
31-3	SR Adjust Cap	Carbon Steel	1	-

Actuator Disassembly

02

2.1 General Information

- DANGER** Ensure the actuator is fully vented and decontaminated before work commences.
- DANGER** Ensure all power supplies are removed before work commences.
- DANGER** Do not remove the spring module while the spring is compressed.
- DANGER** Where actuators are equipped with a spring cartridge mounted manual override or stroke adjuster follow all instructions contained on the warning tag wired to the spring cartridge cover plate.
1. If the Spring Module is to be removed it should be removed from the Drive Module prior to Pneumatic Power Module removal or disassembly.
 2. The Pneumatic Power Module can be disassembled while attached to the Drive Module.
 3. The assembly bolts and Drive Module cover should be removed when the Power Module or Spring Modules is removed.
- CAUTION** The Drive Module cover gasket should be handled carefully during removal to prevent tearing or damage.
4. When removing the Power Module or Spring Module care should be taken to retain all guide pins and O-ring seals.
- CAUTION** Loss or damage to these items may cause misalignment or water ingress after reassembly.

2.2 Double Acting Actuator; Pneumatic Power and Drive Module

- WARNING** Ensure the Pneumatic Power Module is fully vented and the operating air supply disconnected before work commences.
- CAUTION** Use the correct tools when removing the piston and piston rod seals to avoid damage.
- NOTE** Review the instructions and warnings in section 2.1 before proceeding with Pneumatic Power and Drive Module Disassembly.

Work Procedures

1. Disconnect pneumatic and electric power supplies then take the connection off the actuator.

2. Remove the pressure inside of the power module.

CAUTION Before work commences, ensure that explosive and/or noxious gas or liquid are fully vented from the actuator and confirm using appropriate measuring equipment.

3. Remove hexagon bolts (8-1) which are fixed between the indicator (8-0) and the yoke (3-0).
4. Remove the indicator (8-0) from the yoke (3-0).
5. Remove the hexagon bolts (2-2) which are fixed to the cover (2-0) from the drive module.
6. Remove the hexagon bolts (2-3) and the washer seals (2-4) from the cover (2-0).
7. Remove the cover (2-0) and the cover gasket (2-1) from the housing (1-0).

CAUTION Prepare a spare gasket before remove the cover (2-0) from the housing (1-0).

8. Remove the bolts (2-3) and the washer seals (2-4) from the cover (2-0).
9. Remove the hexagon nuts (21-2) which are fixed to the bottom flange (20-0) and the head flange (16-0).
10. Remove the eye plate (21-1) from the bottom flange (20-0).
11. Remove the tie rods (21-0) from the head flange (16-0).
12. Remove the bottom flange (20-0) from the cylinder tube (19-0).

CAUTION Ensure that the cylinder tube should not be impacted during removal the cylinder tube.

13. Remove the bottom flange seal (20-1) and the adjust bolt, nut, cap, seals (9-0, 1, 2, 3).
14. Remove the cylinder tube (19-0) from the head flange (16-0).

WARNING Do not give any damage to the outside of the cylinder tube when removing cylinder tube

15. Remove the piston rod nut (17-1) from the piston rod (17-0) which is fixed to the piston (18-0).
16. Remove the piston washers (18-4) from the piston rod (17-0).
17. Remove the piston (18-0) from the piston rod (17-0).

CAUTION The piston inner seals should be handled carefully during removal from the piston to prevent tearing or damage.

18. Remove the piston inner seals (18-3), the piston seal (18-1), and the backup ring (18-2).
19. Remove the thrust bolts (16-5) which are fixed to the head flange seal cover (16-4) and the head flange (16-0).

Actuator Disassembly

02

20. Remove the head flange seal cover (16-4) from the head flange (16-0).
21. Remove the hexagon bolts (15-0) which are fixed to the head flange (16-0) from the housing (1-0).
22. Remove the head flange (16-0) from the housing (1-0).

CAUTION The housing side gasket should be handled carefully during the head flange removal from the housing to prevent tearing or damage.

23. Remove the head flange seals (16-3) and the bushing head flange (16-2) from the head flange (16-0).
24. Remove the housing side gaskets (12-0) from the housing (1-0).
25. Remove the set screws (4-3) which are fixed between the guide block (4-0) and the piston rod (17-0).
26. Remove the piston rod (17-0) from the guide block (4-0).
27. Remove the adjust bolt, nut, cap, seals (9-0, 1, 2, 3) from the DA end cover (14-0).

CAUTION The eye plate (26-1) is fixed to the end cover (14-0).

28. Remove the bolts, nuts and spring washers (15-1) which are fixed to the DA end cover (14-0) and the housing (1-0).
29. Remove the DA end cover (14-0) from the housing (1-0).
30. Remove the guide rod (5-0) from the housing (1-0).
31. Remove the top bushing (7-0) from the yoke (3-0).
32. Remove the top bushing seal (7-1) from top bushing (7-0).

CAUTION The top bushing seal should be handled carefully during removal to prevent tearing or damage.

33. Remove the yoke (3-0) from the housing (1-0).
34. Remove the yoke seals (3-1), the yoke bottom thrust bearing (3-2) and the yoke bottom bushing (3-3) from the yoke (3-0).

CAUTION The yoke seals should be handled carefully during removal to prevent tearing or damage.

35. Remove the snap rings (6-2) from the yoke (3-0) which are fixed to the sliding block pins (6-0).
36. Remove the sliding blocks (6-1) from the yoke (3-0).
37. Remove the guide block (4-0) and the sliding block pins (6-0).
38. Remove the sliding block pins (6-0) from the guide block (4-0).
39. Remove the set screws (4-3) from the guide block (4-0) which are fixed to the guide block stopper (4-2).
40. Remove the guide block stopper (4-2) and the guide block bushings (4-1) from the guide block (4-0).
41. Remove the dowel pins (1-1, 13-0) from the housing (1-0).

42. Remove the bolts (10-1) from the housing (1-0) which are fixed to the accessory's bracket (10-0).
43. Remove the accessory's brackets (10-0) from the housing (1-0).
44. Remove the check valve vent (11-0) from the housing (1-0).

2.3 Spring Return Actuator ; Pneumatic Power, Drive & Spring Module

1. Disconnect pneumatic and electric power supplies.
2. Remove the pressure inside of the power module.

CAUTION Before work commences, ensure that explosive and/or noxious gas or liquid are fully vented from the actuator and confirm using appropriate measuring equipment.

3. Remove the hexagon bolts (8-1) which are fixed to the indicator (8-0) and the yoke (3-0).
4. Remove the indicator (8-0) from the yoke (3-0).
5. Remove the hexagon bolts (2-2) which are fixed to the cover (2-0) from the drive module.
6. Remove the cover (2-0) and the cover gasket (2-1) from the housing (1-0).
7. Remove the hexagon bolts (2-3) and the washer seals (2-4) from the cover (2-0).
8. Remove the setting screws (4-3) from the guide block (4-0) and then remove the spring rod (24-0).
9. Remove the bolts and spring washers (15-0) which are fixed between the housing (1-0) and the top cover (25-0).
10. Remove the housing side gaskets (12-0) and the spring module from the housing (1-0).
11. Remove the SR adjust bolt, cap, seal (31-0, 1, 2) from the spring end cover (30-0).
12. Remove the bolts (30-2) which are fixed to the spring end cover (30-0).
13. Remove the spring end cover seal (30-1) from the spring end cover (30-0).
14. Remove the lock nut (28-2) and the spring rod plan washer (28-1) from the spring rod (24-0). (Note: This category is applicable to EPT106-160 models only)

CAUTION Before removing the lock nut (28-2) from the spring rod (24-0), fix the position of the spring by using the long bolt through the bolt hole of the spring end cover (30-0) on the bottom cover (29-0) and then remove.

WARNING Do not disassemble the spring cartridge. For further disassembly, contact Flowbus.

Actuator Disassembly

02

15. Remove the hexagon nuts (21-2) which are fixed to the bottom flange (20-0) and the head flange (16-0).
16. Remove the eye plate (21-1) from the bottom flange (20-0).
17. Remove the tie rods (21-0) from the head flange (16-0).
18. Remove the bottom flange (20-0) from the cylinder tube (19-0).

CAUTION The bottom flange seal should be handled carefully during removal to prevent tearing or damage.

19. Remove the bottom flange seal (20-1) and the adjust bolt, nut, cap, seals (9-0, 1, 2, 3).
20. Remove the cylinder tube (19-0) from the head flange (16-0).

WARNING Ensure that the cylinder tube should not be impacted during removal the cylinder tube.

21. Remove the piston rod nut (17-1) from the piston rod (17-0) which is fixed to the piston (18-0).
22. Remove the piston washers (18-4) from the piston rod (17-0).
23. Remove the piston (18-0) from the piston rod (17-0).

CAUTION The piston inner seals should be handled carefully during removal from the piston to prevent tearing or damage.

24. Remove the piston inner seals (18-3), the piston seal (18-1), and the backup ring (18-2).
25. Remove the thrust bolts (16-5) which are fixed to the head flange seal cover (16-4) and the head flange (16-0).
26. Remove the head flange seal cover (16-4) from the head flange (16-0).
27. Remove the hexagon bolts (15-0) which are fixed to the head flange (16-0) from the housing (1-0).
28. Remove the head flange (16-0) from the housing (1-0).

CAUTION The housing side gasket should be handled carefully during the head flange removal from the housing to prevent tearing or damage.

29. Remove the head flange seals (16-3) and the bushing head flange (16-2) from the head flange (16-0).
30. Remove the housing side gaskets (12-0) from the housing (1-0).
31. Remove the set screws (4-3) which are fixed between the guide block (4-0) and the piston rod (17-0).
32. Remove the piston rod (17-0) from the guide block (4-0).
33. Remove the guide rod (5-0) from the housing (1-0).
34. Remove the top bushing (7-0) from the yoke (3-0).

35. Remove the top bushing seal (7-1) from top bushing (7-0).

CAUTION The top bushing seal should be handled carefully during removal to prevent tearing or damage.

36. Remove the yoke (3-0) from the housing (1-0).
37. Remove the yoke seals (3-1), the yoke bottom thrust bearing (3-2) and the yoke bottom bushing (3-3) from the yoke (3-0).

CAUTION The yoke seals should be handled carefully during removal to prevent tearing or damage.

38. Remove the snap rings (6-2) from the yoke (3-0) which are fixed to the sliding block pins (6-0).
39. Remove the sliding blocks (6-1) from the yoke (3-0).
40. Remove the guide block (4-0) and the sliding block pins (6-0).
41. Remove the sliding block pins (6-0) from the guide block (4-0).
42. Remove the set screws (4-3) from the guide block (4-0) which are fixed to the guide block stopper (4-2).
43. Remove the guide block stopper (4-2) and the guide block bushings (4-1) from the guide block (4-0).
44. Remove the dowel pins (1-1, 13-0) from the housing (1-0).
45. Remove the bolts (10-1) from the housing (1-0) which are fixed to the accessory's bracket (10-0).
46. Remove the accessory's brackets (10-0) from the housing (1-0).
47. Remove the check valve vent (11-0) from the housing (1-0).

2.4 Manual Override Disassembly

WARNING Ensure that the actuator is fully vented of operating media, any air or electrical supplies are removed or isolated and any manual override system is locked or isolated before work commences.

DANGER The manual override should be in the auto position during normal actuator operation, otherwise severe equipment damage or fatal injury to personnel may occur.

DANGER Before work commences, isolate the main air supply and ensure that all remaining air pressure in the actuator power module is vented. If the air pressure is not fully vented severe equipment damage or fatal injury to personnel could be occurred.

Actuator Reassembly

03

3.1 General Information

DANGER Only new seals and gaskets should be used when reassembling the actuator. Ensure these items are within their manufacturers recommended shelf life.

DANGER On inspection any damaged or worn parts should be replaced.

1. Remove all old seals and gaskets.
2. All parts should be cleaned to remove all dirt and other foreign material prior to inspection.
3. All parts should be thoroughly inspected for excessive wear, stress cracking, galling and pitting. Attention should be directed to threads and sealing surfaces subjected to sliding or rotating motion. Sealing surfaces of the cylinder, tie bars and piston rod must be free of deep scratches, pitting, corrosion and blistering or flaking coating. Any parts found to be damaged or worn should be replaced.
4. Before installation all moving parts should be coated with a film of lubricant. All seals should be coated with lubricant before installing into seal grooves.

WARNING The recommended lubricant for all parts and seals is detailed in section 1.6

DANGER Care should be taken to avoid the air supply into the cylinder when the piston has been removed. This may cause severe equipment damage or fatal injury to personnel.

3.2 Double Acting Actuator ; Pneumatic Power & Drive Module

Work Procedures

1. Install the guide block bushings (4-1) into the guide block (4-0).

CAUTION The guide block bushings should be free to slide under its own weight when the guide rod moves.

CAUTION The standard jig should be used when assembling guide block bushing (4-1).

2. Fix the setting screws (4-3) after installing the guide block stopper (4-2) into the guide block (4-0).

CAUTION The lock tight 271# should be applied to the thrust bolts (16-5) to prevent loosening before installation

3. Install the guide block (4-0), the sliding block pins (6-0) and the sliding blocks (6-1) into the yoke (3-0) and then install the snap rings (6-2).

CAUTION The guide block (4-0), the sliding block pins (6-0) and the Sliding blocks (6-1) should be greased sufficiently before installation.

4. Install the yoke thrust bearing (3-2) into the yoke (3-0).

5. Install the yoke seals (3-1) and the yoke bottom bushing (3-3) into the yoke (3-0).

CAUTION The seals (3-1), bearing (3-2) and bushing (3-3) should be greased sufficiently before installation

6. Install the top bushing seal (7-1) into the top bushing (7-0).

CAUTION The top bushing (7-1) should be greased sufficiently before installation.

7. Install the yoke top bushing (7-0) into the yoke (3-0).

CAUTION Care should be taken to avoid damage to the yoke seal (3-1).

8. Install the yoke (3-0) into the housing (1-0).

CAUTION Care should be taken to the yoke seal (3-1) to prevent tearing or damage.

9. Install the guide rod (5-0) into the the housing (1-0) and the guide block (4-0).

CAUTION The inside of the guide block (4-0) should be greased sufficiently before installation.

10. Install the dowel pins (1-1) into the housing (1-0).

11. Install the housing side gaskets (12-0) into the dowel pins (1-1).

12. Install the bushing head flange (16-2) into the head flange (16-0).

CAUTION The standard jig should be used for the bushing head flange (16-2)

13. Install the head flange (16-0) into the housing (1-0) using the hexagon bolts and spring washers (15-0).

CAUTION The hexagon bolts and spring washers (15-0) should be tightened to the torque advised in section 6.

14. Install the piston rod (17-0) into the guide block (4-0) and then fix the setting screws (4-3).

CAUTION The lock tight 271# should be applied to the set screw (4-3) to prevent from loosening before installation.

15. Install the head flange out seal (16-1), the head flange seals (16-3), the head flange cover (16-4) into the head flange (16-0) and install the thrust bolts (16-5) into the head flange (16-0).

Actuator Reassembly

03

CAUTION The head flange out seal and the head flange seal should be greased sufficiently before installation.

CAUTION The lock tight 271# should be applied to the thrust bolts (16-5) to prevent loosening before installation.

CAUTION Care should be taken to the seals during (16-1, 3) installation.

16. Install the cylinder tube (19-0) into the head flange (16-0).

CAUTION Take care to prevent damage the head flange out seal (16-1).

17. Install the piston inner seals (18-3), the piston seal (18-1) and the backup ring (18-2) into the piston (18-0).

CAUTION The piston inner seal and the piston seal should be greased sufficiently.

18. Install the piston washers (18-4) into the piston rod (17-0).

19. Install the assembled piston into the cylinder tube (19-0) and the piston rod (17-0).

CAUTION Care should be taken to avoid damage the piston inner seal (18-3) during the installation the piston (18-0) into the piston rod (17-0).

CAUTION Care should be taken to avoid damage the piston seal (18-1) and cylinder tube (19-0) during installation.

20. Install the piston washers (18-4) and the piston rod nut (17-1) in the piston (18-0).

CAUTION The lock tight 271# should be applied to the piston rod nut (17-1) to prevent loosening.

CAUTION Care should be taken to the piston seal (18-1) and the piston inner seal (18-3) to prevent damage during installation the piston (18-0) into the cylinder tube (19-0) and the piston rod (17-0).

21. Install the bottom flange seal (20-1) into the bottom flange (20-0).

CAUTION Ensure the bottom flange seal (20-1) is sufficiently lubricated before installation.

22. Install the bottom flange (20-0) into the cylinder tube (19-0).

CAUTION Care should be taken to avoid damage the bottom flange seal (20-1).

23. Install the tie rods (21-0) into the head flange (16-0) and the bottom flange (20-0).

24. Fix the tie rod hex nuts (21-2) after installation the eye plate (21-1) into the bottom flange (20-0).

25. Install the DA adjust bolt, nut, cap, seals (9-0, 1, 2, 3) into the bottom flange (20-0).

CAUTION Ensure the seal (9-1) and bolts (9-0) are lubricated sufficiently before installation.

26. Fix the bolt & Nut & S/Washer(15-1) into the double acting end cover(14-0) after installation the eye plate(26-1)

27. Install the dowel pins (1-1) into the housing (1-0).

28. Install the housing side gaskets (12-0) into the housing (1-0) and the dowel pins (1-1).

29. Install the assembled DA end cover (14-0) into the housing (1-0) with the bolt, nut and spring washers (15-1).

30. Install the DA adjust bolt, nut, cap, seals (9-0, 1, 2, 3) into the DA end cover (14-0).

CAUTION Ensure the seal (9-1) and bolt (9-0) is lubricated sufficiently before installation.

31. Install the dowel pins (13-0) into the housing (1-0).

32. Install the gasket (2-1) and the cover (2-0) into the housing (1-0) with the hexagon bolts (2-2).

CAUTION Care should be taken to the top bushing seal (7-1) to prevent damage during the cover (2-0) installation.

CAUTION The silicon should be applied to the top side of the housing (1-0) and the gasket (2-1) during the gasket (2-1) installation.

33. Install the bolts (2-3) and the washer seals (2-4) into the cover (2-0).

34. Install the indicator (8-0) into the yoke (3-0) with the bolts (8-1).

35. Install the check valve vent (11-0) into the housing (1-0).

36. Install the accessory's brackets (10-0) into the housing (1-0) with the bolt (10-1).

3.3 Spring Return Actuator ; Pneumatic Power, Drive & Spring Module

CAUTION Review the instructions and warnings in section 3.1 before proceeding with Pneumatic Power & Drive Module Reassembly.

Work Procedures

1. Install the guide block bushings (4-1) into the guide block (4-0).

CAUTION The guide block bushings should be free to slide under its own weight when the guide rod moves.

CAUTION The standard jig should be used when assembling guide block bushing (4-1).

2. Fix the setting screws (4-3) after installing the guide block stopper (4-2) into the guide block (4-0).

Actuator Reassembly

03

3. Install the guide block (4-0) and the sliding block pins (6-0), the sliding blocks (6-1) into the yoke (3-0) and then install the snap rings (6-2).
4. Install the yoke thrust bearing (3-2) into the yoke (3-0).
5. Install the yoke seals (3-1) and the yoke bottom bushing (3-3) into the yoke (3-0).

CAUTION The seals (3-1), bearing (3-2) and bushing (3-3) should be greased sufficiently before installation.

6. Install the top bushing seal (7-1) into the top bushing (7-0).

CAUTION The top bushing (7-1) should be greased sufficiently before installation.

7. Install the yoke top bushing (7-0) into the yoke (3-0).

CAUTION Care should be taken to avoid damage to the yoke seal (3-1).

8. Install the yoke (3-0) into the housing (1-0).
9. Install the guide rod (5-0) into the the housing (1-0) and the guide block (4-0).

CAUTION The inside of the guide block (4-0) should be greased sufficiently before installation.

10. Install the dowel pins (1-1) into the housing (1-0).
11. Install the housing side gaskets (12-0) into the dowel pins (1-1).
12. Install the bushing head flange (16-2) into the head flange (16-0).

CAUTION The standard jig should be used for the bushing head flange (16-2)

13. Install the head flange (16-0) into the housing (1-0) using the hexagon bolts and spring washers (15-0).

CAUTION The hexagon bolts and spring washers (15-0) should be tightened to the torque advised in section 6.

14. Install the piston rod (17-0) into the guide block (4-0) and then fix the setting screws (4-3).

CAUTION The lock tight 271# should be applied to the set screw (4-3) to prevent from loosening before installation.

15. Install the head flange out seal (16-1), the head flange seals (16-3), the head flange cover (16-4) into the head flange (16-0) and install the thrust bolts (16-5) into the head flange (16-0).

CAUTION The head flange out seal and the head flange seal should be greased sufficiently before installation.

CAUTION The lock tight 271# should be applied to the thrust bolts to prevent loosening before installation

CAUTION Care should be taken to the seals during installation.

16. Install the cylinder tube (19-0) into the head flange (16-0).

CAUTION Take care to prevent damage the head flange out seal (16-1).

17. Install the piston inner seals (18-3), the piston seal (18-1) and the backup ring (18-2) into the piston (18-0).

CAUTION The piston inner seal and the piston seal should be greased sufficiently.

18. Install the piston washers (18-4) into the piston rod (17-0).

19. Install the assembled piston into the cylinder tube (19-0) and the piston rod (17-0).

CAUTION Care should be taken to avoid damage the piston inner seal (18-3) during the installation the piston (18-0) into the piston rod (17-0).

CAUTION Care should be taken to avoid damage the piston seal (18-1) and cylinder tube (19-0) during installation.

20. Install the piston washers (18-4) and the piston rod nut (17-1) in the piston (18-0).

CAUTION The lock tight 271# should be applied to the piston rod nut (17-1) to prevent loosening.

CAUTION Care should be taken to the piston seal (18-1) and the piston inner seal (18-3) to prevent damage during installation the piston (18-0) into the cylinder tube (19-0) and the piston rod (17-0).

21. Install the bottom flange seal (20-1) into the bottom flange (20-0).

CAUTION Ensure the bottom flange seal (20-1) is sufficiently lubricated before installation.

22. Install the bottom flange (20-0) into the cylinder tube (19-0).

CAUTION Care should be taken to avoid damage the bottom flange seal (20-1).

23. Install the tie rods (21-0) into the head flange (16-0) and the bottom flange (20-0).
24. Fix the tie rod hex nuts (21-2) after installation the eye plate (21-1) into the bottom flange (20-0).

25. Install the DA adjust bolt, nut, cap, seals (9-0, 1, 2, 3) into the bottom flange (20-0).

CAUTION Ensure the seal (9-1) and bolts (9-0) are lubricated sufficiently before installation.

26. Install the dowel pins (1-1) into the housing (1-0).

27. Install the housing side gaskets (12-0) into the housing (1-0) and the dowel pins (1-1).

Actuator Reassembly

03

28. Install the spring module into the housing (1-0).
29. Install the top cover (25-0) into the housing (1-0) with the bolts and spring washers (15-0).

CAUTION The hexagon bolt and spring washer (15-0) should be tightened to the torque advised in Section 6.

30. Fix the setting screws (4-3) into the guide block (4-0) after the spring rod (24-0) installation.

CAUTION Apply the lock tight 271# to setting screw (4-3) to prevent from loosening before installation

31. Install the spring rod plan washer (28-1) into the spring rod (24-0) and fix it with lock nut (28-2). (Note: This category is applicable to EPT106-160 models only)

CAUTION Tension of spring can be changed according to fastening strength of the lock nut.

32. Install the spring end cover seal (30-1) and the spring end cover (30-0) into the bottom cover (29-0) with the bolts (30-2).

33. Install the SR adjust bolt, cap, seals (31-0, 1, 2) into the bottom cover (29-0).

CAUTION The SR adjust seal (31-1) and bolts (31-0) should be greased sufficiently.

34. Install the dowel pins (13-0) into the housing (1-0).

35. Install the gasket (2-1) and the cover (2-0) into the housing (1-0) with the hexagon nuts (2-2).

CAUTION Care should be taken to the top bushing seal (7-1) to prevent damage during the cover (2-0) installation.

CAUTION The silicon should be applied to the top side of the housing (1-0) and the gasket (2-1) during the gasket (2-1) installation.

36. Install the bolts (2-3) and the washer seals (2-4) into the cover (2-0).

37. Install the indicator (8-0) into the yoke (3-0) with the bolts (8-1).

38. Install the check valve vent (11-0) into the housing (1-0).

39. Install the accessory's brackets (10-0) into the housing (1-0) with the bolt (10-1).

3.4 Actuator Testing

WARNING Operating pressure should not exceed maximum rated operating pressure indicated on the actuator label. Operating pressure should be checked using a calibrated gauge and in the event of an unregulated supply a pressure regulator should be used.

Work Procedures

1. Apply supply pressure and check for any external leakage at all joints and fittings.
2. Operate the actuator 5 times at the maximum supply pressure specified on the actuator label.
3. Apply normal operating pressure to input / output port of actuator.
4. Conduct leakage test as follow;

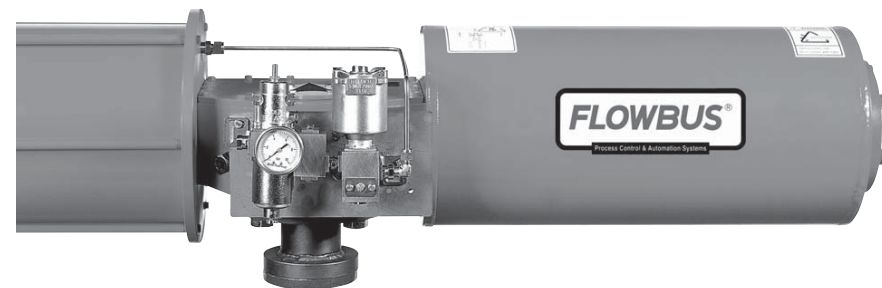
WARNING Both the input and output ports should be tested by pressurizing each port in turn and applying the test procedure.

CAUTION Leaks should be tested by applying a leak detector medium to the outside of the part or joint being tested, while the actuator is pressurized.

- 4.1. Check for leakage at the piston seal of the pneumatic power module.
- 4.2. Check for leakage at the end cover.
- 4.3. Check for leakage at the housing vent check valve.
- 4.4. If leaks are detected remove the air supply.

5. Once actuator is repaired, repeat the leakage test.

6. Repeat the test for the other port.



Trouble Shooting Guide

04

Bolt & Nut Torque Tables

05

4.1 Irregular Movement

1. Ensure the air supply is constant with no pressure fluctuations.
2. Disassembly and check all components are correctly lubricated.
3. Visually check worn parts and replace if necessary.
4. Check valve operation and consult the valve manufacturer if required.

4.2 Incomplete Stroke

1. Check travel stops are set correctly and adjust if required.
2. Remove any hard grease and re-lubricate.
3. Check that the cylinder is free of obstructions or dirt.
4. Check valve operation and consult the valve manufacturer if required.

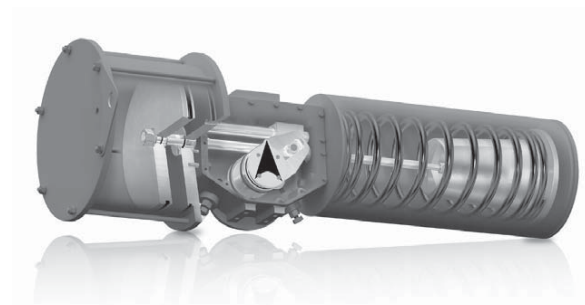
4.3 Insufficient Power

1. Check that the supply pressure is above the minimum actuator working pressure.
2. Ensure that the actuator provides sufficient torque to operate the valve at the air supply pressure provided.
3. Inspect any ancillary controls and replace if required. Refer to component manufacturer's documentation if necessary.
4. Inspect the air supply line for damage, leaks or blockages. If necessary, clean or replace.
5. Inspect the exhaust port, and silencers if fitted, for blockages. If necessary, clean or replace.
6. Ensure speed controls are correctly set if fitted.
7. Inspect the piston and rod seals for excessive wear or damage. If necessary, remove and replace.
8. Check valve operation and ensure it is suitable for operation by the actuator. Contact the valve manufacturer if required.

Description	Cover Hex Bolt			Spring Rod Locking Nut		
Part No.	2-2			28-2		
Model	Size	Strength.	Torque	Size	Strength.	Torque
EPTS 106	M6	4.8T	4.3N.m	M20	8.8T	SETTING
EPTS 108	M8	4.8T	10.5N.m	M27	8.8T	SETTING
EPTS 110	M10	4.8T	21N.m	M30	8.8T	SETTING
EPTS 130	M12	4.8T	36N.m	M39	8.8T	SETTING
EPTS 160	M14	4.8T	58N.m	M45	8.8T	SETTING
EPTS 200	M16	4.8T	88N.m	-	-	-
EPTS 270	M20	4.8T	170N.m	-	-	-
EPTS 270B	M24	4.8T	280N.m	-	-	-

Description (Part No.)	Top Cover Hex Bolt(25-2) Head Flange Hex Bolt(14-0)			Piston Retaining Nut			Tie Rod Retaining Nut		
				17-1			21-2		
Model	Size	Strength.	Torque	Size	Strength	Torque	Size	Strength	Torque
EPTS 106	M12	10.9T	110N.m	M20	10.9T	420N.m	M12	8.8T	78N.m
EPTS 108	M16	10.9T	270N.m	M27	10.9T	790N.m	M14	8.8T	124N.m
EPTS 110	M20	10.9T	420N.m	M33	10.9T	1060N.m	M16	8.8T	190N.m
EPTS 130	M24	10.9T	620N.m	M42	10.9T	1710N.m	M20	8.8T	350N.m
EPTS 160	M30	10.9T	910N.m	M48	10.9T	2200N.m	M20	8.8T	350N.m
EPTS 200	M36	10.9T	1230N.m	M56	10.9T	3190N.m	M22	8.8T	470N.m
EPTS 270	M42	10.9T	1710N.m	M72	10.9T	4990N.m	M24	8.8T	600N.m
EPTS 270B	M56	10.9T	2900N.m	M95	10.9T	9260N.m	M27	8.8T	890N.m

* Maximum Allowable Torque Error $\pm 5\%$



Actuator Guide Module Weights

06

(Unit : kgs)

Model	Drive Module	Power Module		Spring Module	
		Cylinder	Weight	Type	Weight
EPTC106	44	200	41	S1	57
		240	64	S2	63
		295	82	S3	67
		340	90	S4	71
EPTC108	84	295	102	S1	107
		340	110	S2	113
		385	145	S3	121
		435	176	S4	126
EPTC110	142	485	211	S5	130
		340	139	-	-
		385	180	S1	216
		435	218	S2	233
EPTC130	271	485	260	S3	255
		535	305	S4	261
		585	354	S5	249
		435	280	-	-
EPTC160	461	485	330	S1	401
		535	382	S2	412
		585	446	S3	462
		635	511	S4	451
EPTC200	809	685	576	S5	435
		485	386	-	-
		535	455	S1	678
		585	523	S2	689
EPTC270	1693	635	595	S3	736
		685	671	S4	747
		735	759	S5	762
		785	846	S6	821
EPTC106	44	585	646	-	-
		635	731	S1	1232
		685	822	S2	1247
		735	912	S3	1308
EPTC108	84	785	1013	S4	1386
		835	1134	S5	1348
		885	1247	S6	1427
		985	1528	S7	1476
EPTC110	142	685	1102	-	-
		735	1217	-	-
		785	1336	-	-
		835	1472	S1	1987
EPTC130	271	885	1621	S2	2172
		935	1796	S3	2198
		985	1978	S4	2227
		1050	2281	S5	2403

(Unit : kgs)

Model	Drive Module	Power Module		Spring Module	
		Cylinder	Weight	Type	Weight
EPTS106	39	200	38.8	S1	57
		240	60.7	S2	59
		295	77.5	S3	63
		340	86	S4	69
EPTS108	71	240	76	S0	107
		295	96	S1	114
		340	105	S2	117
		385	137	S3	124
EPTS110	128	435	168	S4	128
		485	201	S5	132
		340	133	-	-
		385	172	S1	202
EPTS130	245	435	209	S2	218
		485	248	S3	238
		535	293	S4	243
		585	337	S5	249
EPTS160	418	435	266	-	-
		485	314	S1	397
		535	365	S2	402
		585	427	S3	433
EPTS200	721	635	488	S4	417
		685	552	S5	448
		485	365	-	-
		535	430	S1	666
EPTS270	1489	585	496	S2	675
		635	564	S3	719
		685	638	S4	726
		735	725	S5	733
EPTS270B	2755	785	808	S6	798
		585	611	-	-
		635	693	S1	1232
		685	780	S2	1299
EPTS270	1489	735	872	S3	1272
		785	968	S4	1336
		835	1073	S5	1307
		885	1193	S6	1375
EPTS270B	2755	985	1462	S7	1428
		685	1036	-	-
		735	1147	-	-
		785	1263	-	-
EPTS270	1489	835	1393	S1	1984
		885	1537	S2	2036
		935	1704	S3	2147
		985	1875	S4	2103
EPTS270B	2755	1050	2161	S5	2313
		935	2293	-	-
		985	2525	-	-
		1050	2880	-	-
EPTS270B	2755	1100	3090	-	-
		1150	3312	-	-
		1200	3629	S1	2810
		1250	3906	S2	2910
EPTS270B	2755	1300	4157	S3	2958
		1350	4454	S4	2996
		1400	4762	S5	3021
		1450	5051	S6	3107

Actuator Guide Module Weights

06

(Unit : kgs)

Model	Drive Module	Power Module		Spring Module	
		Cylinder	Weight	Type	Weight
EPTSC106Z	39	200	38.8	S1	60
		240	60.7	S2	65
		295	77.5	S3	68
		340	86	S4	71
EPTSC108Z	71	240	76	S0	107
		295	96	S1	114
		340	105	S2	117
		385	137	S3	124
		435	168	S4	128
		485	201	S5	132
		295	122	S0	184
EPTSC110Z	128	340	133	S1	187
		385	172	S2	204
		435	209	S3	208
		485	248	S4	213
		535	293	S5	219
		585	337	-	-
		635	396	-	-
EPTSC130Z	245	385	222	SL	323
		435	266	S0	329
		485	314	S1	351
		535	365	S2	356
		585	427	S3	363
		635	488	S4	371
		685	552	S5	380
EPTSC160Z	418	735	631	-	-
		435	310	S1	541
		485	365	S2	541
		535	430	S3	579
		585	496	S4	584
		635	564	S5	595
		685	638	S6	642
EPTSC200Z	721	735	725	-	-
		785	808	-	-
		535	535	S1	1133
		585	611	S2	1196
		635	693	S3	1160
		685	780	S4	1230
		735	872	S5	1288
		785	968	S6	1267
		835	1073	S7	1324
		885	1193	-	-
		935	1346	-	-
		985	1462	-	-

(Unit : kgs)

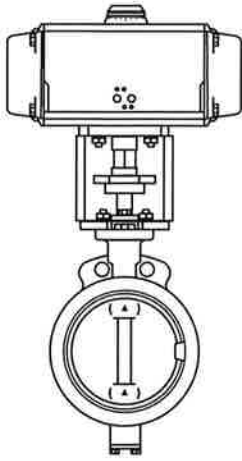
Model	Drive Module	Power Module		Spring Module	
		Cylinder	Weight	Type	Weight
EPTSC270Z	1489	685	1036	S1	1834
		735	1147	S2	1920
		785	1263	S3	1946
		835	1393	S4	1973
		885	1537	S5	1924
		935	1704	S6	2036
		985	1875	S7	2122
EPTSC270BZ	2755	1050	2161	-	-
		935	2293	S1	2810
		985	2525	S2	2910
		1050	2880	S3	2958
		1100	3090	S4	2996
		1150	3312	S5	3021
		1200	3629	S6	3107
		1250	3906	S7	3147
		1300	4157	-	-
		1350	4454	-	-
		1400	4762	-	-
		1450	5051	-	-
		1500	5347	-	-

NOx, SOx Regulation Compliant

High-temperature Butterfly Valve for Emission Control



Instruction Manual



Safety Precautions-Strict Observance Required

Thank you for purchasing this product.

To ensure long-term safe use of this product, make sure to read this entire instruction manual (hereinafter referred to as "this manual") and follow all instructions.

The precautions shown below are intended to ensure that the High Performance Butterfly Valve EXV (hereinafter referred to as "the product") is used correctly to prevent injury and damages.

Symbols

In this manual, the levels of injury or damages that could occur due to ignoring instructions or mistaken operation of the product are divided into categories which are represented by the following symbols.



WARNING

This symbol indicates the "possibility of death or serious injury."



Caution

This symbol indicates the "possibility of malfunctions or physical damages only."

Instructions in this manual that must be followed are divided into categories which are represented by the following symbols.



Prohibited

This symbol indicates "prohibited" actions.



Mandatory

This symbol indicates "mandatory" actions that must be carried out.

Notes

- Make sure to read this entire manual before transporting, storing, connecting piping, operating, or performing maintenance and inspection.
- This manual does not contain all possible information related to transporting, storing, connecting piping, operating, or performing maintenance and inspection of the product. Contact a sales representative if you have any questions.
- The operating, maintenance, and inspection reference and limit values specified in this manual were determined with maintenance of the product in mind. Use the product within the reference and limit values.
- Only use the product with the included dedicated actuator. Do not use any other actuators.
- Store this manual in a location where it can be referenced at any time, particularly during installation and initial operation. Make sure to transfer the manual and operating procedures to the next person in line when a new person is assigned to handle operation.
- From a safety standpoint, you should stop use and replace the product if it is struck and dented or damaged in any way.
- The content of this manual may be changed without prior notice.

1. Product Features



1.1 Product information

This is a double eccentric butterfly valve which controls fluid by rotating the valving element 90°. In addition to fully open and fully closed, the flow rate can also be controlled via an intermediate opening angle.

1.2 Standard specifications

■ EXV standard specifications (Table 1)

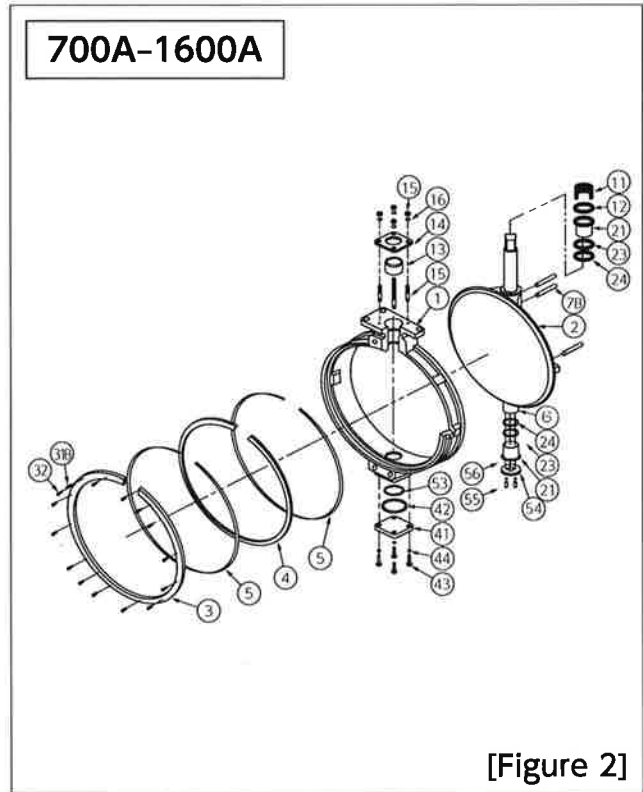
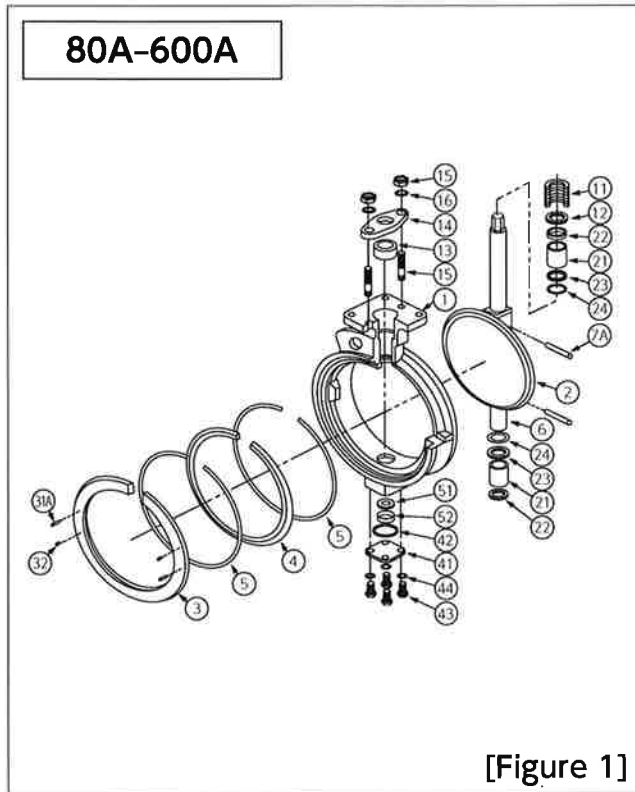
Valve type		ExVLL	
Body shape		Double eccentric wafer	
Valve type		80A, 100A, 125A, 150A, 200A, 250A, 300A, 350A, 400A, 450A, 500A, 600A, 700A, 800A, 900A, 1000A, 1200A, 1400A, 1600A	
Maximum operating pressure		1.0 bar	
Allowable valve seat leakage		Flow rate × 0.1%	
Pressure direction (Direction of flow)		Stem pressurization (Recommended)	
Applicable standards	End-to-end dimensions	EN558 (20 series)	
	Applicable flange connection	JIS 5K	
	Top flange	ISO 5211 compliant (80A - 600A) OKM self-imposed measurement (700A - 1600A)	
Standard materials	Body	SCS13A	SCS14A
	Valving element	SCS13A	SCS14A
	Valve stem	SUS316	
	Seat ring	SUS316	
	Gland packing	Graphite	
Fluid temperature range		0 °C – 450°C	
Ambient temperature range		-10°C – 60°C	
Test pressure	Body pressure resistance	Pneumatic pressure: 1.5 bar	
	Valve seat leakage	Pneumatic pressure: 1.0 bar	
Actuator	Pneumatic cylinder	Single acting type	80A – 800A
		Double acting type	80A – 1600A
Application limit (limit value) of average fluid velocity in pipe		30 m/s or less (Valve fully open, continuous operation)	
Coating		Unpainted for both SCS13A and SCS14A (Actuator is manufacturer standard)	

■ EXV standard specifications (Table 2)

Valve type		ExVHH	
Body shape		Double eccentric wafer	
Valve type		80A, 100A, 125A, 150A, 200A, 250A, 300A, 350A, 400A, 450A, 500A, 600A, 700A, 800A, 900A, 1000A, 1200A, 1400A, 1600A	
Maximum operating pressure		3.5 bar	
Allowable valve seat leakage		Size squared × 0.001 (L/min)	
Pressure direction (Direction of flow)		Stem pressurization (Recommended)	
Applicable standards	End-to-end dimensions	EN558 (20 series)	
	Applicable flange connection	JIS 10K / ISO PN10	
	Top flange	ISO 5211 compliant (80A - 600A) OKM self-imposed measurement (700A - 1600A)	
Standard materials	Body	SCS13A	SCS14A
	Valving element	SCS13A	SCS14A
	Valve stem	SUS316	
	Seat ring	SUS316	
	Gland packing	Graphite	
Fluid temperature range		0 °C – 550°C	
Ambient temperature range		-10°C – 60°C	
Test pressure	Body pressure resistance	Pneumatic pressure: 5 bar	
	Valve seat leakage	Pneumatic pressure: 3.0 bar	
Actuator	Pneumatic cylinder	Single-acting type	80A – 400A
		Double-acting type	80A – 1600A
Application limit (limit value) of average fluid velocity in pipe		30 m/s or less (Valve fully open, continuous operation)	
Coating		Unpainted for both SCS13A and SCS14A (Actuator is manufacturer standard)	

Structural Drawing

2.1 Exploded view and part names



Parts List (80A-600A)				
No.	Parts Name	Qty.	Consumables set	Spare packing set
1	Body	1		
2	Disc	1		
3	Set ring	1		
4	Seat ring	1	○	
5	Seat gasket	2	○	
6	Stem	1		
7A	Taper pin	1set		
11	Gland paking	1set	○	☆
12	Paking washer	1		
13	Gland	1		
14	Gland flange	1		
15	Gland bolt, nut	2		
16	Spring washer	2		
21	Bush	2		
22	Spacer	1set		
23	Paking	2		
24	Ring	2		
31A	Set pin	1set	○	
32	Draw out screw	1set	○	
41	Cover	1		
42	Gasket	1	○	☆
43	Cover bolt	4		
44	Cam lock washers	4		
51	Spring	4		
52	Guide ring	1	350A, 600A only	

Parts List (700A-1600A)				
No.	Parts Name	Qty.	Consumables set	Spare packing set
1	Body	1		
2	Disc	1		
3	Set ring	1		
4	Seat ring	1	○	
5	Seat gasket	2	○	
6	Stem	1		
7B	Pin	1set		
11	Gland paking	1set	○	☆
12	Paking washer	1		
13	Gland	1		
14	Gland flange	1		
15	Gland bolt, nut	4		
16	Spring washer	4		
21	Bush	2		
23	Paking	2		
24	Ring	2		
31B	Set screw	1set	○	
32	Draw out screw	1set	○	
41	Cover	1		
42	Gasket	1	○	☆
43	Cover bolt	4		
44	Cam lock washers	4		
53	Thrust bush	1		
54	Adppter	1		
55	Adppter bolt	2		
56	Cam lock washers	2		

Consumables set contains parts marked with ○.
Spare packing set contains parts marked with ☆.

Note: Parts marked with ★ in the Remarks column are consumable parts. When ordering a consumable parts set, specify a "Seat Ring Set." The above parts will include a hex key (Part No. 21 hexagon socket locking screw for attachment and removal).

3. Precautions

3.1 Safety precautions



WARNING 3.1.1 Product handling

1. Only a person who has thoroughly read and sufficiently understands the content of this manual should assemble, operate, and maintain the product.
2. Follow legal and business regulations and wear protective gear such as a helmet, safety harness, safety glasses, work gloves, and safety shoes when carrying out any work.
3. Do not climb onto or place heavy objects on the product. Doing so will not only damage the product, but could also result in falling and other accidents.



WARNING 3.1.2 Safety check

Before removing the device, check the following items to ensure that it can be removed safely.

1. Have you taken measures to prevent the product from falling or rolling away?
2. Are the product, flange, and piping surface temperatures cool enough to touch?
3. Is the pressure inside the pipe the same as atmospheric pressure, and has the fluid been purged?
4. Have sufficient safety measures been taken if the fluid inside the pipe is toxic, flammable, or corrosive?
5. Have relevant power sources, air sources, and other energy sources been shut off?
6. Are there any fluids harmful to humans stuck to the surface of the product or surrounding pipes?

Check the following items when restarting the device.

1. Are the product and the actuator securely fastened?
2. Is the exterior damaged or are there any missing parts?
3. Are there any tools attached to the product or piping?
4. Is there anything that could hinder the operation of the product (lever or handle operation, valve opening/closing)?
5. Is it possible to safely evacuate in case of unexpected operation or leaks?



3.2 Transportation and storage



WARNING 3.2.1 Transportation

1. Heavy products (approximately 20 kg or more) should be moved using equipment or machinery rather than relying on a person's strength alone. Check the catalog or product drawing issued by OKM for information on the weight of the product.
2. Works such as forklifts, cranes, and slings should only be operated by certified individuals within the confines of legal and business safety regulations. Also make sure to follow Item 3.2.2.
3. When transporting the product, take sufficient measures, such as resting, to ensure that it is not scratched or damaged. Scratches and other damage can result in leaks and corrosion.
4. Use a container when transporting the product via sea routes. Sea breeze can corrode the product if a container is not used.
5. Use a box car or other enclosed vehicle when transporting the product via land to protect it from wind and rain. Cover the product with a sheet when transporting it in an uncovered vehicle.
6. Do not throw the product or place heavy loads on top of it.



WARNING 3.2.2 Falls

1. Before hoisting or lifting with a sling, carefully check the weight of the product and use equipment and machinery that is capable of handling the weight. Take sufficient safety measures to ensure that no one enters the area underneath the suspended load.
2. Secure a safe foothold with sufficient lighting during transportation and avoid working on unstable piping.
3. Properly secure the product during loading and unloading or shifting to prevent it from being dropped and damaged.
4. Do not use hooks on the handle to hoist or lift the product. Doing so is extremely dangerous, and can result in damage or dropping the product. Use a nylon sling or other material that will not damage the product and place it in a balanced position under the valve body neck when lifting the product.



WARNING 3.2.3 Packaging

Other than the Air to closed single acting type cylinder, the product is shipped fully closed according to actuator specifications. Take care not to scratch the edges of valve element, seat ring, or flange.



Mandatory 3.2.4 Unpacking

1. Only unpack the product directly before attaching piping. To protect the product from dust and other harmful substances and to avoid deterioration due to ozone and ultraviolet rays, do not leave the product unpackaged and exposed for long periods of time. Doing so could result in a drop in performance, contamination, discoloring, and deteriorated materials.
2. When opening the packaging with a knife, etc., take care not to scratch or damage the product.



Mandatory 3.2.5 Mandatory

To avoid a drop in performance, contamination, discoloration, and deteriorated materials, store the product in the following ways.

1. Do not store the product in direct sunlight, places subject to high temperatures and humidity, dusty or wet locations.
2. When storing the product, leave the cardboard packaging and protective packaging on the valve body and store it indoors (Temperature: 0°C to 50°C, humidity: 70% or less).
3. Humidity can weaken cardboard packaging, causing it to rip, resulting in damage to the product. Take care to ensure that the packaging does not become wet.
4. Do not store the product in areas with corrosive gas in the air. Doing so could corrode parts, resulting in poor performance.
5. During storage, do not allow the product to be dropped, tipped over, or shaken, and do not place heavy loads on top of it. Doing so could result in poor performance.
6. Do not stack the product during storage. Doing so could cause it to tip over, injuring others or damaging the product. (See Item 3.2.2)
7. Store the product in a fully closed state, and open and close it once every three months.
8. Do not store the product with heavy loads placed on the actuator. Doing so could result in poor performance.
9. When storing the product for a long period of time, coat plated parts (opening plate, bolts, nuts, etc.) with anti-rust spray.

3.3 Installation and usage environment



WARNING 3.3.1 Installation site and usage environment

Make sure you have sufficient work space in the installation site for actuator operation and wiring, and other anticipated work such as pipe fitting and maintenance.

In the following installation sites and usage environments, special arrangements may be necessary to comply with functional specifications and legal requirements. Contact a sales representative if you have any questions during the planning phase.

1. Special usage environments not included on the specifications sheet
2. Example of a location which could result in significant damages to persons, property, or the environment if the product malfunctions: High Pressure Gas Safety Act related equipment, Industrial Safety and Health Law related equipment, nuclear power related equipment, medical equipment, vehicles, etc.



Caution 3.3.2 Installation site environment

Implement the following measures depending on the environment of the installation site.

1. Avoid locations exposed to gas that includes salt content, corrosive gas, liquid chemicals, organic solvents and steam, and seawater.
2. If there is a possibility that the product could come into contact with radiant heat, cover the product and included equipment to protect them.
3. Do not submerge the product. When installed in a location where it could become wet at any time, cover the product and included equipment to protect them.
4. When installed on the deck of a boat, etc., take measures to protect the product from salt damage.



Mandatory 3.3.3 Installation site and usage environment temperature

When used outside the permissible temperature range, the seat ring and O-ring can be subject to heat degradation and hardening, and differences in thermal expansion or contraction of parts can result in malfunction, etc.

1. The ambient temperature of the installation site should remain within the ambient temperature range of product specifications (Section 1.2).
2. When left in direct sunlight, ensure that the product and actuator do not exceed the maximum permissible temperature.
3. Keep the product away from heat sources and install it in a location that remains within the ambient temperature range. When used in particular near motors or engines, air compressors, boilers, etc., the ambient temperature range may be exceeded.



Caution

3.3.4 Installation site vibration and shocks

Implement the following measures if the installation site is subject to vibration and shocks.

1. If the product is used in the following conditions, confirm the vibration, shock acceleration, etc. and contact a sales representative.

Locations expected to be subject to excessive vibration or shock, exceeding 2G (0 - 150 Hz)

2. Securely tighten mountings and connections to keep them from becoming loose.
3. Implement anti-vibration measures to lessen vibration and shocks to equipment. Install piping supports and anti-vibration materials.
4. Periodically inspect connections to ensure that they have not become loose or warped. Tighten bolts or replace parts if there are any problems. If bolts come off, the product may fall out of its mounting or rotate in an unexpected direction.



Prohibited

3.3.5 Removing and replacing the product and actuator

1. The actuator full close adjustment mechanism on the product determines the performance of the valve seat seal. Therefore, when removing the actuator, mark it to ensure that the position remains the same after reassembly by the method such as putting a matchmark.
2. Do not modify the product by removing the actuator and replacing it with a different type of actuator. The product is not guaranteed if the actuator is replaced or modified.



WARNING 3.3.6 Precautions when installing insulation

During test operation or normal operation, gland packing stress relaxation can result in decreased tightening force leading to external fluid leaks. To prevent leaks from occurring, install insulation as long as it does not interfere with gland bolt tightening. [Figure 3]



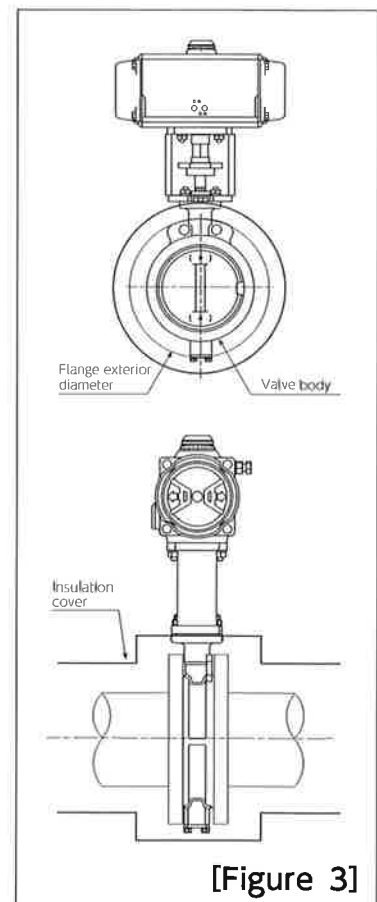
WARNING 3.3.7 Condensation

A difference in external and internal temperature can result in condensation forming on the actuator.



WARNING 3.3.8 Selection precaution

During the pipe fitting process, remember that there is a recommended pressure direction (direction of flow) for the product.



[Figure 3]

3.4 Pipe fitting precautions



Mandatory 3.4.1 Precautions before beginning pipe fitting

1. The material of the seat ring and valving element limits the working pressure, fluid, and temperature range of the product. Before beginning pipe fitting, make sure to check the specifications of the valve on the nameplate, in the catalog, and on the drawings.
2. Make sure there are sufficient footholds and lighting in the work space at the installation site.
3. Secure the pipes with supports as necessary to ensure that excessive loads are not placed on the piping due to the dead weight of the product or due to other tasks.
4. Use a standardized flat face or raised face flange as indicated in product specifications (Section 1.2).
5. Use carbon steel pipe, carbon steel pressure pipe, or stainless steel pipe greater than the "minimum pipe diameter" shown in Section 6.1.



Mandatory 3.4.2 Precautions during pipe fitting

When connecting piping, pay attention to the following items.

From a safety standpoint, you should stop use and replace the product if it is struck and dented or damaged in any way.

1. Thoroughly wash piping to remove any cutting chips, cutting oil, and any other debris from inside the pipe before installation.
2. Do not apply strong force to, hit with objects, or strike the product or piping. Rough handling can warp or damage the product, leading to leaks and malfunction.
3. The product has a designated pressure direction (direction of flow). During pipe fitting, make sure to align the pipes in the direction of the arrows marked on the body.
4. Avoid a piping configuration where the actuator is pointing downward.
5. Do not climb onto or hit the product in order to insert it into piping.
6. Always use a gasket between the pipe flange and valve. Use a joint sheet gasket or spiral gasket. See the table in Section 6.2 for details on pipe gasket dimensions.
7. The product seals in fluid when the pipe flange compresses the set ring using the compression force of the gasket. To properly hold the set ring in place during pipe fitting, make sure the product and the center of the flange are aligned. Utilize the centering sections on the top and bottom of the product body during piping for easier centering. Operating the product while it is off-center can result in damage, malfunction, outside leakage, and valve seat leakage.
8. Check the following precautions when tightening pipe bolts. See Item 4.1.1 for instructions on tightening.



Caution

Use of an impact wrench

Caution must be exercised when using a high-output impact wrench to connect pipes for the butterfly valve or for tightening pipe bolts, as the impact wrench model or manner of use can result in warping or damaging the valve body, seat ring, pipe flanges, pipe bolts, etc. When using an impact wrench, make sure to use less than the "maximum allowable value" for the maximum output as shown in the table below.

[Table 3] Maximum allowable torque for a metal flange (Unit: Nm)

Bolt type	M16	M20	M22	M24	M27	M30	M33	M36	M39	M45
Impact torque (Nm)	250	500	650	850	1200	1700	2300	3000	3900	6000

Note: Bolts must be coated with the proper type of lubricant.

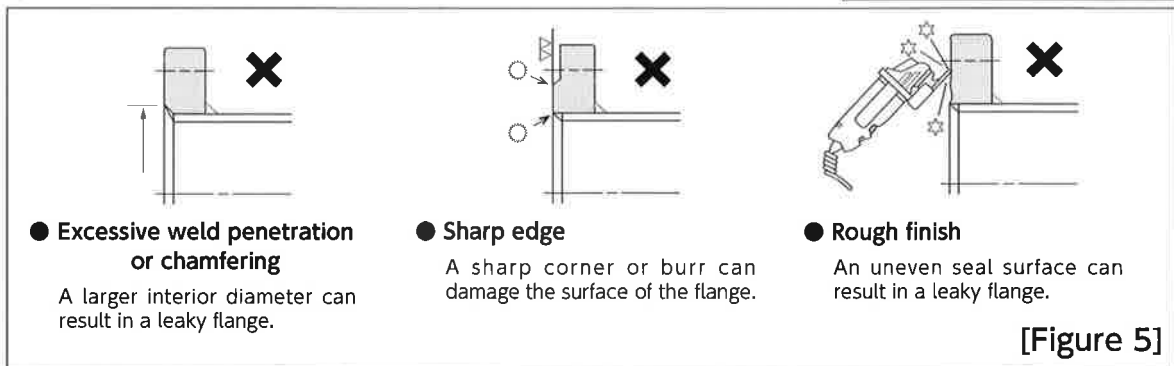
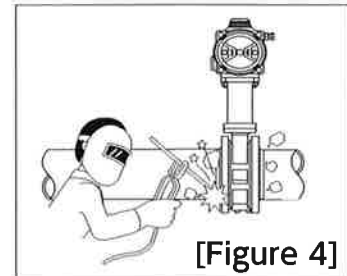
3.4 Pipe fitting precautions

(Continued)



Prohibited

9. Never weld a pipe while it is connected. Immediately attaching the product to a pipe flange directly after welding can cause heat damage to the seat ring and seriously affect the product. Wait until the temperature has cooled sufficiently and remove welding spatter before attaching the product and piping. [Figure 4]
10. If the flange surface contacts the product seat ring as shown in [Figure 5], the flange may leak.



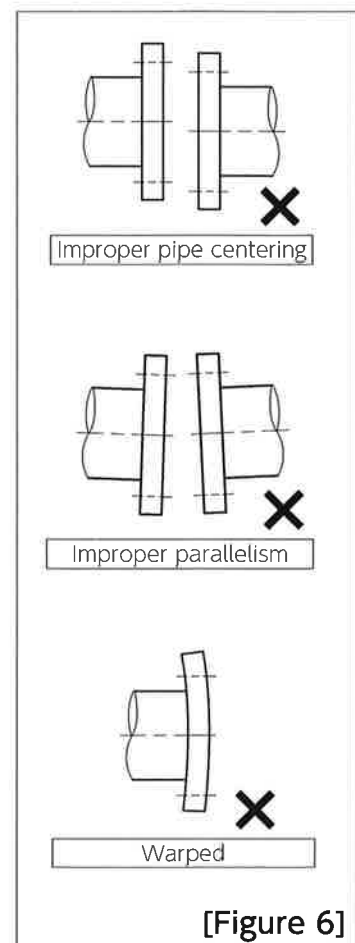
Prohibited

11. Accurately center the primary and secondary pipes and check for parallelism and make sure there is no warping. Imprecise centering can result in outside leakage, valve seat leakage, and malfunction. [Figure 6]



Mandatory

12. When attaching the product to a check valve or flexible coupling, insert a shortened pipe in the space between. Failure to insert a short pipe can result in the valving element contacting the check valve or coupling during operation, resulting in malfunction, outside leakage, and valve seat leakage. See Section 6.1 for valving element protrusion dimensions.
13. Connect the product to the primary side of the curved pipe (elbow or T). If it must be connected to the secondary side, ensure a straight pipe distance that is five times greater than the diameter of the pipe from the curved pipe. Connect the product so that the fluid velocity is the same on the left and right sides in relation to its valve stem. Unbalanced torque caused by fluid velocity or pressure distribution on the valving element may occur when connected to the secondary side in the direct vicinity of a curved pipe, adversely affecting the increased operational ability, product performance, and product lifetime.
14. After piping is complete, open the product fully and confirm that the valving element and flange interior are not contacting one another.



3.5 Handling precautions after piping is complete



Mandatory 3.5.1 Handling precautions after piping is complete

After connecting piping, pay attention to the following items and conduct a final check. Failure to conduct a check can result in damage to the product or serious accidents.

1. Before beginning operation, remove any foreign objects from inside and outside the pipes and clean the product.
2. Increase the internal pipe pressure before beginning operation and make sure there are no leaks from the flange, gland, or lower sections. When doing so, make sure the internal pressure does not exceed the rated pressure of the valve.



Caution

3. After the test operation bolts will be lengthened due to heat expansion so retighten the bolts and nuts after pressure is lowered. See 4.1.1 - 10 "Pipe bolt tightening procedures" for instructions on how to tighten the bolts. If you find a leak from the bottom of the product, check if the hexagon bolts are loose. If you find a leak from the gland section, tighten the gland section nuts. If you cannot stop the leak, completely release the pipe internal pressure, remove the product from the piping, and replace the consumable parts of the gland section or lower section.



[Figure 7]



Mandatory

4. When conducting a pipe pressure resistance test that includes the product, open the valve fully and conduct the test below the rated pressure.
5. If operations are ceased for a long period of time after piping is completed, open and close the valve once every two weeks.
6. Do not fully close the product as an alternative to a blind flange.
7. After the test operation or after a certain period of use, retighten the pipe bolts and nuts after pressure is lowered. High-temperature fluids in particular result in pipe gasket stress relaxation, which loosens bolts and can result in leaky flanges.



WARNING 3.5.2 Product operation precautions

1. Never tighten the product bolts, pins, or pipe bolts when the pipe interior is pressurized. Doing so is dangerous, and could result in fluid spraying out of the product or pipes.
2. Do not remove the actuator from the product when the pipe interior is pressurized. Doing so could result in fast, unexpected valve operation or cause the valve stem to fly out.
3. When using the product while it is partially opened (aperture), make sure to leave it open to 30° or more. Closing it to 30° or less during continuous use can increase the jet flow speed, resulting in seat damage, pipe damage, vibration, and noise.



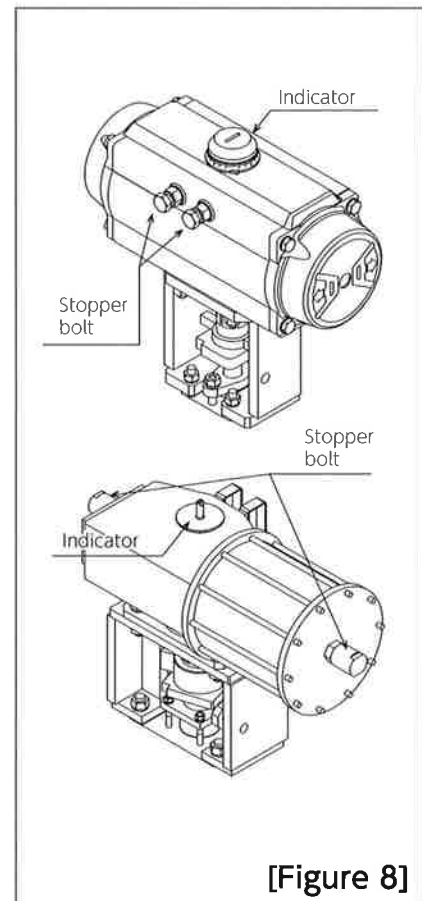
Prohibited

4. Do not loosen the stopper bolts on the actuator. The fully closed position can be misaligned, causing a valve seat leak. If the stopper bolts have been moved, follow Section 5.2 "Guidelines for adjusting valve body fully closed position" to readjust the fully closed position.



Caution

5. After piping is completed and before beginning operation, open and close the valve once or twice.
6. After the test operation or after a certain period of use, re-tighten the pipe bolts and nuts after pressure is lowered. High-temperature fluids in particular result in pipe gasket stress relaxation, which loosens bolts and can result in leaky flanges.



[Figure 8]

3.6 Maintenance and inspection



Mandatory 3.6.1 Daily inspection

Conduct the following during daily inspections.

[Table 4] Daily inspection

Inspection details	Inspection location	Inspection instructions	Solution
External fluid leak	Pipe connection	Visual	Tighten pipe bolts
			Valve and pipe centering/re-tightening
	Bottom, valve surface	Visual	Disassemble for maintenance (Replace consumable parts*1)
			Replace valve
	Gland	Visual	Tighten bolts
Noise or vibration	Valve/ actuator exterior, pipe around valve, bolts/nuts	Visual, touch	Change opening angle, review flow rate and pressure
			Tighten bolts/nuts, remove source of vibration
			Disassemble for maintenance (Check if any parts are damaged)
Bolts/nuts loose	Bolts/nuts	Visual, touch	Tighten bolts/nuts
			Tighten after reducing pressure parts
Valve seat leakage	Is there any leakage from secondary side? (Flow meter, pressure gauge, drain)	Auditory, Visual, measurement	Check via indicator to confirm if open/close position is correct
			Remove foreign objects by flushing with water while fully open (Item 3.6.6)
			Remove from piping (Item 3.6.7), inspect and clean
			Replace consumable parts*1
Check valve operation	Check open/close position, Manual valve: Operability, Auto valve: Operation	Visual, Operating feel	Check via indicator to confirm if open/close position is correct
Check for valve damage	Valve surface	Visual	Immediately stop use and replace valve if damaged

*1 Consumable parts should be replaced after approximately two years of operating time. They may need to be replaced earlier depending on the operating environment, however, you should use this time period as a reference for replacing consumable parts (See Section 2.1 Exploded view).



Mandatory 3.6.2 Periodic inspection

Conduct a periodic inspection of the following items every two years.

[Table 5] Periodic inspection instructions

Inspection details	Inspection location	Inspection instructions	Solution
Valving element corrosion or damage	Valving element	Remove from pipe, visual	Replace valve
Seat ring wear and damage	Seat ring	Remove from pipe, visual	Clean valving element and seat ring (Item 3.6.3) Replace consumable parts*1 Replace valve
Valve operation status	Valve and actuator	Open/close operation	Replace actuator, replace valve

*1 Consumable parts should be replaced after approximately two years of operating time. They may need to be replaced earlier depending on the operating environment, however, you should use this time period as a reference for replacing consumable parts (See Section 2.1 Exploded view).



Mandatory 3.6.3 Valve seat and body stopper cleaning

When using a pneumatic cylinder or electric motor, make sure to turn off the air source and power source and absolutely ensure that the actuator is not moving before inserting your hand into the valve interior. It is extremely dangerous if your hand is caught in a suddenly closing valving element. For single acting cylinders in particular, you must make sure that the air source is off and the operating air pressure has been purged.

1. When removing the product from piping for cleaning during periodic inspections, use a clean waste cloth/ sponge and neutral detergent or alcohol to clean the seat ring without damaging it.
2. Use a waste cloth to clean the periphery of the flanging element.
3. Make sure there are no scratches or wear on the inside of the seat ring and the periphery of the valving element.
4. Make sure there are no foreign objects stuck to the body stopper.



Mandatory 3.6.4 Replacing consumable parts

Always disassemble and reassemble the product in a clean location free of garbage and dust. For types and replacement procedure of consumable parts, see Section 2.1 "Exploded view and part names" and Chapter 5 "Maintenance."



Mandatory 3.6.5 Rust prevention

Make sure to use the following designated rust-prevention agents.

[Table 6] Rust prevention

Application site	Rust-prevention agent
Plated sections Opening plate, bolts, nuts	Rust-prevention agent



WARNING 3.6.6 Dealing with abnormalities

1. Follow legal and business regulations and wear protective gear such as a helmet, safety harness, safety glasses, work gloves, and safety shoes when carrying out any work.
2. Take sufficient safety measures if the fluid inside the pipe is toxic, flammable, or corrosive.
3. Before tightening the pipe flange, always lower the pressure inside the pipe to return it to atmospheric pressure. Also make sure that the pipe is sufficiently cool before tightening.
4. If operation is abnormal, foreign objects could be clogging the product, or the seat ring could be damaged. Using the product without addressing the problem can result in damage to the product or serious accidents. Follow the steps below to check the product.
 - (1) Fully open the valving element to rinse away the foreign objects.
 - (2) If step (1) above does not solve the problem, the seat ring could be damaged.
Remove the product from piping and inspect and clean it.



WARNING 3.6.7 Removing from/attaching to pipes

1. Before removing the product from piping, make sure to purge all remaining pressure and fluid from the equipment and piping. Failure to do so can result in fluid spraying out of the product or unpredictable operation.
2. Take necessary measures to prevent fluid from mistakenly flowing into the applicable pipe.
3. If necessary, wait a while to ensure that internal fluid does not leak out when removing the product.
4. Fully close the product to ensure that the valving element does not come out from the interface before removing it from or attaching it to the pipes. (For detailed procedures, see Item 4.1.1.)
5. Leave the bottom nuts and bolts on and remove the valve. Attaching jack bolts between the flanges can make the task easier.



WARNING 3.6.8 Disposal

1. Dispose of the product as general industrial waste. It does not contain any materials that cannot be processed as general industrial waste.
2. When separating materials for disposal, refer to the materials on the drawings for guidelines.
3. Dispose of the product according to national laws, local government and business regulations.

4. Piping

4.1 Piping guidelines

4.1.1 Piping procedures

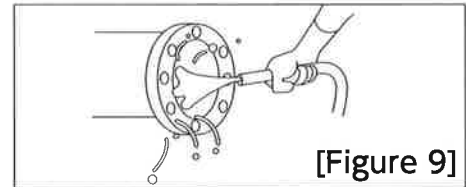
Thoroughly read Section 3.4 "Pipe fitting precautions" before beginning piping procedures, and follow the steps below.



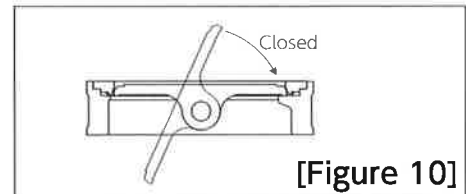
Caution

When attaching the product to a check valve, pump, or flexible coupling, insert a shortened pipe in the space between. Failure to do so could result in the pipe hitting the valve element during operation, resulting in malfunction or leaks.

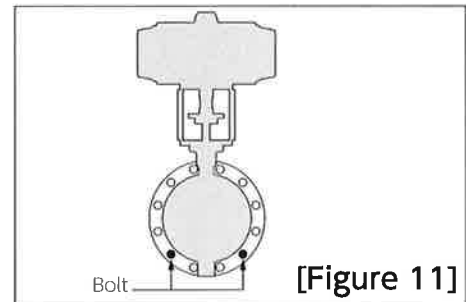
1. Clean the flange surface that comes into contact with the product. Remove any rust or foreign objects if present, and clean the product with an appropriate solution (alcohol or neutral detergent). [Figure 9] Remove all foreign objects from inside pipes before connecting the product.
2. Fully close the product before installing or removing it. [Figure 10]
3. After aligning the center of both flanges, insert pipe bolts as shown in the drawing and secure the product so that it does not fall. [Figure 11]
4. Set jack bolts as shown in the drawing and increase the distance between flanges. Keep the flange distance approximately 6 to 10 mm from the valve interface width. Do not remove the jack bolts until all pipe bolts have been attached. [Figure 12] [Figure 13]
5. Do not use hooks on the handle to hoist the product. Use a nylon sling or other material that will not damage the body and place it in a balanced position under the product when lifting the product. [Figure 13]
6. The product has a designated pressure direction (direction of flow). During pipe fitting, make sure to align the valve pressure direction in the direction of the arrows marked on the body. Take care not to scratch the surface of the valve flange. Forcing the flanges when attaching pipes can damage the flange surface, resulting in leaks. Always use jack bolts, etc. to secure sufficient distance between flanges when inserting the product. [Figure 13]
7. Insert a pipe gasket between both ends of the valve and the pipe flange surfaces.
8. After the product is fully inserted, insert pipe bolts as shown in the piping guide. [Figure 14, 15]
9. Remove the jack bolts after all pipe bolts have been attached.



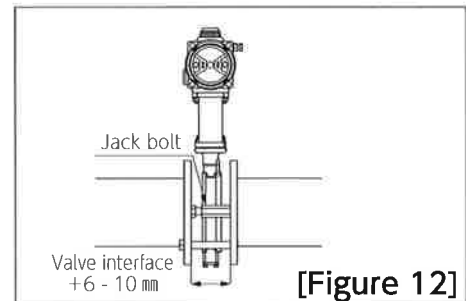
[Figure 9]



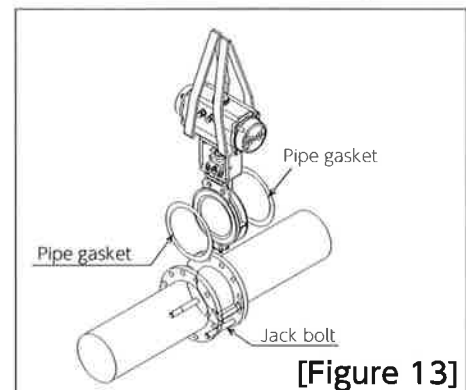
[Figure 10]



[Figure 11]



[Figure 12]



[Figure 13]

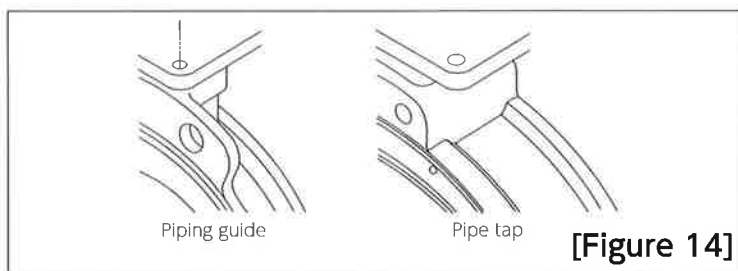


4.1 Piping guidelines

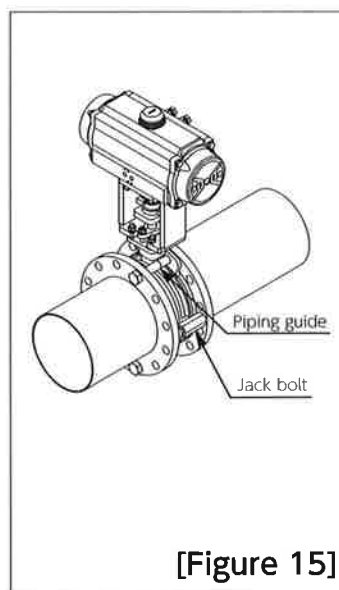
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10. Follow the procedures below to tighten pipe bolts so that the flange and the product are properly centered and to prevent uneven tightening. The product seals in fluid when the pipe flange compresses the seat ring using the compression force of the gasket. To properly hold the seat ring in place during pipe fitting, make sure the product and the center of the flange are aligned. Utilize the centering ribs during piping for easier centering. Operating the product while it is off-center can result in damage, malfunction, outside leakage, and valve seat leakage.

※ When using an impact wrench, make sure to refer to Item 3.4.2.



[Figure 14]



[Figure 15]

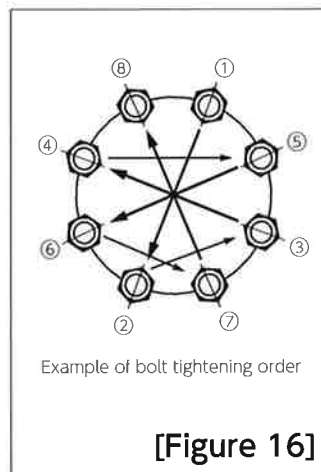


Caution

Pipe bolt tightening procedures

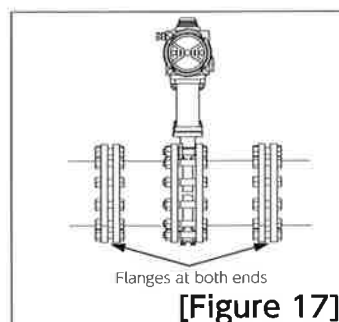
If there are no appropriate in-house tightening procedures, tighten the nuts and bolts as shown below.

1. Clean each nut and bolt and apply lubricant. (Do not use rusted or damaged nuts or bolts.)
2. Tighten the nuts and bolts by hand in no particular order.
3. Tighten bolts in any order using approximately 20% torque.
4. In diagonal order (See Figure on right), tighten bolts using approximately 70% torque.
5. Tighten bolts in diagonal order using 100% torque.
6. Again, tighten bolts in diagonal order using 100% torque.
7. Tighten bolts in clockwise order using 100% torque. Pipe gasket stress relaxation can cause bolts to loosen once they have been tightened. Always re-tighten 6 and 7 and repeat until all bolts are evenly tightened.



[Figure 16]

11. Temporarily tighten the flanges at both ends, and fully tighten the product so that the flange and the product are properly centered. [Figure 17]
12. After piping is complete, open and close the product to make the operation from fully open to fully closed is smooth.



[Figure 17]

5. Maintenance

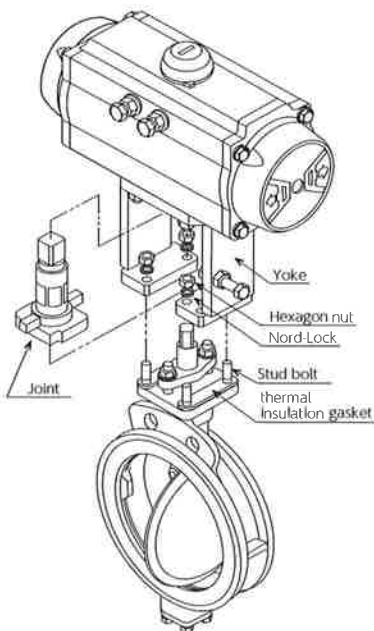
5.1 Guidelines for removing and assembling the valve body and actuator



Caution

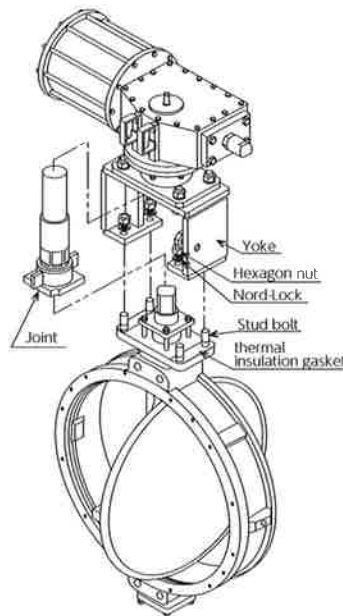
Before attaching and removing the actuator while the product is attached to piping, confirm that the internal pipe pressure is equal to atmospheric pressure, and that internal fluid has been purged.

80A - 600A



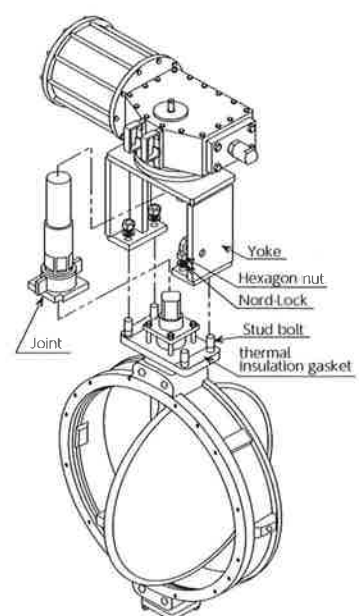
[Figure 18]

700A - 1000A



[Figure 19]

1200A - 1600A



[Figure 20]

5.1.1 How to remove the actuator

Thoroughly read Section 3.4 "Pipe fitting precautions" before beginning piping procedures, and follow the steps below.

1. Secure the bottom of the body with a vice or press. When doing so, make sure not to scratch the flange surfaces.
2. Remove the hexagon nuts securing the body and yoke.
3. Lift the actuator up and remove it from the body. When doing so, the joint may also be pulled up with the yoke, so take care not to drop the joint.

5.1.2 How to assemble the actuator

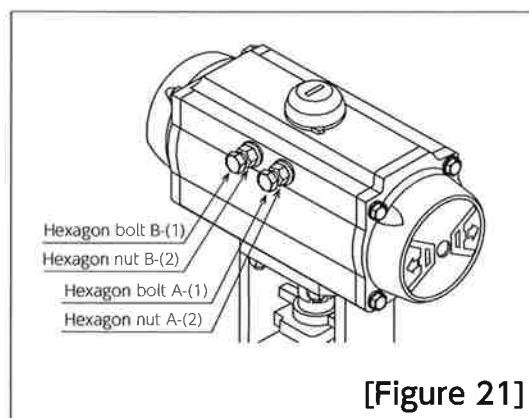
1. Secure the bottom of the body with a vice or press and set the opening angle to the fully open position. When doing so, make sure not to scratch the flange surfaces.
2. Set the actuator to the fully open position.
3. Attach an insulating gasket to the body where the stud bolts are screwed in.
4. Insert the joint between the body and yoke, attach the actuator, and secure with hexagon nuts and Nord-Lock washers. When doing so, take care to make sure the joint index matches the angle of the valving element.
5. Follow Section 5 "Guidelines for adjusting fully closed position" to adjust the fully closed position.



5.2 Guidelines for adjusting the valve body fully closed position

5.2.1 Guidelines for adjusting fully closed position (80A - 600A)

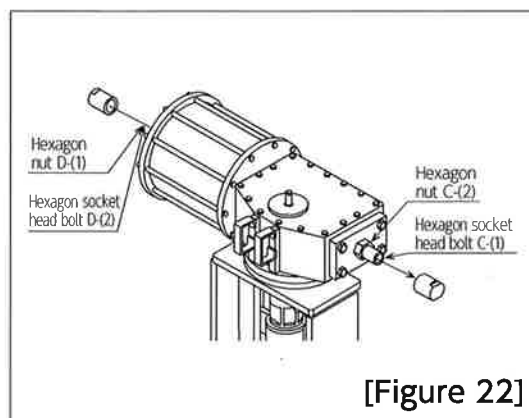
1. Set the valve to the fully open position.
2. Loosen hexagon nut A-(2) and hexagon bolt A-(1).
3. Fully close the valve and make sure that hexagon bolt A-(1) is free. (If not, further loosen hexagon bolt A-(1).)
4. Tighten it until it lightly touches hexagon bolt A-(1). (Do not use excessive force to tighten with a tool such as a wrench.)
5. Set the valve to the fully open position.
6. Tighten hexagon bolt A-(1) 1/4 turn.
7. Tighten hexagon nut A-(2) so that hexagon bolt A-(1) does not rotate.



[Figure 21]

5.2.2 Guidelines for adjusting fully closed position (700A - 1600A)

1. Set the valve to the fully open position.
2. Loosen hexagon nut C-(2) and hexagon socket locking screw C-(1).
3. Fully close the valve and make sure that hexagon socket locking screw C-(1) is free. (If not, further loosen hexagon bolt and hexagon socket locking screw C-(1).)
4. Tighten it until it lightly touches hexagon socket locking screw C-(1). (Do not use excessive force to tighten with a tool such as a wrench.)
5. Set the valve to the fully open position.
6. Tighten hexagon socket locking screw C-(1) 1/4 turn.
7. Tighten hexagon nut C-(2) so that hexagon socket locking screw C-(1) does not rotate.

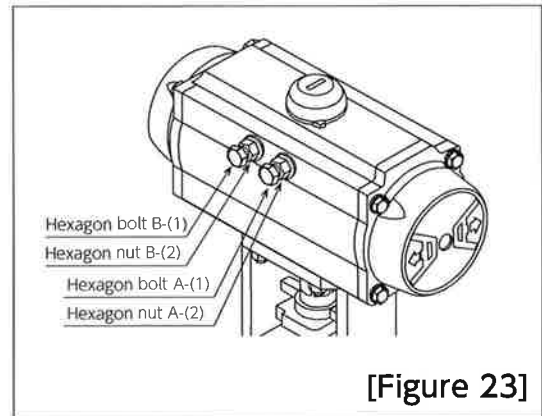


[Figure 22]

5.3 Guidelines for adjusting valve body fully open position

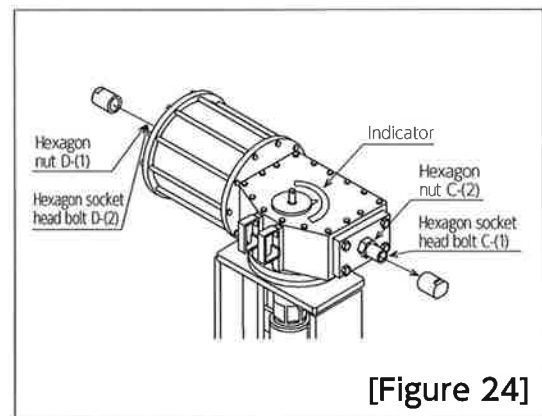
5.3.1 Guidelines for adjusting fully open position (80A - 600A)

1. Set the valve to the fully close position.
2. Loosen hexagon nut B-(2) and hexagon bolt B-(1). Turn hexagon bolt B-(1) clockwise to make the fully open position shallower, and turn it counterclockwise to make it deeper.
3. Set the valve to the fully open position.
4. Check the indicator position to make sure it is turned 90° from the fully closed position. If the fully open angle is misaligned, return to step 1 and repeat adjustment procedures.
5. Set the valve to the fully close position.
6. Tighten hexagon nut B-(2) so that hexagon bolt B-(1) does not rotate.



5.3.2 Guidelines for adjusting fully open position (700A - 1600A)

1. Set the valve to the fully close position.
2. Loosen hexagon nut D-(2) and hexagon bolt D-(1). Turn hexagon bolt D-(1) clockwise to make the fully open position shallower, and turn it counterclockwise to make it deeper.
3. Set the valve to the fully open position.
4. Check the indicator position and check to make sure it is turned 90° from the fully closed position. If the fully open angle is misaligned, return to step 1 and repeat adjustment procedures.
5. Set the valve to the fully close position.
6. Tighten hexagon nut D-(2) so that hexagon socket head bolt D-(1) does not rotate.



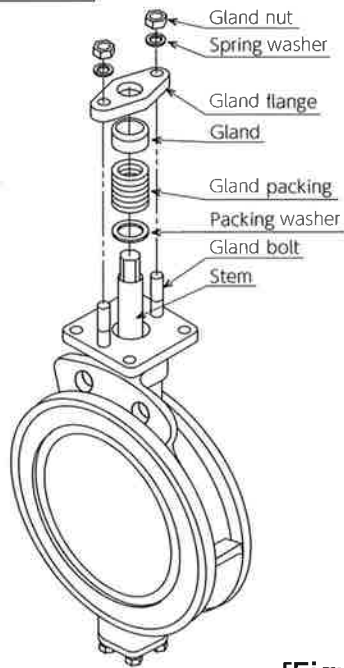
5.4 Gland disassembly and assembly guidelines



Caution

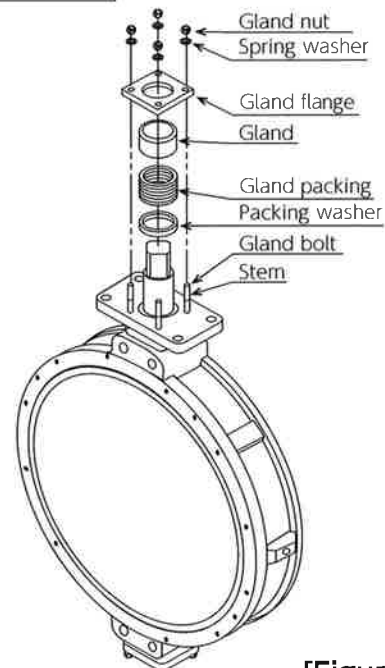
Before replacing this component, make sure the pressure inside the pipe is equal to atmospheric pressure, and that the interior of the pipe is at room temperature. Also, do not replace the component until you can confirm that any fluid left in the device is not harmful to human health.

80A - 600A



[Figure 25]

700A - 1600A



[Figure 26]

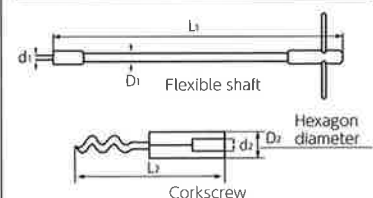
5.4.1 Disassembly

1. Remove the valve actuator.
2. Remove the gland nut, gland flange, and gland.
3. Remove the gland packing. [Figure 27]
(Use a gland packing removal tool, etc. to remove the packing.)
4. Use a cloth to clean the stem, inside the body gland box, and the washer.

5.4.2 Assembly

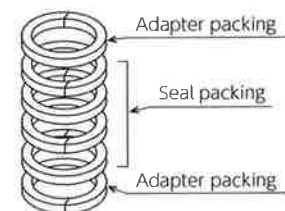
1. Insert the packing washer.
2. Insert gland packing by pushing the seal packing with the adapter packing. Make sure the cuts in the packing alternate sides. Take care not to scratch the packing.
3. Attach the gland and gland flange, and tighten the gland nut to the designated torque. (See Table 7)
When finishing, take care not to allow tightening to become uneven.
4. Attach the actuator. If there are any leaks or once the temperature increases, tighten the bolts as necessary.

Gland packing removal tool



[Figure 27]

Gland packing detail drawing

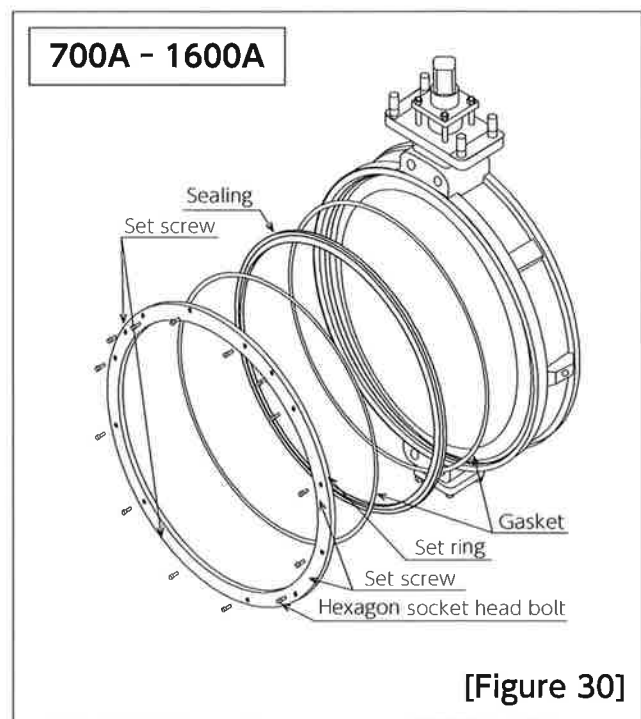
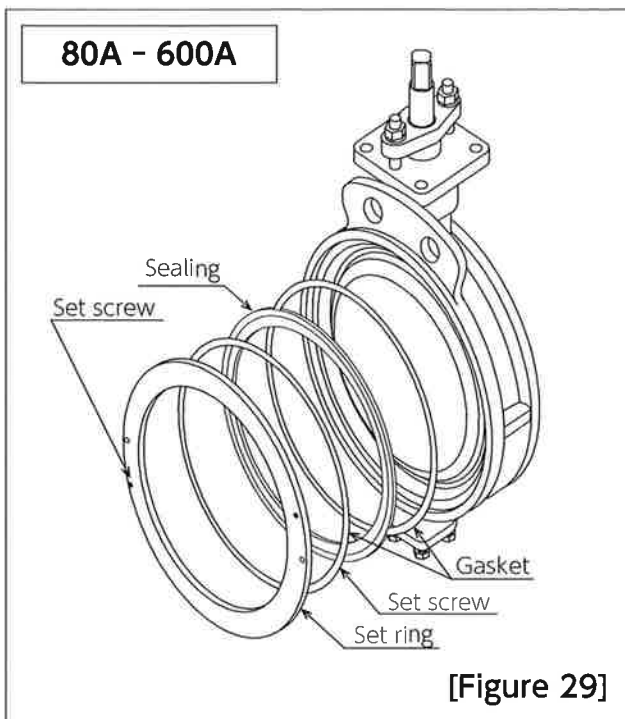


[Figure 28]

[Table 7] Initial tightening torque table

Nominal diameter	80A	100A	125A	150A	200A	250A	300A	350A	400A	450A	500A	600A	700A	800A	900A	1000A	1200A	1400A	1600A
Tightening torque N·m	7	7	12	12	17	25	28	51	57	78	111	129	63	86	90	95	135	220	250

5.5 Seat ring disassembly and assembly guidelines



Caution

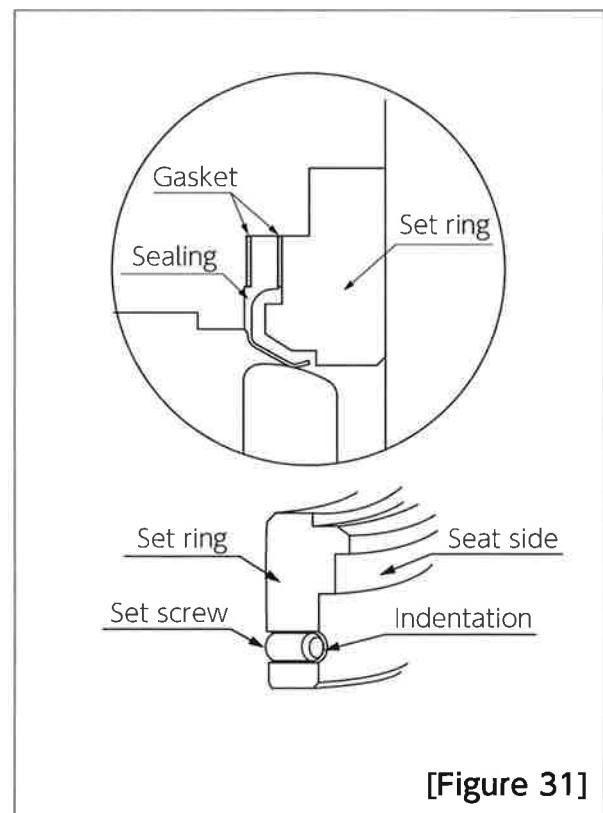
For safety purposes, never operate the valve using the actuator during this task.

5.5.1 Disassembly

1. Keep the valve slightly more open than the fully closed position.
2. [80A - 300A] Tighten the two set screws on the set ring with a hexagon wrench, and pull out the set ring. For 350A - 1600A, after removing the set ring hexagon socket head bolts, tighten the set screw and pull out the set ring.
3. Remove the seat ring and gasket.

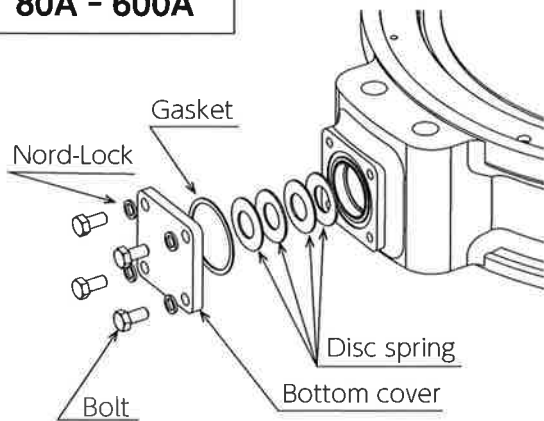
5.5.2 Assembly

1. Set the valve to the fully closed position.
2. Attach the gasket, seat ring, and gasket to the valve body in that order.
3. For 80A - 300A, align the valve body set pin with the set ring set pin hole position and attach the set ring. For 350A - 1600A, after attaching the set ring, tighten the hexagon socket head bolt.
4. Screw the hexagon socket locking screw into the set ring hole.
5. Make sure the set screw is not sticking out from the set ring.



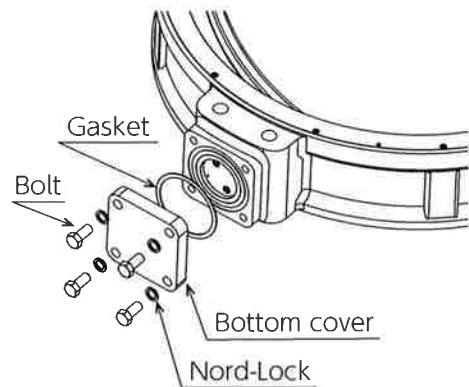
5.6 Replace bottom gasket

80A - 600A



[Figure 32]

700A - 1600A



[Figure 33]



Caution

Before replacing this component, make sure the pressure inside the pipe is equal to atmospheric pressure, and that the interior of the pipe is at room temperature. Also, do not replace the component until you can confirm that any fluid left in the device is not harmful to human health.

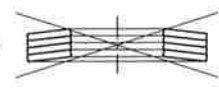
1. Loosen the bolts and replace them along with the Nord-Lock washers.
2. Remove the gasket and bottom cover.
3. Clean the body and bottom cover, and remove all debris.
4. Put a new gasket onto the body.
(If the disc spring is also removed, insert it in series in combination with the body.)
5. Attach the bottom cover to the body.
Attach and tighten the hexagon bolts and Nord-Lock washers.

<Disc spring information>

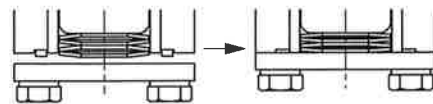
1. Make sure all disc spring combinations are "in series."

In series (Face-to-face)

In parallel (Same direction)



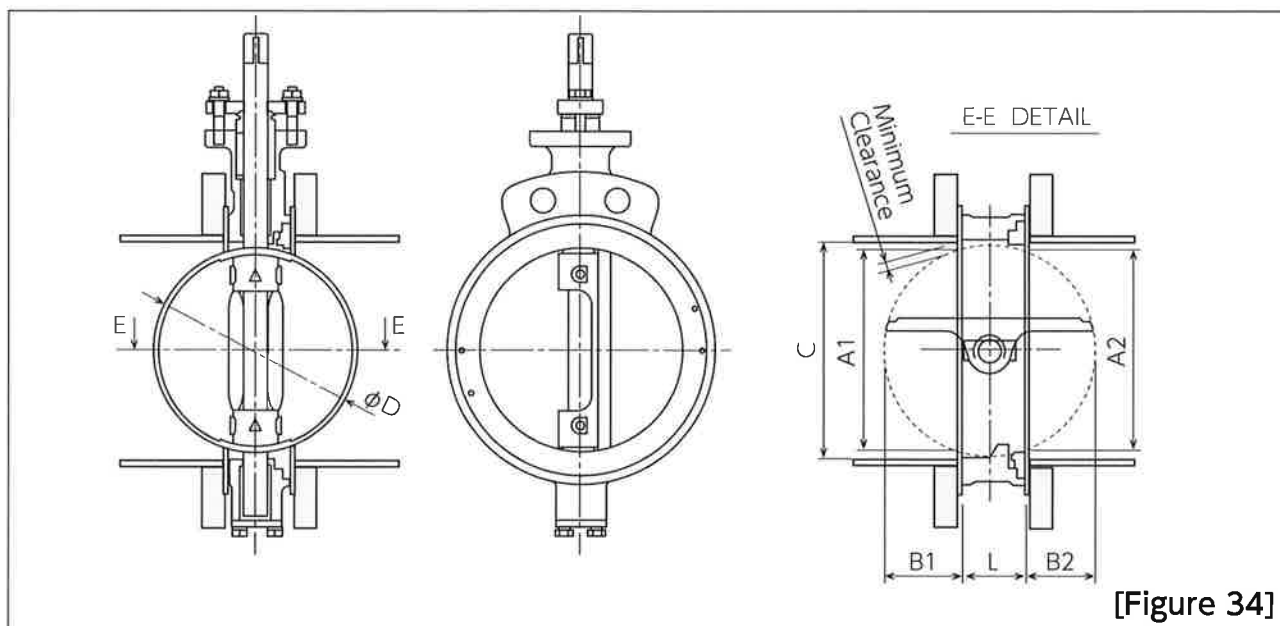
2. Disc springs increase tightening force, however, keep tightening until there are no gaps.



6. Piping data



6.1 Minimum inner piping diameter and valving element protrusion dimensions when fully open



[Figure 34]

Size	Face to Face L	Disc Diameter D	A1	B1	A2	B2	Minimum Clearance	Min.Pipe I.D. C
80A	46	72	64	17	52	13	2	69
100A	52	93	79	21	79	23	2	84
125A	56	120	109	33	108	34	2	113
150A	56	144	135	45	135	46	2	139
200A	60	193	189	72	184	64	3	195
250A	68	243	239	92	235	86	3	245
300A	78	292	288	114	283	104	3	294
350A	78	327	323	131	319	121	3	330
400A	102	365	360	140	353	128	3	366
450A	114	414	408	157	403	148	3	414
500A	127	462	456	177	449	164	3	462
600A	154	569	562	219	555	203	3	569
700A	165	675	668	267	661	250	6.5	682
800A	190	771	762	301	757	287	6.5	776
900A	203	873	867	350	858	328	6.5	880
1000A	216	973	967	395	958	370	6.5	980
1200A	254	1174	1162	473	1157	455	6.5	1175
1400A	279	1373	1363	566	1355	536	6.5	1377
1600A	318	1573	1566	653	1553	612	6.5	1579

※ Minimum Clearance conform to JIS B 2032 (80A - 600A) , Large diameter is OKM standards (700A - 1600A) .

※ Piping Gasket shall be spiral wound gasket nominal thickness 4.5 mm (3.2 mm after tightening) .

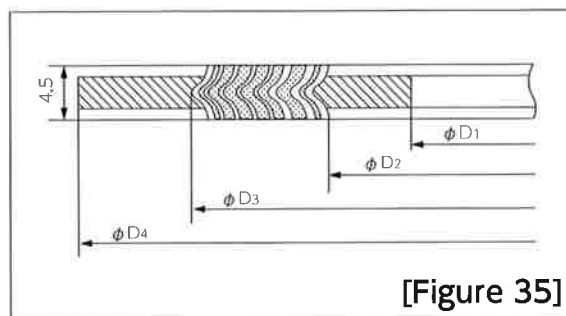
Note: The butterfly valve valving element protrudes into piping when fully open. When using piping or a flange that is less than the minimum inner diameter, insert a spacer, etc. in between the product and flanges.

6.2 Pipe gasket dimensions

Always use the following dimensions for EXV series butterfly valve pipe gaskets.

※ Remember that caution is needed as dimensions differ from general standardized items.

- When selecting a spiral gasket type, use a gasket with inner and outer rings.
- Use high-strength alloy steel SNB-7 or above for pipe bolts.
- Materials: (Valqua brand) V#6596, V#8596 or equivalent items



[Figure 35]

JIS 10K flange/PN10 flange

Unit : mm

Nominal diameter	D1	D2	D3	D4	
				JIS 10K	PN10
50	61	69	90	104	109
65	74	82	104	124	129
80	85	93	120	134	144
100	111	119	139	159	164
125	136	144	174	190	194
150	158	170	203	220	220
200	211	224	250	270	275
250	256	278	313	332	330
300	316	329	358	377	380
350	354	366	400	422	440
400	400	417	457	484	491
450	443	470	518	539	541
500	500	520	570	594	596
600	600	620	670	700	698
700	698	726	776	810	813
800	800	828	878	920	920
900	902	931	981	1020	1020
1000	1003	1033	1083	1124	1127
1200	1206	1240	1302	1344	1344
1400	1408	1444	1508	—	1551
1600	1608	1648	1720	—	1775

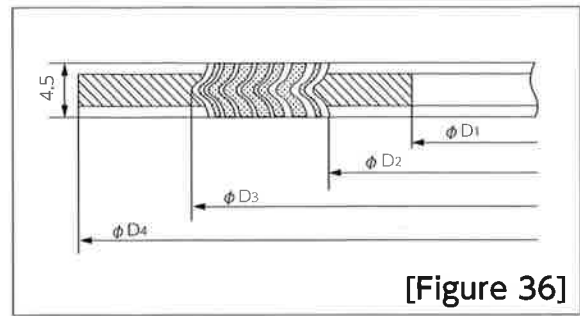
6.2 Pipe gasket dimensions

(Continued)

Always use the following dimensions for EXV series butterfly valve pipe gaskets.

※ Remember that caution is needed as dimensions differ from general standardized items.

- When selecting a spiral gasket type, use a gasket with inner and outer rings.
- Use high-strength alloy steel SNB-7 or above for pipe bolts.
- Materials: (Valqua brand) V#6596, V#8596 or equivalent items



[Figure 36]

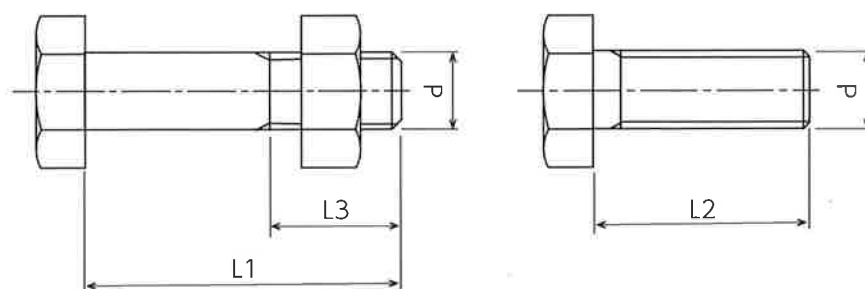
JIS 5K flange

Unit : mm

Nominal diameter	D1	D2	D3	D4
				JIS 10K
50	61	69	83	93
65	74	82	104	118
80	85	93	119	129
100	111	119	139	149
125	136	144	174	184
150	158	170	203	214
200	211	224	250	260
250	256	278	313	325
300	316	329	358	370
350	354	366	400	413
400	400	417	457	473
450	443	470	517	533
500	500	520	567	583
600	600	620	670	691
700	698	726	776	796
800	800	828	878	900
900	902	931	981	1000
1000	1003	1033	1080	1100
1200	1206	1240	1300	1320

6.3 Pipe bolt dimensions

ExVHH (JIS 10K)



[Figure 37]

FLENGE	JIS10K STEEL FLANGE				
MATERIAL	Hex-Bolt : SNB7, NUT : S45C				
Nominal Size DN	Hex-Bolt • Nut		Hex-Bolt		Weight (kg)
	d × L1 × L3	Q'ty	d × L2	Q'ty	
80A	M16 × 110 × 38	8	—	—	2.0
100A	M16 × 120 × 38	8	—	—	2.2
125A	M20 × 130 × 52	8	—	—	3.7
150A	M20 × 140 × 52	8	—	—	3.9
200A	M20 × 140 × 52	12	—	—	5.8
250A	M22 × 160 × 56	12	—	—	7.8
300A	M22 × 170 × 56	12	M22 × 055	8	10.0
350A	M22 × 170 × 56	12	M22 X 055	8	10.0
400A	M24 × 200 × 60	12	M24 X 055	8	13.7
450A	M24 × 220 × 73	16	M24 X 060	8	18.6
500A	M24 × 230 × 73	16	M24 X 060	8	19.2
600A	M30 × 270 × 85	20	M30 X 070	8	44.3
700A	M30 × 280 × 85	20	M30 X 075	8	46
800A	M30 × 310 × 85	24	M30 X 075	8	58
900A	M30 × 330 × 85	24	M30 X 080	8	61
1000A	M36 × 350 × 97	24	M36 X 085	8	96
1200A	M36 × 400 × 97	28	M36 X 090	8	122
1400A	—	—	—	—	—
1600A	—	—	—	—	—

Remark

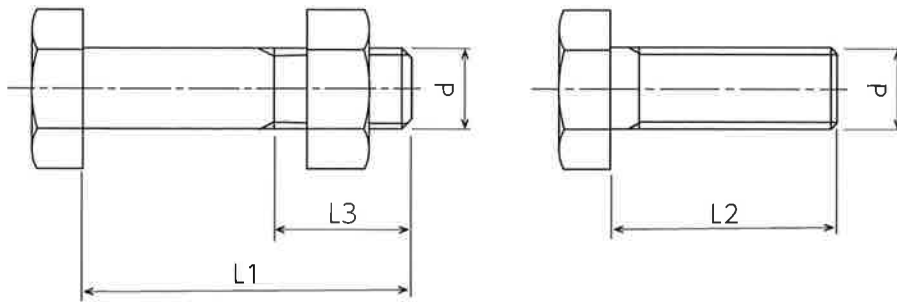
※ A hexagon nut uses a Heavy hex Nut.

※ A Piping gasket uses a spiral gasket.

※ A Piping gasket is calculated by nominal thickness 4.5 mm (tightening thickness 3.3 mm).

6.3 Pipe bolt dimensions

ExVHH (JIS 5K)



[Figure 38]

FLANGE	JIS5K STEEL FLANGE				
MATERIAL	Hex-Bolt : SNB7, NUT : S45C				
Nominal Size DN	Hex-Bolt • Nut		Hex-Bolt		Weight (kg)
	d × L1 × L3	Q'ty	d × L2	Q'ty	
80A	M16 × 110 × 38	4	—	—	1.0
100A	M16 × 120 × 38	8	—	—	2.2
125A	M16 × 120 × 38	8	—	—	2.2
150A	M16 × 120 × 38	8	—	—	2.2
200A	M20 × 140 × 52	8	—	—	3.9
250A	M20 × 150 × 52	12	—	—	6.1
300A	M20 × 160 × 52	8	M20 × 045	8	5.6
350A	M22 × 170 × 56	8	M22 × 050	8	7.2
400A	M22 × 190 × 56	12	M22 × 050	8	10.6
450A	M22 × 200 × 56	12	M22 × 055	8	11.1
500A	M22 × 220 × 69	16	M22 × 055	8	15.1
600A	M24 × 250 × 73	16	M24 × 060	8	20.3
700A	M24 × 260 × 73	20	M24 × 060	8	25.5
800A	M30 × 300 × 85	20	M30 × 065	8	47.6
900A	M30 × 310 × 85	20	M30 × 070	8	49.0
1000A	M30 × 330 × 85	24	M30 × 070	8	60.7
1200A	M30 × 370 × 85	28	M30 × 075	8	77.0
1400A	—	—	—	—	—
1600A	—	—	—	—	—

Remark

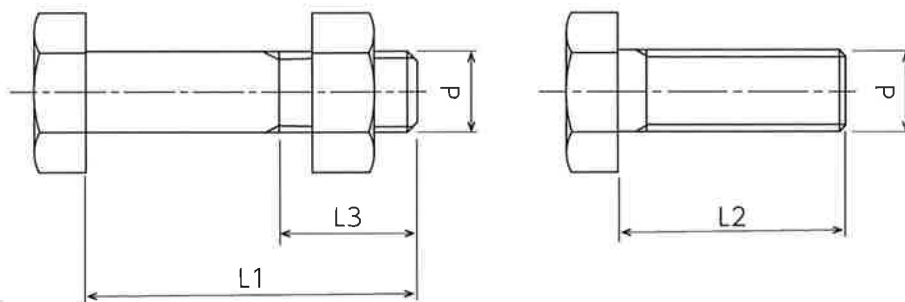
※ A hexagon nut uses a Heavy hex Nut.

※ A Piping gasket uses a spiral gasket.

※ A Piping gasket is calculated by nominal thickness 4.5 mm (tightening thickness 3.3 mm).

6.3 Pipe bolt dimensions

ExVHH (ISO7005-1 PN10)



[Figure 39]

FLENGE	ISO7005-1 PN10 STEEL FLANGE TYPE12				
MATERIAL	Hex-Bolt : SNB7, NUT : S45C				
Nominal Size DN	Hex-Bolt • Nut		Hex-Bolt		Weight (kg)
	d × L1 × L3	Q'ty	d × L2	Q'ty	
80A	M16 × 120 × 38	8	—	—	2.2
100A	M16 × 130 × 44	8	—	—	2.3
125A	M16 × 130 × 44	8	—	—	3.3
150A	M20 × 140 × 52	8	—	—	3.9
200A	M20 × 150 × 52	8	—	—	4.1
250A	M20 × 160 × 52	12	—	—	6.4
300A	M20 × 170 × 52	8	M20 × 055	8	6.0
350A	M20 × 170 × 52	12	M20 × 055	8	8.3
400A	M24 × 200 × 60	12	M24 × 055	8	13.7
450A	M24 × 210 × 60	16	M24 × 060	8	18.1
500A	M24 × 230 × 73	16	M24 × 060	8	19.2
600A	M27 × 270 × 79	16	M27 × 070	8	28.7
700A	M27 × 270 × 79	20	M27 × 070	8	35
800A	M30 × 310 × 85	20	M30 × 070	8	49
900A	M30 × 320 × 85	24	M30 × 075	8	59
1000A	M33 × 340 × 91	24	M33 × 075	8	73
1200A	M36 × 390 × 97	28	M36 × 085	8	119
1400A	M39 × 420 × 103	32	M39 × 090	8	173
1600A	M45 × 480 × 115	36	M45 × 100	8	297

Remark

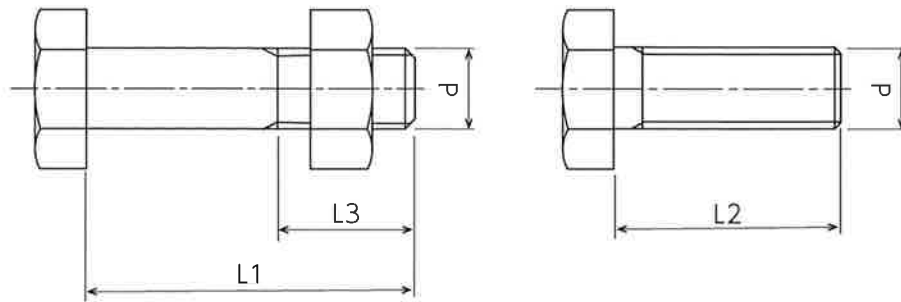
※ A hexagon nut uses a Heavy hex Nut.

※ A Piping gasket uses a spiral gasket.

※ A Piping gasket is calculated by nominal thickness 4.5 mm (tightening thickness 3.3 mm).

6.3 Pipe bolt dimensions

ExV (JIS 10K)



[Figure 40]

FLANGE	JIS10K STEEL FLANGE				
MATERIAL	Hex-Bolt : SNB7, NUT : S45C				
Nominal Size DN	Hex-Bolt • Nut		Hex-Bolt		Weight (kg)
	d × L1 × L3	Q'ty	d × L2	Q'ty	
80A	M16 × 110 × 38	8	—	—	2.0
100A	M16 × 120 × 38	8	—	—	2.2
125A	M20 × 130 × 52	8	—	—	3.7
150A	M20 × 140 × 52	8	—	—	3.9
200A	M20 × 140 × 52	12	—	—	5.8
250A	M22 × 160 × 56	12	—	—	7.8
300A	M22 × 170 × 56	12	M22 × 050	8	9.9
350A	M22 × 170 × 56	12	M22 × 050	8	9.9
400A	M24 × 200 × 60	12	M24 × 055	8	13.7
450A	M24 × 220 × 73	16	M24 × 060	8	18.6
500A	M24 × 230 × 73	16	M24 × 060	8	19.2
600A	M30 × 270 × 85	20	M30 × 065	8	44.1
700A	M30 × 280 × 85	20	M30 × 070	8	45.4
800A	M30 × 310 × 85	24	M30 × 075	8	58.1
900A	M30 × 330 × 85	24	M30 × 080	8	61.2
1000A	M36 × 350 × 97	24	M36 × 080	8	95.5
1200A	M36 × 400 × 97	28	M36 × 085	8	121.6
1400A	—	—	—	—	—
1600A	—	—	—	—	—

Remark

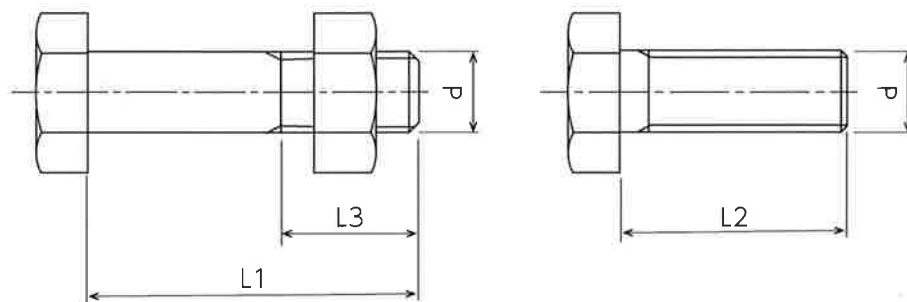
※ A hexagon nut uses a Heavy hex Nut.

※ A Piping gasket uses a spiral gasket.

※ A Piping gasket is calculated by nominal thickness 4.5 mm (tightening thickness 3.3 mm).

6.3 Pipe bolt dimensions

ExV (JIS 5K)



[Figure 41]

FLENCE	JIS5K STEEL FLANGE				
MATERIAL	Hex-Bolt : SNB7, NUT : S45C				
Nominal Size DN	Hex-Bolt • Nut		Hex-Bolt		Weight (kg)
	d × L1 × L3	Q'ty	d × L2	Q'ty	
250A	M20 × 150 × 52	12	—	—	6.1
300A	M20 × 160 × 52	12	—	—	6.4
400A	M22 × 190 × 56	16	—	—	11.8
500A	M22 × 220 × 69	16	M22 × 055	8	15.1

Remark

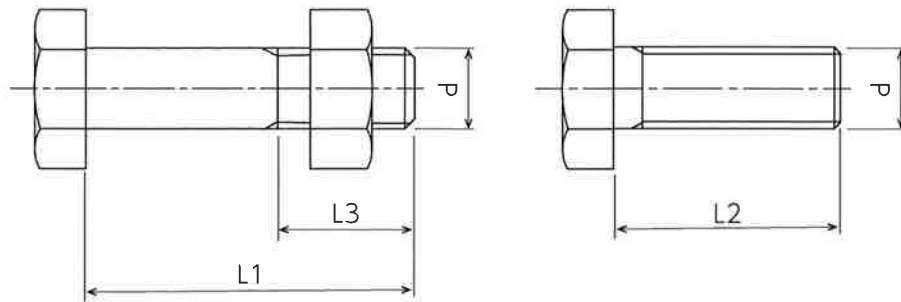
※ A hexagon nut uses a Heavy hex Nut.

※ A Piping gasket uses a spiral gasket.

※ A Piping gasket is calculated by nominal thickness 4.5 mm (tightening thickness 3.3 mm).

6.3 Pipe bolt dimensions

ExV (ISO7005-1 PN10)



[Figure 42]

FLANGE	ISO7005-1 PN10 STEEL FLANGE TYPE12				
MATERIAL	Hex-Bolt : SNB7, NUT : S45C				
Nominal Size DN	Hex-Bolt • Nut		Hex-Bolt		Weight (kg)
	d × L1 × L3	Q'ty	d × L2	Q'ty	
80A	M16 × 120 × 38	8	—	—	2.2
100A	M16 × 130 × 44	8	—	—	2.3
125A	M16 × 130 × 44	8	—	—	2.3
150A	M20 × 140 × 52	8	—	—	3.9
200A	M20 × 150 × 52	8	—	—	4.1
250A	M20 × 160 × 52	12	—	—	6.4
300A	M20 × 170 × 52	8	M20 × 050	8	5.9
350A	M20 × 170 × 52	12	M20 × 050	8	8.2
400A	M24 × 200 × 60	12	M24 × 055	8	13.7
450A	M24 × 210 × 60	16	M24 × 060	8	18.1
500A	M24 × 230 × 73	16	M24 × 060	8	19.2
600A	M27 × 270 × 79	16	M27 × 065	8	28.5
700A	M27 × 270 × 79	20	M27 × 065	8	34.7
800A	M30 × 310 × 85	20	M30 × 070	8	49.0
900A	M30 × 320 × 85	24	M30 × 075	8	59.5
1000A	M33 × 340 × 91	24	M33 × 075	8	72.9
1200A	M36 × 390 × 97	28	M36 × 080	8	119.0
1400A	M39 × 420 × 103	32	M39 × 085	8	172.2
1600A	M45 × 480 × 115	36	M45 × 095	8	296.1

Remark

※ A hexagon nut uses a Heavy hex Nut.

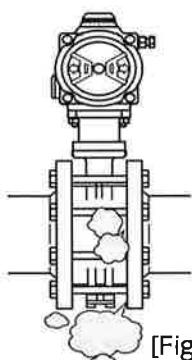
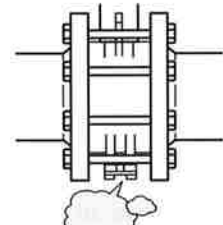
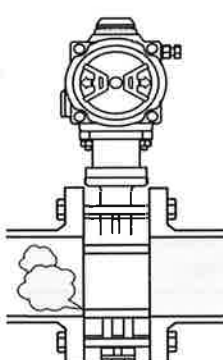
※ A Piping gasket uses a spiral gasket.

※ A Piping gasket is calculated by nominal thickness 4.5 mm (tightening thickness 3.3 mm).

7. Troubleshooting

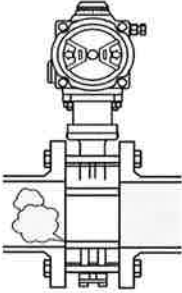
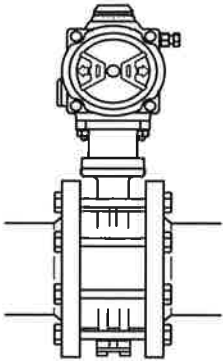


7.1 Malfunctions and solutions

Symptom	Main cause	Solution
1. Leak from body and pipe flange  [Figure 43]	Pipe bolts are loose or only partially tightened	After lowering the pressure, loosen the pipe bolts, and re-tighten them evenly in a diagonal pattern. (Item 4.1.1-10 "Pipe bolt tightening procedures")
	Pipe flange surface scratched, debris or foreign objects attached	Remove the valve and repair or clean the pipe flange surface. After cleaning, reattach the valve. (Item 3.4.2-1)
	Misaligned flange or piping	Remove the valve, and make the pipe flange center and parallel. (Item 3.4.2-6,10)
	Valve improperly centered	Loosen the bolts, and recenter the valve. (Item 3.4.2-6,10)
	Forgot to put in pipe gasket or used the wrong type/ dimensions	Insert the proper gasket between the pipe flange and valve. (Item 3.4.2-5)
2. Leaks from gland bottom  [Figure 44]	Gland bolt loose Gland packing worn/ deteriorated	Tighten the gland bolts. Replace the gland packing if this does not solve the problem.
	Bottom bolt loose Bottom gasket deteriorated	If the hexagon bolts are loose, re-tighten them. Replace the bottom gasket if this does not solve the problem.
	Body/valve stem warped	The body may become warped if there is external force on, or a support is securing the valve body. Also make sure the valve stem is not warped with a visual check. If it is, the valve must be replaced.
	Body damage	If the body is cracked or damaged, immediately cease use and replace the valve.
3. Valve seat leakage  [Figure 45]	Component corrosion due to mistaken material selection according to fluid specifications	Replace the valve with one that uses the appropriate materials. Contact a sales representative for details.
	Product specifications and fluid specifications are not compatible	Use the product within the scope of specifications (temperature, pressure, flow rate, fluid type).
	The valving element and seat ring are damaged due to foreign objects caught in the pipe	Replace the seat ring if it is damaged. Replace the valve if you can see something wrong on the edge of the valving element.
	Misaligned valving element fully closed position (actuator mounting bolt loose, etc.)	Clean the valve seat and body stopper (Item 3.6.3) and secure the proper fully closed position (Section 5.5). Also, make sure that actuator output is correct.

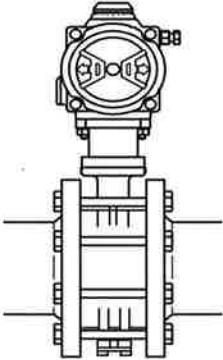
7.1 Malfunctions and solutions

(Continued)

Symptom	Main cause	Solution
3. Valve seat leakage  [Figure 46]	Valve stem twisted due to increase in opening/closing torque	Replace the valve.
	Uneven compression between seat ring and valving element due to partially tightened pipe bolts	Loosen pipe bolts, check valve and flange centering, and re-tighten the bolts. (Item 4.1.1-10 "Pipe bolt tightening procedures")
	Seat ring wear and deterioration due to long-term usage/frequent opening/closing	Replace the seat ring.
4. Valve does not operate Abnormal operation  [Figure 47]	Valving element is interfering with piping or other device	Insert a short pipe or spacer between the valve and flange to avoid interference. (Section 6.1) Because of the high possibility of damage to the valving element seal in this case, remove it and perform a check.
	Valve warped/damaged	Check the exterior to make sure there is no warping, denting, scratch, or corrosion on the body, valving element, or valve stem. Replace the valve if you can see any of these signs.
	Actuator component damage	See the actuator instruction manual for details.
	Pipe bolts are loose or only partially tightened, valve is improperly centered, pipe flange is off center/parallel or warped	If the bolt tightening force or contact surface is uneven, the valve seat pressure will be uneven, resulting in increased torque. Loosen the bolts and re-tighten them diagonally. (Items 3.4.2-6, 10 and 4.1.1-10 "Pipe bolt tightening procedures")
	Increased torque due to foreign objects caught in pipe	Fully open the valve to rinse away the foreign objects. (Item 3.6.6-4) Because of the high possibility of damage to the valving element seal in this case, remove it and perform a check.
	Powdered foreign matter inside the pipe is stuck in bearings	If there is rust powder or other powdered foreign matter inside the pipe, it can prevent the valve stem from rotating if it becomes stuck in the bearings. If you suspect this is the case, remove and clean the valve.
	Product specifications and fluid specifications are not compatible	When using an automatic valve, select the actuator size according to your usage conditions (temperature, pressure, flow rate, fluid type). When usage conditions change, insufficient actuator torque can result in the product not functioning. Contact a sales representative.

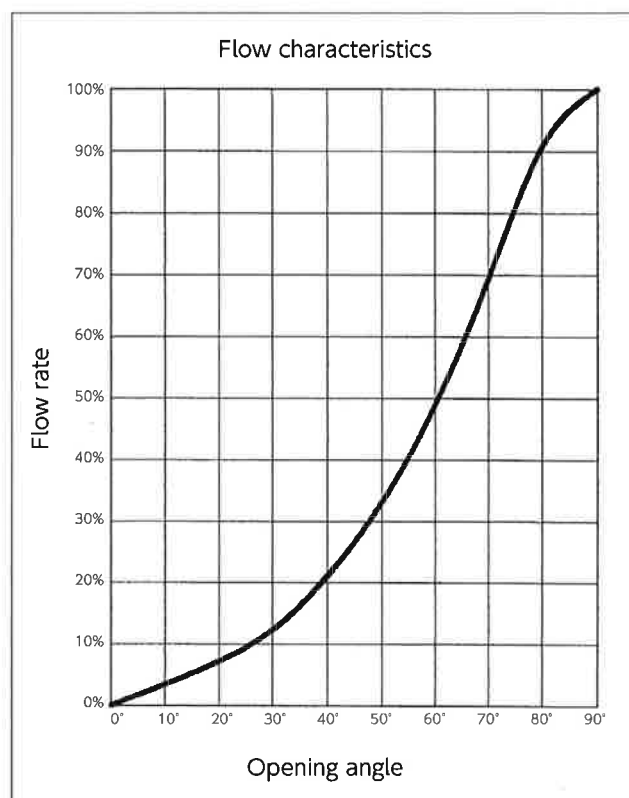
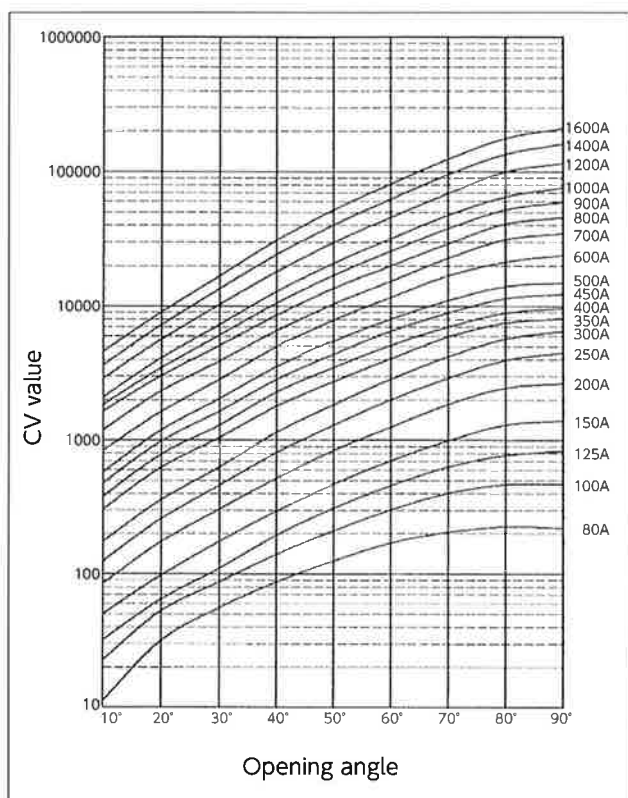
7.1 Malfunctions and solutions

(Continued)

Symptom	Main cause	Solution
4. Valve does not operate Abnormal operation  [Figure 48]	Not achieving the actuator rated output (For an automatic valve)	Check the following for a cylinder. 1. Are the rated air pressure and supply amount being secured? 2. Is the bypass valve closed? 3. Is the operating air stop valve open? 4. Is the speed controller opening correctly? 5. Did you remember to remove the exhaust port plug? Check the following for an electric motor. 1. Is the power supply voltage rated as specified? 2. Is the motor receiving the correct voltage? 3. Is the thermal protector functioning? 4. Are two or more actuators running on one switch? 5. Is there water inside the electric motor? See each actuator instruction manual for details.
	Abnormal force on the valve causing it to warp	If a support is attached to the valve neck or actuator, it may have enough force to warp the valve. Remove the support and check. Also, if the product is interfering with other equipment or the building, ensure that it does not do so.
	Valving element abnormal interference due to seat ring damage or warping	Replace the seat ring. Replace the valve if you can see something wrong on the edge of the valving element.
	Damage to parts of valving element, valve stem, body, joint, etc.	If none of the above applies, valve parts may be damaged. Contact a sales representative, as some parts may need to be replaced.

8. Technical Documentation

8.1 Technical documentation Valve CV value



Nominal diameter	Cv value								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
80A	11	32	56	87	125	170	205	225	220
100A	23	53	87	140	210	300	400	465	470
125A	32	65	110	195	310	455	630	770	830
150A	50	98	175	295	470	700	990	1300	1400
200A	85	175	305	520	840	1250	1850	2450	2650
250A	125	260	460	810	1300	2000	2900	3950	4500
300A	175	360	630	1150	1850	2850	4200	5700	6500
350A	305	630	1050	1800	2750	4050	5900	7500	8100
400A	380	790	1300	2300	3500	5100	7000	8900	9600
450A	480	990	1650	2850	4400	6500	8900	11400	12300
500A	580	1200	2050	3550	5500	8000	11000	14000	14900
600A	840	1650	2850	5000	7900	11600	16800	21300	23900
700A	1200	2350	3900	6600	10400	15300	22700	31300	34700
800A	1650	3050	5100	8600	13600	19900	29100	40800	45600
900A	1850	3500	6100	10600	17000	25600	37700	52000	59400
1000A	2100	4150	7300	12900	20900	31700	47400	64900	76000
1200A	2900	5700	10300	18100	29800	45600	68700	99500	115100
1400A	3650	7300	13500	24300	40200	62300	94900	134300	160500
1600A	4600	9100	16800	31000	52000	80700	123400	176300	209200



8.2 Technical documentation Actuator documentation

Valve Type	Valve Size	Cylinder Size	M.O.P (bar) ※1	Air Volume (NL) ※2	Air Consumption (NL) ※2, 3
ExVHH	80A	AT201U-S12A	8	0.35	2.5
	100A	AT251U-S12A	8	0.55	4.0
	125A	AT301U-S12A	8	0.75	5.0
	150A	AT351U-S12A	8	1.20	8.5
	200A	AT451U-S12A	8	2.45	17.0
	250A	AT501U-S12A	8	3.15	22.0
	300A	AT551U-S12A	8	4.30	29.5
	350A	AT601U-S12A	8	5.95	41.5
	400A	AT651U-S12A	8	10.0	69.5
	450A	AT601U-DA	8	15.5	110
	500A	AT601U-DA	8	15.5	110
	600A	AT651U-DA	8	25.5	175
	700A	EPTS108-240-DA	12	19.5	135
	800A	EPTS108-295-DA	10	29.5	205
	900A	EPTS108-340-DA	7.5	39.0	270
	1000A	EPTS110-340-DA	10	46.5	320
	1200A	EPTS130-385-DA	12	77.0	535
	1400A	EPTS160-485-DA	10	148	1025
	1600A	EPTS160-535-DA	8.5	180	1250
ExVLL	80A	AT201U-S12A	8	0.35	2.5
	100A	AT251U-S12A	8	0.55	4.0
	125A	AT301U-S12A	8	0.75	5.0
	150A	AT351U-S12A	8	1.20	8.5
	200A	AT401U-S12A	8	1.55	11.0
	250A	AT501U-S12A	8	3.15	22.0
	300A	AT551U-S12A	8	4.30	29.5
	350A	AT551U-S12A	8	4.30	29.5
	400A	AT601U-S12A	8	5.95	41.5
	450A	AT651U-S12A	8	10.0	69.5
	500A	AT701U-S12A	8	14.5	105
	600A	AT751U-S12A	8	20.0	140
	700A	EPTS106-240-DA	8	15.0	105
	800A	EPTS108-240-DA	12	19.5	135
	900A	EPTS108-295-DA	10	29.5	205
	1000A	EPTS110-295-DA	12	35.0	245
	1200A	EPTS110-340-DA	10	46.5	320
	1400A	EPTS110-435-DA	6	75.5	525
	1600A	EPTS130-435-DA	10	98.0	680

Note:

※1 M.O.P - Maximun Operating Pressure.

※2 The above air volime and consumption are for one reciprocation (cycle).

(Double acting : open and shut , Single acting : open or shut)

※ 3 Air supply pressure 6bar.

MEMO

MEMO

Warranty Period

The warranty for delivered items is 18 months from the date of shipment from our factory, or one year from the date of test operation, whichever is earlier.

Scope of Warranty and Disclaimer

If the product malfunctions during the above warranty period due to manufacturing faults, the faulty part will be replaced or repaired free of charge at the location of purchase or delivery. (Limited to Japan) However, repair or replacement fees will be charged if any of the following applies.

1. Malfunctions due to handling or use in inappropriate conditions or environments, other than those noted in the catalog or other specifications documentation.
2. If the malfunction is due to any reason other than the delivered item.
3. Malfunctions due to modification or repairs not provided by OKM.
4. Malfunctions due to use in conditions not provided for in the design specification conditions of the valve, or caused by an event that could not be predicted under provided conditions.
5. In cases of considerable wear to the seat ring or gland packing.
6. When the consumables such as lubricant have been insufficiently applied.
7. Malfunctions due to improper maintenance or inspections in cases of frequent opening/closing operations.
8. Malfunctions due to power or air supply.
9. Malfunctions due to debris or other foreign objects caught in the product.
10. Malfunctions due to improper product storage such as being left outside.
11. Malfunctions due to natural disasters and accidents such as fire, water damage, earthquakes, or falling rocks.
12. Malfunctions due to other causes not deemed to be the responsibility of manufacturers.

This warranty applies to the delivered item only. OKM is not responsible for damages due to malfunction of the delivered item.

Repair and part replacement fees for discontinued products

The product may be discontinued or modified without prior notice. Repairs and overhauls of products will no longer be available provided five years have passed after product manufacturing or sales are discontinued. Components and consumable parts will no longer be available for the applicable products.

Consumable Parts Replacement Period

Consumable parts should be replaced after 3,000 opening/closing operations (open - close - open is one operation) or after one year of operation under pure water and ambient temperature. They may need to be replaced earlier depending on the operating environment, however, you should use this time period as a reference for replacing consumable parts.

Conditions of Compliant Use

Before exporting the product outside Japan, check the applicable laws established by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Act, etc.).

Pioneering the future of fluid control



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Phone: 81-92-716-7090 Fax: 81-92-716-7091

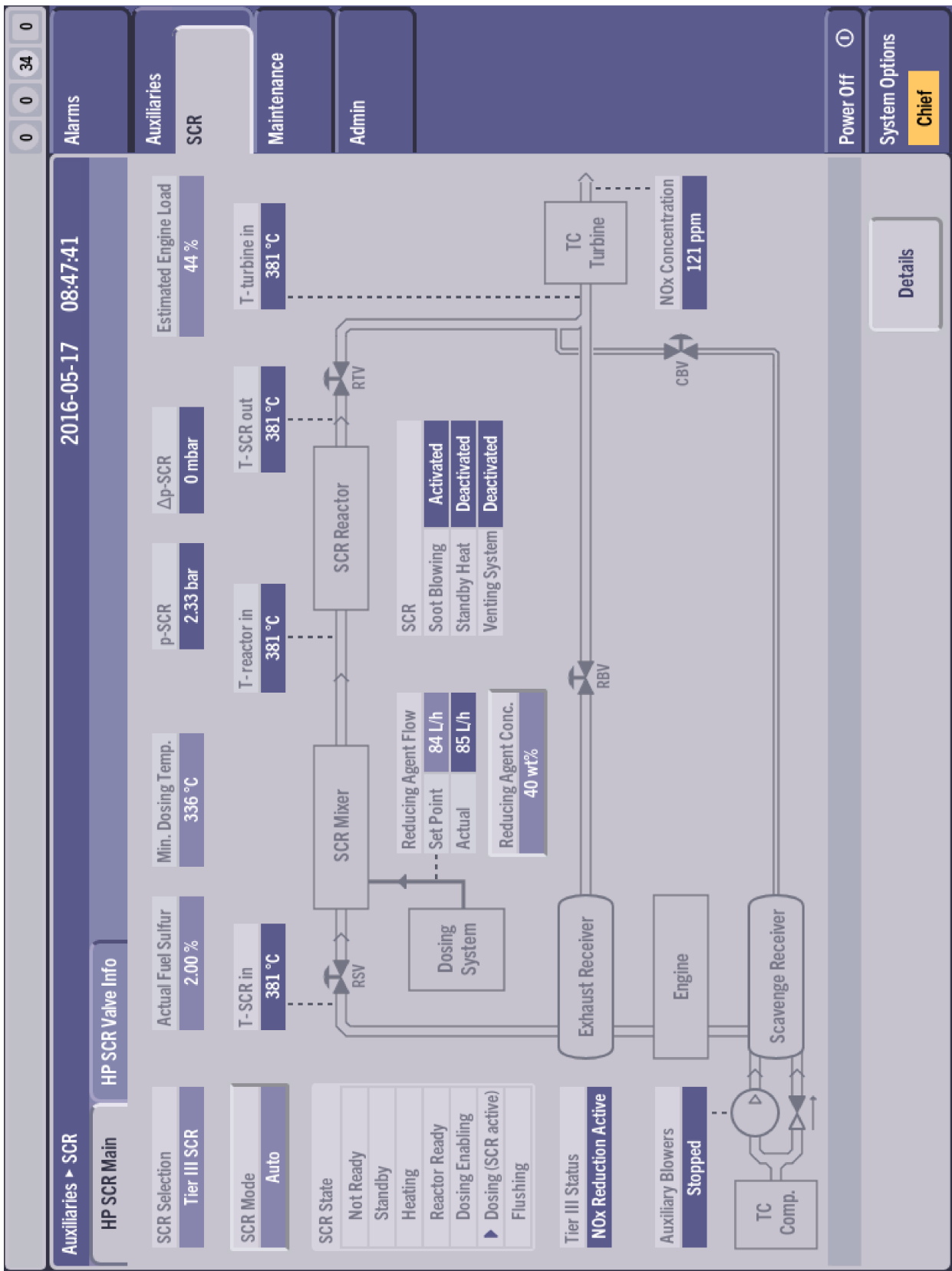


Figure 1: HP SCR Main. No details. Dosing state.

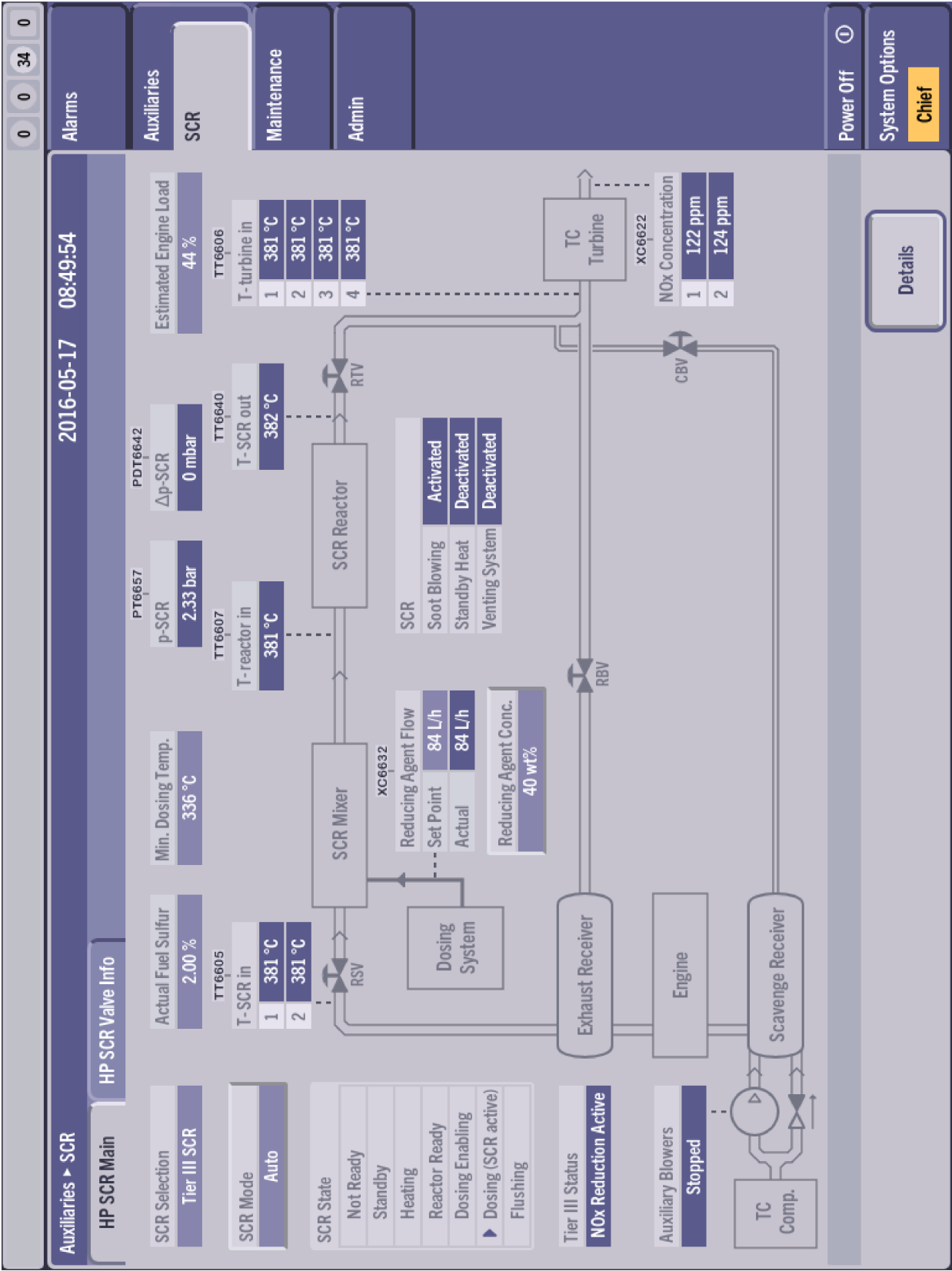


Figure 2: HP SCR Main. With details. Dosing state.

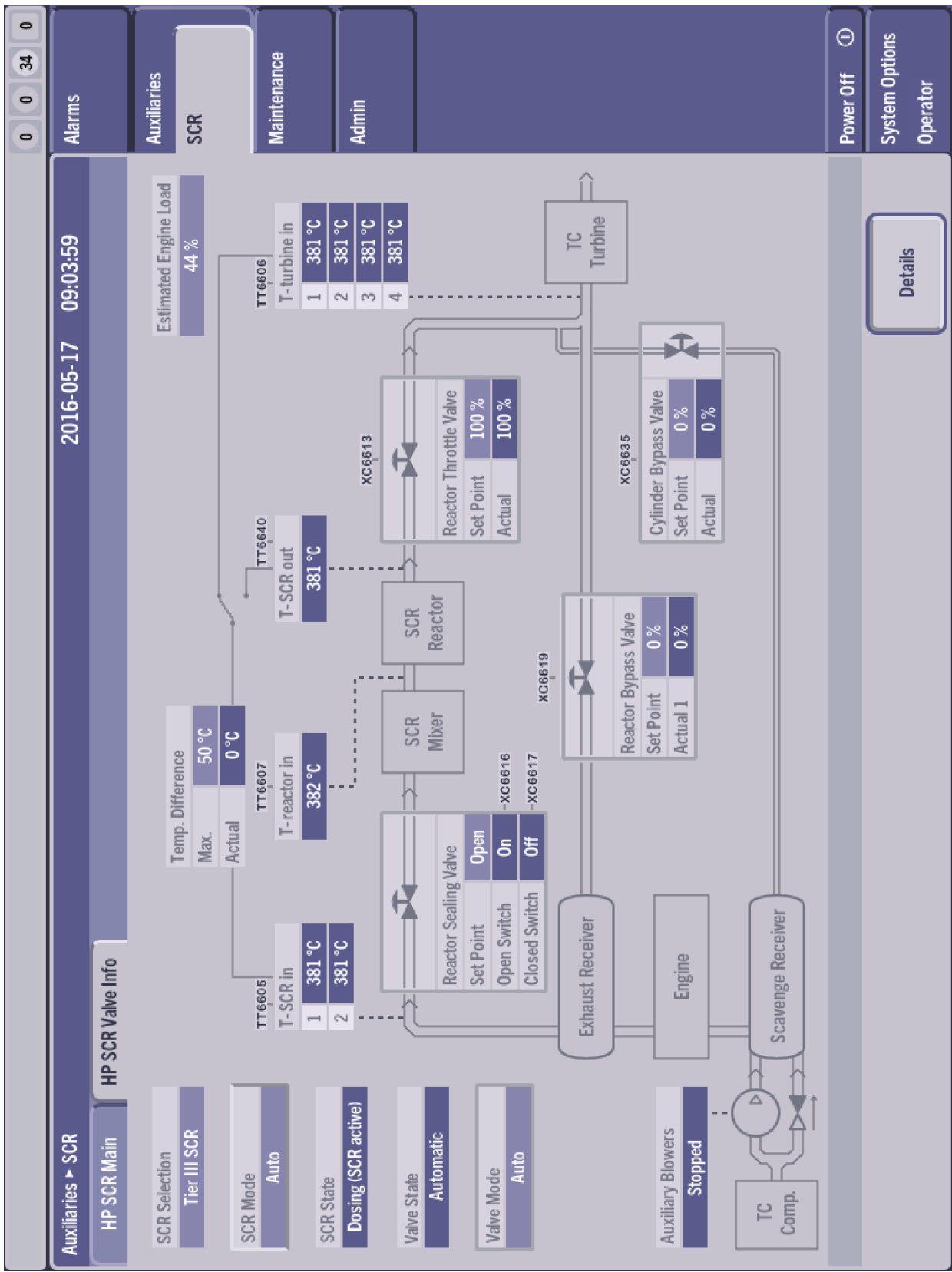


Figure 3: HP SCR Valve Info. With details. Dosing state. 1 Reactor Bypass Valve.

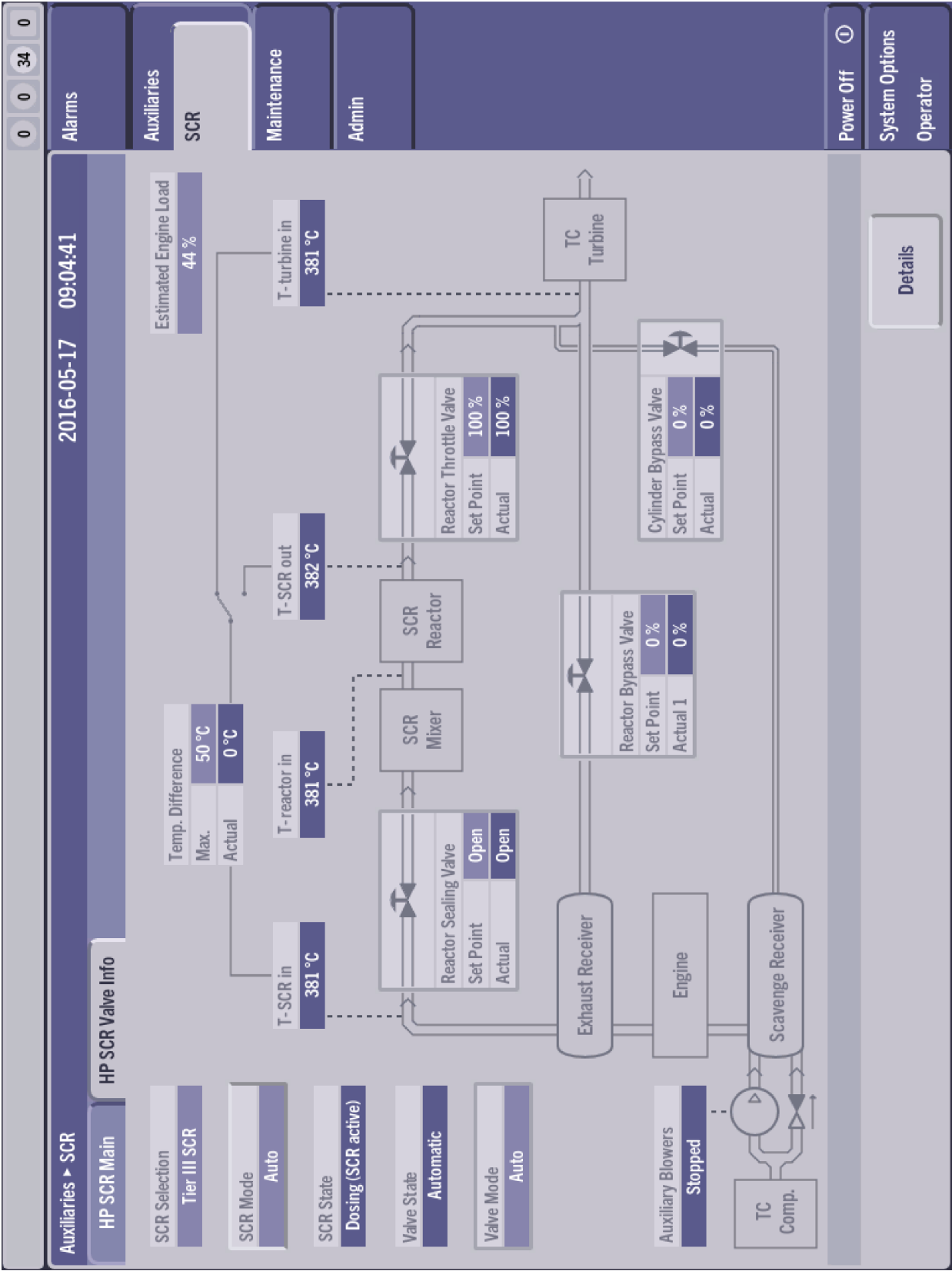


Figure 4: HP SCR Valve info. Dosing state. 1 Reactor Bypass Valve.

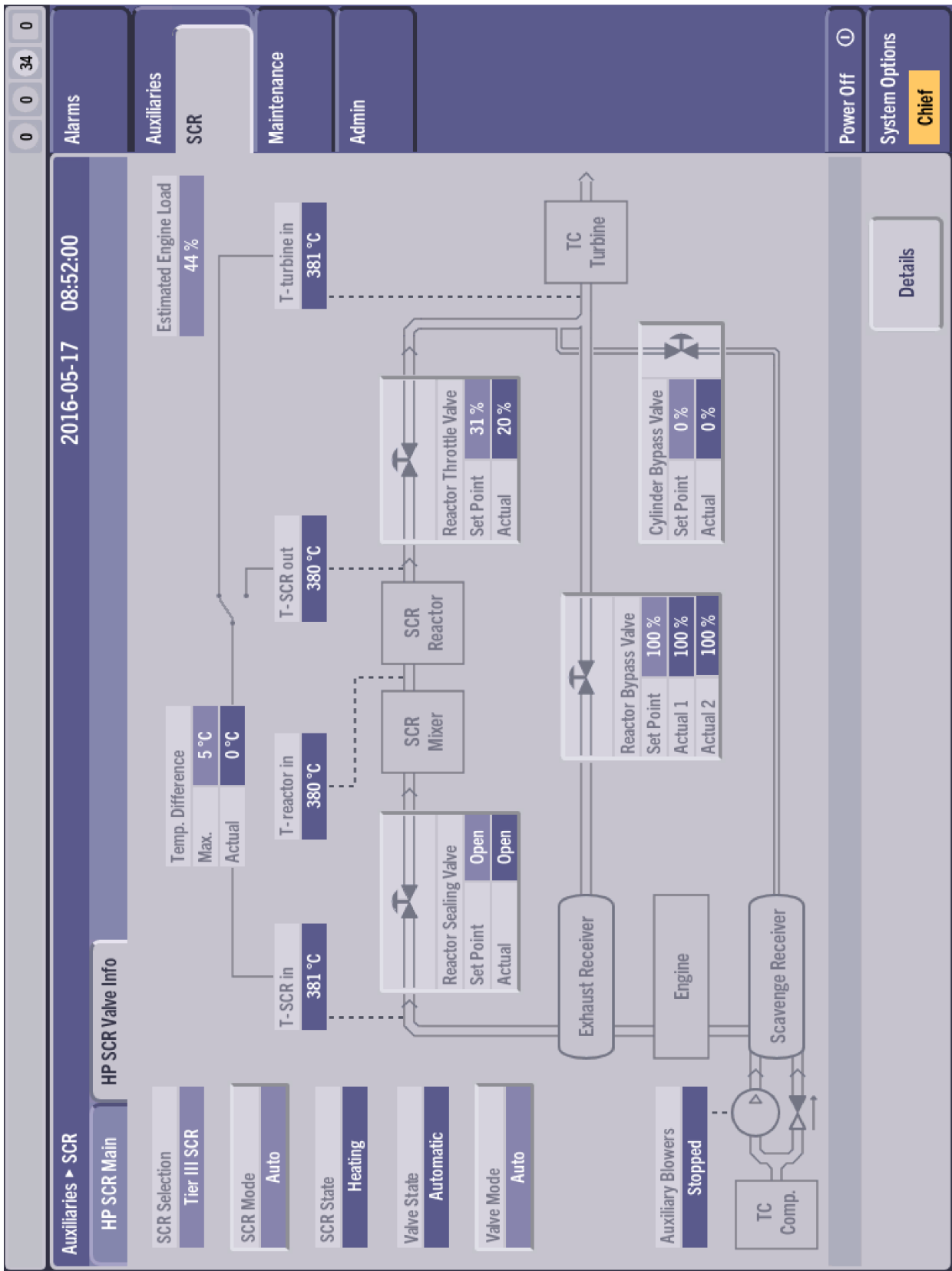


Figure 5: HP SCR Valve info. Heating state. 2 Reactor Bypass Valves.

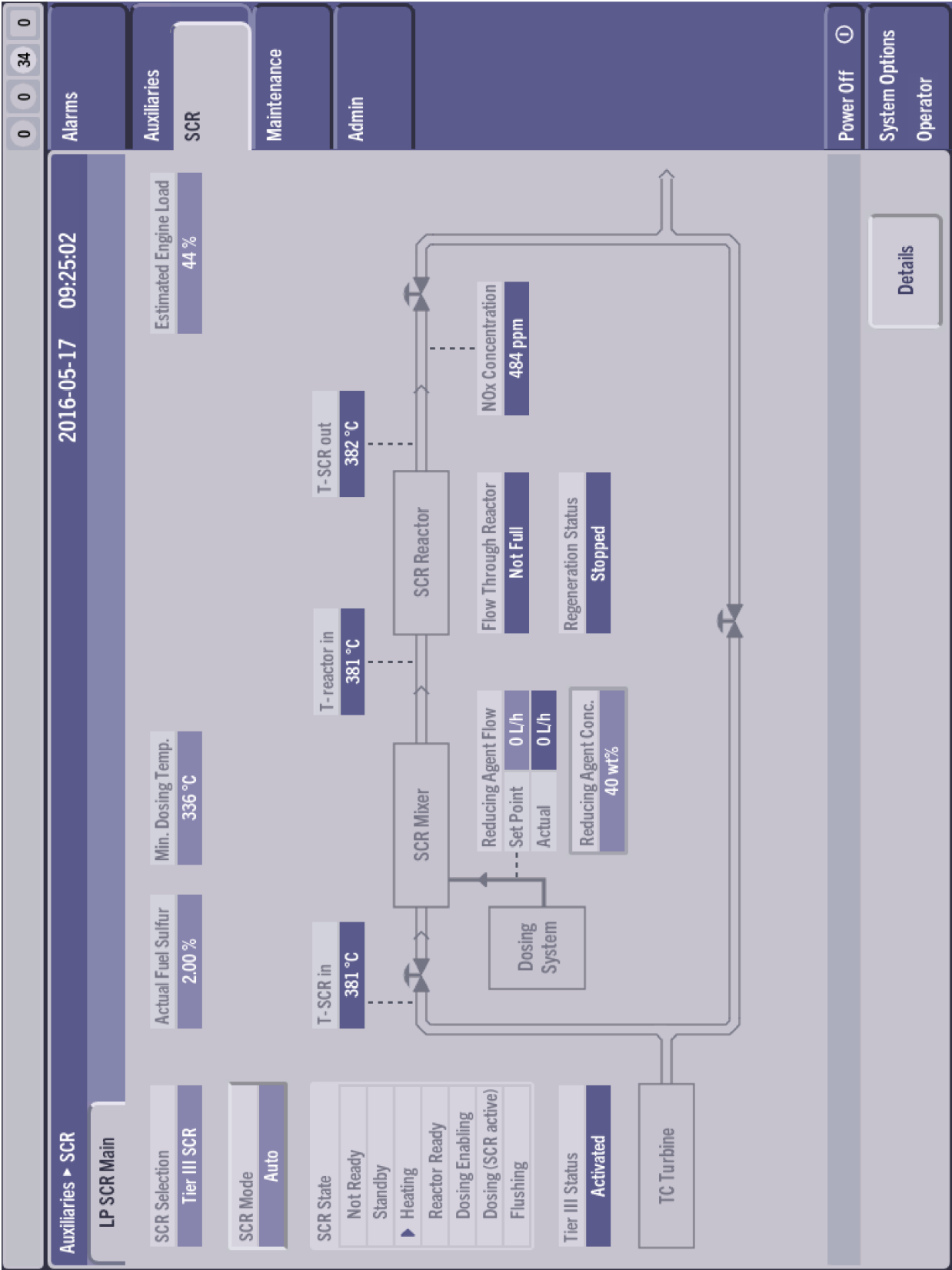


Figure 6: LP SCR Main. No details. Heating state.

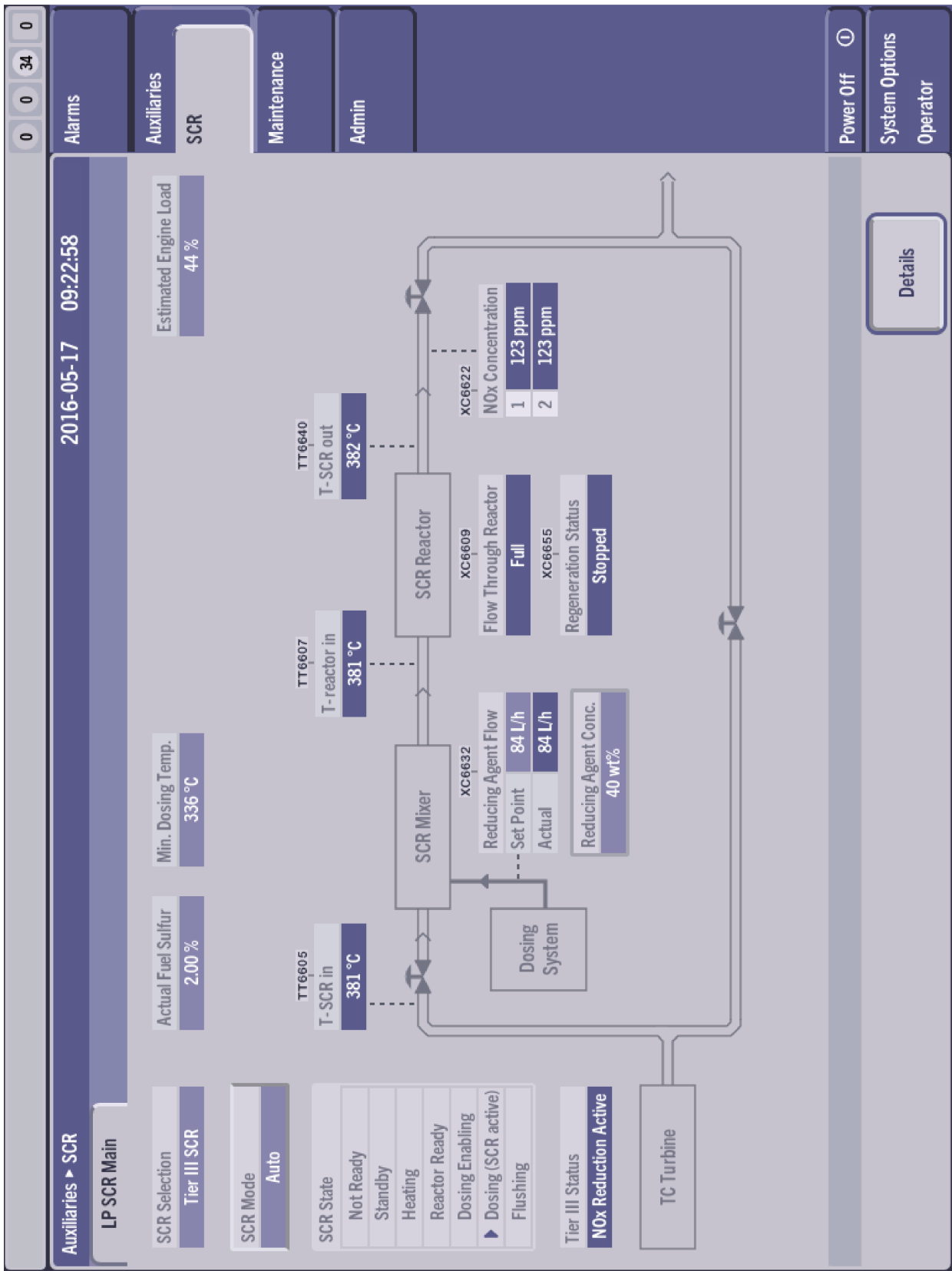
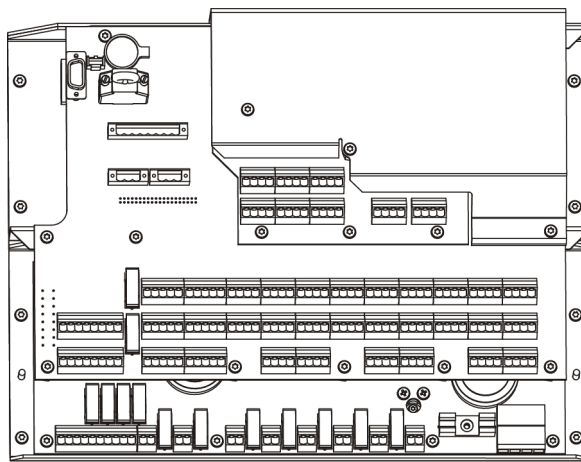


Figure 7: LP SCR Main details. Dosing state.

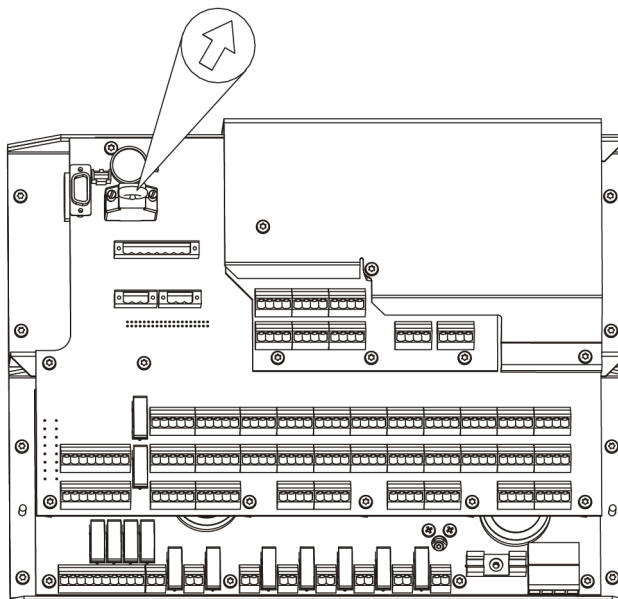
Multi Purpose Controller The Multi Purpose Controller provides for communication between the MOP / HMI and the SCR system. Checking of the MPC is continuously performed by the MOP units.

1. Dismantling of MPC board Disconnect the power connector.



4765-1901-0001D01

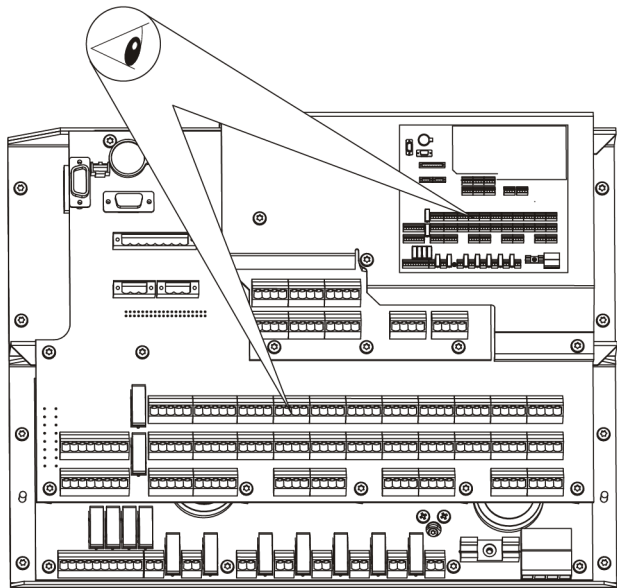
2. ID-key Disconnect the ID-key.



4765-1901-0001D02

3. MPC board

Check placement of connectors according to the table shown on the metal plate on the MPC board. If necessary, note down connector placement.



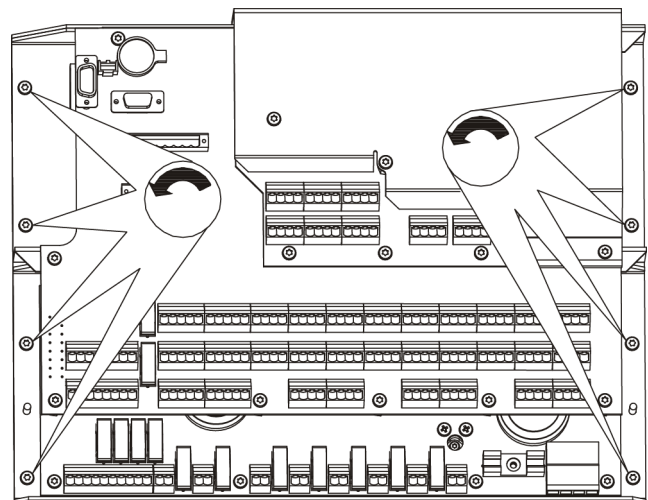
4765-1901-0001D03

4. Connectors

Disconnect all connectors on the MPC board.

5. Remove the MPC board

Unscrew the MPC board and remove it from the panel.



4765-1901-0001D05

Mounting the MPC board If a spare MPC board has been used previously on another engine it is necessary to force the MPC to update software from the MOP panel.

This is done in the following way: Set the yellow dip switch No. 4 on the side of the replacement MPC to OFF.

Mount the MPC as described. Power on the MPC and let the MPC finish downloading.

When the MPC LED flashes 2 red and 3 green (APPLOAD_DIP see appendix), set the yellow dip switch No. 4 to ON.

Do not mount an MPC board unless the backup battery is installed.

1. Backup battery

Check that the back-up battery is mounted and that the DIP switch S1 in neutral position. This means all switches are in the »off« position. This is also known as binary »0«.



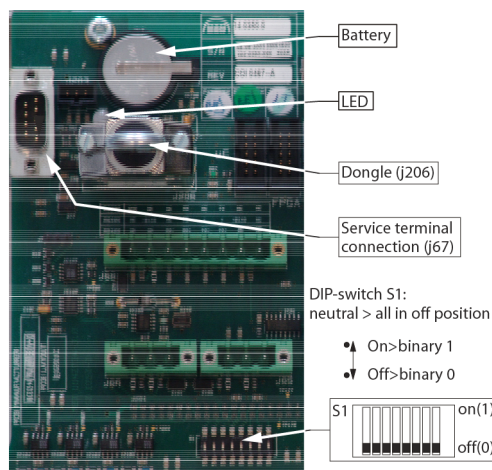
WARNING

This message is mainly relevant for marine diesel engines.

Changing the battery of the Multi Purpose Controller (MPC) may cause a reset and restart of the MPC. Therefore, only change the battery while:

- the ship is in harbour with engine stopped, or
- when sailing in unrestricted areas, where a restart of an MPC does not imply any risk for the ship or the engine.

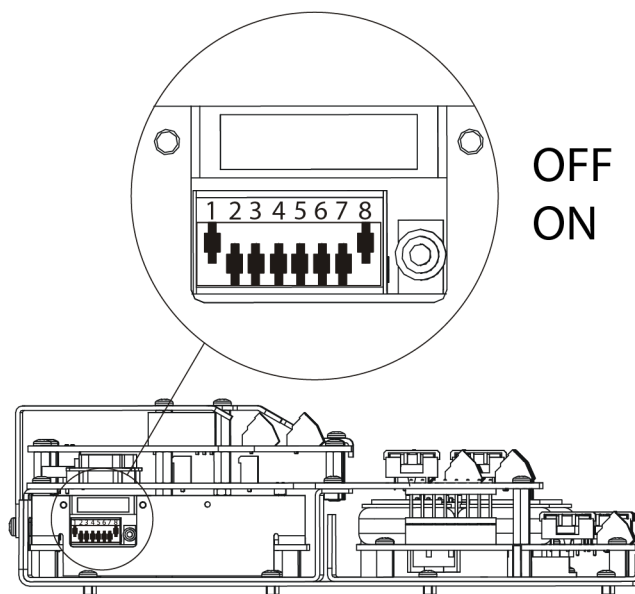
The battery only serves as back up supply for the built in clock of the MPC, and a low battery level for several days until entering port is of no consequence to the safe operation of the engine.



4765-1901-0001M02

2. DIP switches

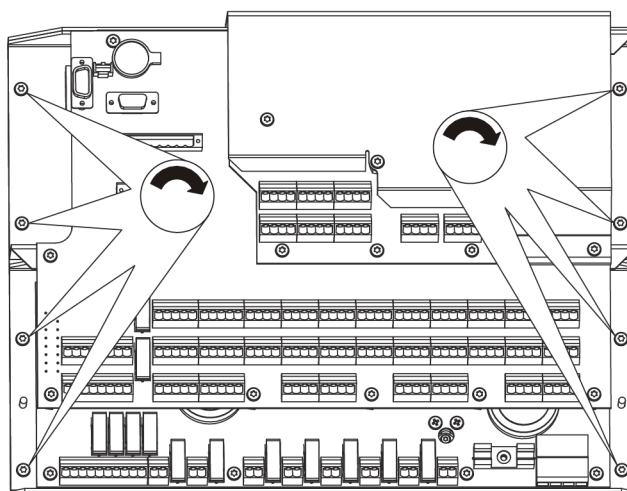
Check that the DIP switches 1 and 8 on the side of the MPC board are set to the »off« position.



4765-1901-0001M03

3. MPC board

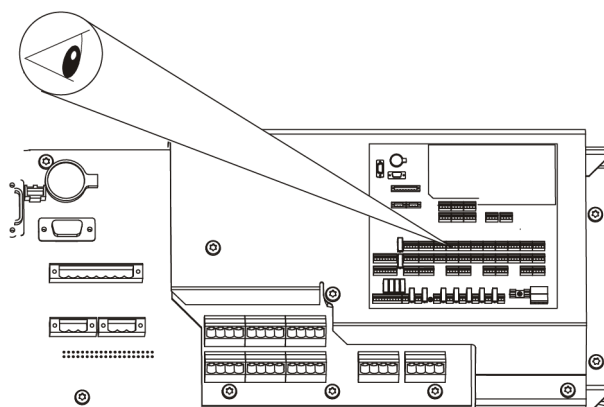
Mount the MPC board



4765-1901-0001M04

4. Connectors

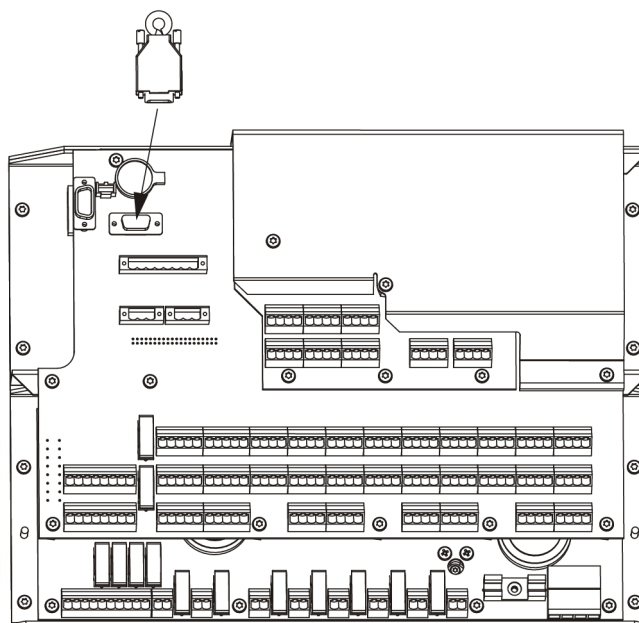
Mount the connectors according to the table shown on the metal plate on the MPC board.



4765-1901-0001M12

5. ID-key

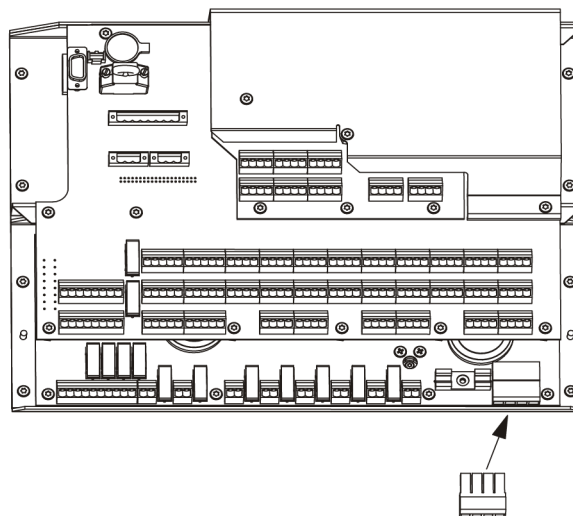
Mount the ID-key.



4765-1901-0001M05

6. Power connector

Mount the power connector.



4765-1901-0001M06

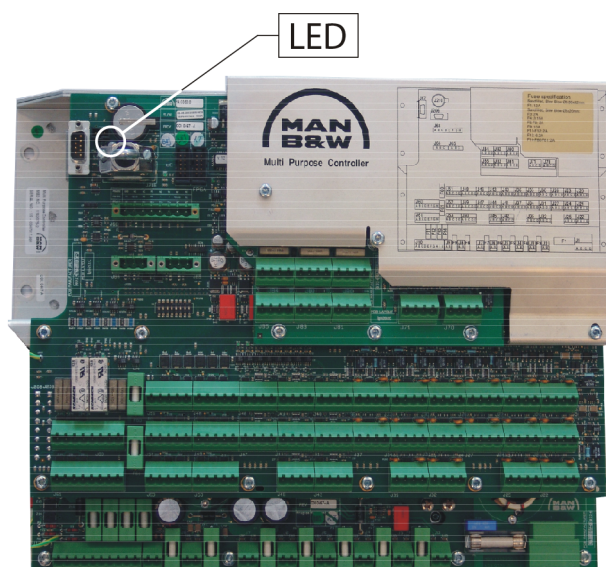
7. Start-up process

During the start-up process, the LED will flash and the MPC board will reboot several times.

During start-up, the MPC verifies if the ID-key is connected. It reads the ID number and checks if the key ID is in the correct format and has a valid range, it reads the DIP-switch S1 value and verifies if it is 0 (Off). A new MPC board will download software and settings from the MOP panel during this process.

The program completes the ID-key verification and is now ready to continue the boot sequence. Any deviations will send an error message via the LED. The startup time of a new MPC board may vary but will take about 15 minutes.

When the LED shows green, the MPC board is running normally. The MPC LED indications are shown on the appendix in this procedure.



4765-1901-0001M07

1 MPC LED Indication

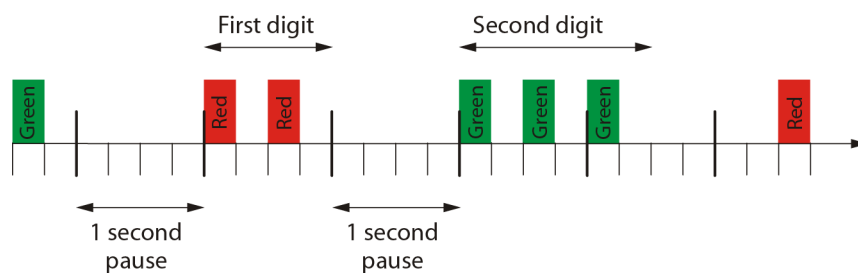
Description

The first part of this section describes the syntax of the LED indication and assigns a short description to each of the used indications. The second part presents a more detailed description of the different indications.

Syntax

The MPC LED may be issuing indications by either emitting constant light or by flashing. The LED indications are uniquely identified by the colour that the MPC LED emits.

A flashing LED indication consists of two pulse trains separated in time by a 1-second pause. Each of these pulse trains represents an integer. All pulses are set against a yellow background. The first pulse train will alternate between the yellow background and a red foreground, while the second will use green as foreground.



4765-1901-0001M10

Figure 1: LED indications - syntax

For identification of the indication the user must therefore note the number of red and green pulses. The first digit is the number of red pulses and the second digit is the number of green pulses. In the illustration above, the indication code would thus be (2,3).

Indications

Constant		
Colour	Short name	Short description
Red	ERROR	Either early initialization or fatal error
Orange	INIT	Initialization, no parameters available or non-normal node mode
Green	NORMAL	Application up and running

Flashing		
Digits		Short description
Red	Green	
1	1	CTRL_PRG
2	1	APPLOAD_SCAN
2	2	APPLOAD_DOWNLOAD
2	3	APPLOAD_DIP
3	1	BOOTLOAD_SCAN
3	2	BOOTLOAD_DOWNLOAD
4	1	DONGLE_VERIFY
4	2	DONGLE_ERROR
4	3	DONGLE_DIP
4	4	DONGLE_FORMAT
4	5	DONGLE_DIP

4765-1901-0001M11

Figure 2: LED pulses - identification and descriptions.

ERROR (Red)	This code is used primarily for indicating if the MPC has experienced a fatal error. However, the MPC will also use this indication during early initialisation. Therefore, the user should only take this code as an indication of error if it persists more than 10 seconds.
INIT (Orange)	Generally, this code is used for indicating initialisation, but the MPC may also use this indication to signal one of the following conditions: No parameters: No valid parameters are available to the application software. Configuration or test mode: The MPC is in a non-normal node mode. Generally, if the INIT code is shown longer than 10 seconds this would indicate one of the latter conditions.
NORMAL (Green)	Application is up and running.
CTRL_PGM (1,1)	One of the on-board micro controllers is being programmed. This is a part of the MPC initialization process.
APPLOAD_SCAN (2,1)	The application software download program (bootloader) is trying to find a server from which it can download its application program. If this code persists it indicates either that no application program server is connected to the network or the network is broken.
APPLOAD_DOWNLOAD (2,2)	An application program is being downloaded.
APPLOAD_DIP (2,3)	The yellow DIP-switch on the MPC CPU board can be used for forcing download of new application software. To avoid looping it is therefore required that the yellow DIP-switch be reset on completion of such a forced download. Reset it to ON/down.
BOOTLOAD_SCAN (3,1)	This indication is analogous to the APPLOAD_SCAN indication except that this code indicates that there is not server available from which the MPC can download a new bootloader. This code should only be indicated if attempts are being made to update the bootloader using the special update program.

BOOT- LOAD_DOWNLOAD (3,2)	A new bootloader program is being downloaded and programmed.
DONGLE_VERIFY (4,1)	The ID-key is being checked. This should only take a couple of seconds.
DONGLE_ERROR (4,2)	A ID-key error has been identified. Either the ID-key is missing, broken or holds an invalid value. Try to reprogram it.
DONGLE_DIP (4,3)	The DIP-switch mounted on the CMI/O board is used for programming the ID key. The programming process requires that this DIP-switch be reset before completing. This code is used for indicating this to the user. Reset the CMI/O board DIP switches to OFF/down.
DONGLE_FORMAT (4,4)	Waiting for confirmation to reformat the records in the Dongle with Start up and Persistent Data Area information.
DONGLE_DIP_CON- FLICT (4,5)	ID key not connected, no usable address supplied from DIP or Service Terminal.
DIP_ILLE- GAL_RANGE (5,1)	The selected address is outside the defined range 0xC0-0xFF (192 - 255).

Table 1: Detailed Description of LED Indications

1 Maintenance

If the MPC needs changing of the back-up battery this can be done without turning of the power to the MPC. However, MAN Diesel & Turbo recommends stopping the SCR system as a safety precaution. Upon receiving a new MPC, remember to install a new back-up battery before turning on the power for the MPC.

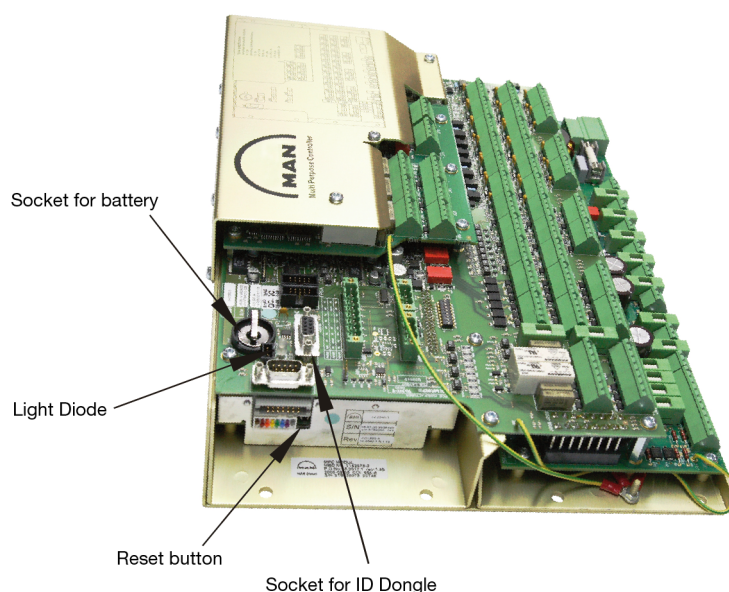


Figure 1: Multi Purpose Controller (MPC)

It is of the utmost importance that the MPCs have a constant power source. Therefore, MAN Diesel recommends that attention be drawn to the general maintenance of the Un-interruptible Power Supply (UPS) supplying the MPCs. Mainly, change of batteries according to interval is important. For more information, refer to the manual as supplied by the manufacturer.

1.1 Maintenance Screens

The maintenance screens give an overall view of the status of the ECS system seen on the following six screens:

- MPC description
- System View I/O Test
- Invalidated Inputs
- Network Status
- Function Test
- Troubleshooting

The above-mentioned five maintenance screens can be accessed via the secondary navigator by pressing the "Maintenance" button in the main navigator. They are mainly used at engine commissioning, during fault finding on I/O cabling / channels and external connections to sensors and during engine operation. The use of these screens is therefore relevant for engine crew as well.

1.2 System View I/O Test (See Drawing 6655-0190)

To understand the use of this screen, an explanation of the layout of the Multi Purpose Controller (MPC) is appropriate.

The MPC is a computer unit which has no user interface such as a display or a keyboard, but has a wide variety of inputs/outputs (I/O) for interfacing to sensors and actuators of the engine, e.g.: (see drawing next page).

- Inputs for e.g. tacho signals, standard (0)4-20mA transducers, $\pm 10V$ signals, switches and 24V binary signals.
- Outputs such as (0)4-20mA and $\pm 10V$ signals, contacts and high-speed semiconductor switches.
- Duplicated Control Network for security.
- Serial communication controller for either a Remote I/O Network or point-to-point serial communication.
- Service channel to be connected to a laptop PC for service purposes.

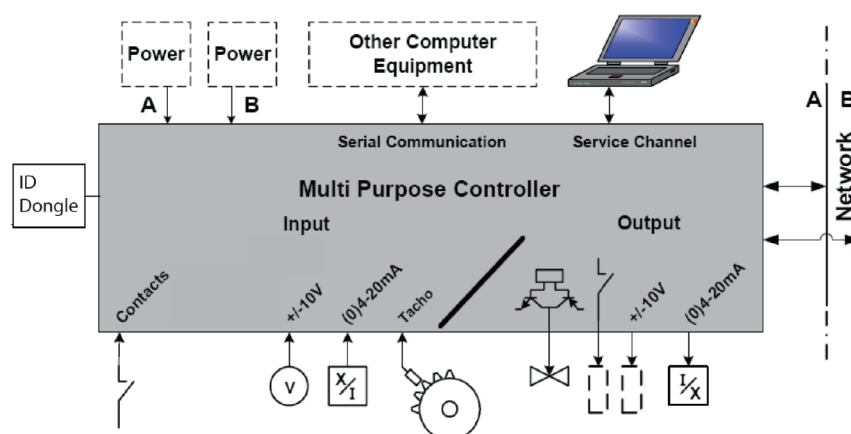


Figure 2: MPC and its communication paths with associated components.

The main processor of the Multi Purpose Controller is a Motorola 68332, which is a 32-bit processor »borrowed« from the automotive industry. It includes an on-chip timing co-processor for synchronisation with the crankshaft rotation and speed measurement.

To ease the production of the Multi Purpose Controller, all programmable components are in-circuit programmable, which also allows field update of the controller by means of relatively simple tools. The MPC contains no harddisk or other sensitive mechanical components, and the software is stored in a non-volatile Flash-PROM memory, i.e. the application software may be sent to and programmed into the Multi Purpose Controller through the network, and thereby restore the functionality after the Multi Purpose Controller has been exchanged with a spare unit from stock.

When a new MPC is mounted in the cabinet, the dongle in the cabinet is mounted in the dongle plug-in, after reconnection of all wires. The dongle tells the “new” MPC in which cabinet it is mounted and, in that way, which software and parameters it should upload from the MOP harddisk (e.g. CCU1, ACU 3 or EICUA).

The MPC is also equipped with a light diode, capable of showing green, yellow or red light. This light tells the engineer in what status the MPC is.

During normal running the diode is green. When the diode is yellow, the MPC is rebooting or is in Test or Configuration Mode. When the diode is red, the MPC is unavailable. *See figure, page 7, Section 4765-1901-0005 for location of diode.* If resetting does not solve the problem with the red diode then replacement of the MPC might be necessary.

A red light diode is not clearly the situation/status that triggers a replacement of an MPC, but merely a hint in that direction.

If in doubt, the engineer can use the Maintenance screens to explain the status to skilled personnel at MAN Diesel. The communication with engineers at MAN Diesel will be less complicated, and possible misconceptions may be ruled out when exact descriptions are communicated to MAN Diesel.

The idea of the Maintenance screens is to help the engineer run and monitor the Engine Control System (ECS). The icons shown on the controllers, show the status of each single controller, e.g. whether it is in mode:

- Active
- Controlling
- Test
- Configuration
- Blocked
- Not accessible

By pressing the single controller on this screen, the actual inputs/ outputs on the selected controller are shown in a new screen.

The screen shows Info, ID and Descriptions and processes values of each single channel on the MPC.

To perform a view of each single channel or manually set the output of a channel, press the “MPC Mode” field (Chief Level). By doing this, a button named “Test” appears on the toolbar; Press this button.

CAUTION

Changing to TEST Mode will STOP the MPC from controlling the system.

By pressing the channel number to the left on the individual channel, a screen is shown. Here we see a single channel and the status and values of this channel is listed on this screen.

From this screen, input channels can be invalidated and validated again (Chief Level).

CAUTION

Changing the status of a channel may cause the system to malfunction.

It may be relevant to invalidate an input channel on an MPC if the sensor linked to the channel, for some reason or another, occasionally or continuously is giving alarm.

The reason for alarm could for instance be a defective sensor or loose wiring from the sensor to the MPC.

We recommend that channels only are invalidated in agreement with skilled personnel from MAN Diesel.

If a channel is invalidated, the channel involved will appear in the invalidated Inputs screen. At the same time, the ECS will continue to operate in the best possible way, without the invalidated input sensor value.

1.3 Invalidated Inputs

If an input channel is invalidated, it is listed on the screen "Invalidated Inputs". ID number, signal ID and a short description to easily overview and recognise the channel(s) involved are shown on this screen.

The "Invalidated Inputs" screen is a "Quick View" helping the engineer look through and control which channels have been invalidated. This could be helpful, for instance after an MPC change.

Input Channels invalidated can be validated from this screen (Chief Level).

CAUTION

Changing the status of a channel may cause the system to malfunction.

1.4 Network Status (See Drawing 6655-0200)

This screen gives the engineer an overall view and exact status of the Control Network of the ECS

From this screen, it is possible to see the status of the Network using the icons named below: (Icons are visible at drawing 6655-0200, bottom)

• OK	
• This MOP	
• No Reply Single Channel	
• No Communication	
• Not Accessible	
• On-line But No Information	
• Not Relevant	
• Reference	
• Cross Connection	

When all fields are shown with a green ✓ (check mark) everything is okay.

The use of the screen becomes especially relevant when manual checks for earth fault is performed.



CAUTION

Engine must be stopped when check for earth fault is performed.

1.4.1 System

All controllers in the ECS, and version numbers, are listed and displayed in the Admin main navigator, time set, and in table format. The screens are:

- Set Time
- Version (Software and IMO Check Sum)

1.4.1.1 Set Time

At the Set Time screen, the operator can set the time/ date for UTC (Chief Level required) or set the time offset for Local Time in intervals down to 5 minutes.

Pressing either the “UTC Date/Time” or the “Local Date/Time” buttons, will display the relevant toolbars. From these toolbars, Date and Time can be set.

Pressing the “UTC Time displayed” or “Local Time Displayed” buttons gives the operator the option to choose between the time that is displayed on the MOP panel (upper right corner) and in the lists (alarm list, event log etc.).

Alarms and logs are recorded with both Local Time/Date and UTC Time/Date regardless of which time/date you set as default.

1.4.1.2 Version

This screen displays the version type of the ECS controlling the MC engine. It is used to obtain the configuration information of the Engine Control System (ECS) on an MC engine. It displays, in table format, all the controllers that comprise the system, including specific information relating to each controller.

Screen Items

In the upper system information line, general information of the ECS system for this particular engine is shown. The fields are:

- Type: The type of ECS
- Version Software version number of ECS
- BES vers: Basic Engine Software version number
- Engine Group No: Engine builders engine number
- IMO No: Engine IMO number (former Lloyds number)
- Engine Builder: Name of engine builder
- Eng. No: Engine Serial number

Controller Unit

In the Controller information pane, data for each Controller in the system is displayed. The pane contains the following:

- ID: Name of MPC (controller)
- Addr: Network Address of MPC
- Type: Application group the MPC belongs to SCU

Parameter Checksum

- User
- Chief
- Service
- Design
- IMO Design
- IMO Chief
- Data shown, is only for illustrative purpose.

NOTICE

The IMO numbers listed in this table, are unique numbers. The IMO Design numbers never change, unless the Technical File is updated / New approved.

The IMO Chief number may change when e.g. changing mode of engine operation through the MOP.

For any questions regarding IMO numbering / Technical File, contact MAN Diesel, Copenhagen.

Using the Screen

When the screen is first displayed, no information appears on the table. Press the "Refresh" button to retrieve the system information and parameter checksums of all controllers connected to the ECS.

If at least one controller supplies information on the system that does not agree with the other controllers, a warning message is displayed in yellow on the tool bar (screen bottom).

Pressing the Print button generates a hard copy of the information displayed in the table (if a printer is connected to the MOP).

1 Alarm system

The alarms on the MOP are all related to the engine control system (ECS). The ECS communicates with the ordinary alarm system, and the safety system. These three systems are able to interact with each other i.e. in case of a shut - down.

2 Alarm handling

Alarm handling is carried out from one of the following four screens

1. Alarm List
2. Event Log
3. Manual Cut-Out List
4. Channel List

These four alarm handling screens can be accessed via the secondary navigator by pressing the "Alarms" button in the main navigator. When pressing this button, the latest selected alarm screen will be shown on the screen. If no screen has previously been selected, the "Alarm List" is shown. The screen can then be changed via the secondary navigator.

2.1 Alarm List (See drawing 6655-0130)

The Alarm List contains the central facility of the alarm handling, allowing for display, acknowledgement and cut-out of raised alarms. Detailed alarm explanation can be accessed for each of the alarm occurrences.

The alarms are displayed in chronological order, with the latest alarm at the top.

The alarms might be grouped by the ECS if they are related to the same cause in order to simplify the overview of the alarm list. The group can be expanded by selecting a group and pressing the -/+ button on the toolbar. Not all alarms are grouped.

If there are too many alarms to be displayed at the same time on the screen, the remaining alarms can be accessed by pressing the page-up/page-down buttons on the toolbar.

Alarms presented in the alarm list can be found in three states:

1. Alarm unacknowledged
2. Alarm acknowledged
3. Normal unacknowledged

An alarm can only appear as "one line" in the alarm list. An acknowledged alarm going into normal or an alarm in the normal state being acknowledged, is immediately removed from the list.

Acknowledgement of a single alarm or all alarms is allowed on both levels (operator or chief) from the “Ack”/“All” buttons on the toolbar at the bottom of the screen. (When pressing “Ack”/“All” only the alarms visible on the screen are acknowledged).

To see a detailed alarm explanation, press the relevant alarm line. The alarm line is then surrounded by a thick blue line showing that it has been selected. By pressing the button “Info” on the toolbar, a window will appear just above the toolbar. This window contains:

- Description
- Cause
- Effect
- Action

So the engineer is able to start troubleshooting on this particular alarm (The detailed alarm explanation is removed by pressing the same “Info” button).

2.1.1 Alarm line fields, colours and symbols

Each alarm line is divided into the following fields:

Ack. The acknowledgement status field of unacknowledged alarms contains an icon toggling between two states, alerting the operator of a unacknowledged alarm.

The status of the alarm can also be identified by the background colour as well as the graphical identification in the Acknowledgement field on the Screen as shown below.

	Unacknowledged alarm in alarm state
	Unacknowledged alarm in normal state
	Transition from unacknowledged to acknowledge of an alarm in alarm state
	Acknowledged alarm in alarm state
	Unacknowledged alarm is cut out
	Alarm was previously unacknowledged in normal state. Now the state is not available
	Alarm was previously unacknowledged in alarm state. Now the state is not available
	Transition from unacknowledged to acknowledge of an alarm in normal state
	Alarm is acknowledged in normal state, and in the process of being removed from the alarm list



At the upper right corner of the screen four small icons are shown which are (from left to right):

	Number of unacknowledged alarms
	Number of active alarms
	Number of Manual Cut-out alarms
	Number of invalidated channels

From the toolbar at the bottom of the Alarm List screen, alarms can be cut-out.

Description. This field contains the alarm text (e.g. »HCU oil leakage«)

Status. This field shows the status of the alarm as one of the following:

- Normal
- Alarm
- Low
- High
- Not Available
- Auto Cut-out
- Manual cut-out

ID. This field contains a unique alarm identity. (e.g. ECUA_010112). This ID must always be used for reference and reporting.

Time. This field shows the time of the first occurrence of the alarm, no matter the status changes. The time is shown in hours, minutes, seconds and 1/100 sec. (e.g.13:47:02.56)

2.2 Event Log (See drawing 6655-0135)

The event log can be used for viewing the history of events and to support the operator in troubleshooting. Events stay in the log even after they have been acknowledged and are no longer active. Alarms are logged with three events in the Event Log. The events are Alarm, Normal and Acknowledged. There can be up to 1 million events logged in the event log.

The events are stored in a database on the MOP's hard disc with both local and UTC time stamps. If more than 1 million events are logged, the oldest events are discarded.

Each event (with the most recent event on top) is shown as a single line and each event line is divided into the following fields:

ID Unit Tag. This field contains a unique event identity.

Date. This field contains the date of the event.

Time. This field shows the time of the event. The time is shown in hours, minutes, seconds and 1/100 sec.

Description. This field contains the alarm text (e.g. »HCU oil leakage«).

Status. This field shows either Normal or Alarm.

MCo. Shows whether the alarm is Manual Cut-Out or not.

ACo. Automatic Cut-Out.

Ack. The alarm is acknowledged.

2.2.1 Search and filter Event Log records

When using the Event Log to help analysing an event, different search and filter facilities are available to narrow the search. Explaining in brief, the facilities are (one button for each):

Go to Date/Time:

This feature can be helpful when extracting information to external parties or when investigating an event.

When pressing the Go to Date/Time button an on-screen keyboard appears with two button/fields for Date and Time respectively. Press the button to be specified and enter the value. The Date field is obligatory, while the Time field is optional. Press Apply to execute the search. The selection will be the first event after the specified date (and time).

The keyboard scroll buttons can be used afterwards to narrow the search.

Time Span Filter:

This feature can be used if only a part of the list is interesting, e.g. if a certain range of the event log list is to be printed or exported, e.g. for troubleshooting assistance at MAN Diesel.

Enter the from/to date and time in the Time Span Filter toolbar by using the onscreen keyboard. If only the From Date is entered, the To Date is automatically set to the current date. Also if only the To Date is entered, the From Date is automatically set to 1900-01-01. From Time/To Time is optional. Press Apply to execute the selection.

NOTICE

The time entered **MUST** be UTC time.

Unit/Tag Filter:

When an alarm occurs, it is stored in the Event Log by its ID (unit/tag number). It is possible to filter for a specific cause of event or a group of events by pressing the Unit/Tag Filter button, e.g. if one wants to see how often a specific event occurs, or if e.g. only events related to a specific unit, are interesting.

Three criteria buttons (filter buttons) appear in the on-screen keyboard to define the filter:

- **Unit:** The unit name, e.g. SCU
- **Index:** The unit number, e.g. SCU1 (only available if a unit has been entered)
- **Tag:** The alarm tag name, e.g. 031220

The fields are all optional. Fields that are not filled in, means 'any text'. Press *Apply* to execute the search and filtering.

2.2.2 Saving Event Log records

Export:

This button is used when saving the Event Log record displayed to a USB memory stick, the hard disk drive (HDD) or when printing a hard copy of the data displayed.

Printing:

If a printer is connected to the MOP hub, printing the displayed data is possible.

1. Press the Export button.
2. Press Print from the pop-up screen .

To limit the amount of line s to be printed, see Time Span Filter

NOTICE

For troubleshooting purposes, MAN Diesel may request an Event Log record. The Event Log record can be stored as a compressed file (.zip) on a USB memory stick or on the hard disc drive (HDD), by the engine crew. The .zip file is then sent by e-mail from the ship's ordinary PC to MAN Diesel.

Save to USB memory stick:

MAN Diesel recommends this option to deliver an Event Log record for trouble-shooting purpose.

1. Insert the USB memory stick into the MOP.
2. On the Event Log screen , press the Export button and the Export Event Log toolbar shows up. Destination field will read USB.
3. On the Export Event Log tool bar, press the Save button.
4. When the saving is finished, the Destination field will read Saved, and the USB memory stick can be removed.

The data displayed on the Event Log screen , is now stored on the USB memory stick. The output will be a comma separated file with the name Event Log<date, time>.zip.

To limit the file size to be exported, see *Time Span Filter*

Save to hard disk:

If a USB memory stick is not available, the Event Log data can be saved to the hard disk.

1. On the Event Log screen , press the Export button and the Export Event Log tool bar opens. Destination field will read HDD, as no USB memory stick is plugged in.
2. On the Export Even t Log tool bar, press the Save button.
3. When the saving operation is finished the Destination field will read Saved. The data displayed on the Event Log screen, is now stored on the hard disk drive. The output will be a comma separated file with the name Event Log<date, time>.zip.

To limit the file size to be exported, *see Time Span Filter*

Dump:

Dump and Save have the same functionality, except for the actual output. I.e., when the Dump button is pressed, the displayed Event Log is saved to the location shown in the Destination field. The data, however will be saved as an SQL script and compressed to a zip file. The file name will be Event LogDump<DateTime>.zip.

<DateTime> is the current UTC time when the files were saved.

2.2.3 Searching for an Event From a Specific Date and Time or by Tag Number.

This feature can be helpful when extracting information to external parties or when investigating an event.

When scrolling up or down on the Event Log screen is not sufficient, it is possible to search for a specific event by tag number by pressing the button “Unit/Tag Filter”. When an alarm occurs, it is given a tag number that is stored together with the alarm event. By writing this number in the dialog box and pressing “Apply” the alarm event is shown on the screen.

Similarly, the button “Time Span Filter” sorting can be selected.

Enter the from/to date and time in the toolbar by using the popped up keyboard. Press “Apply” to execute. Note that the entered time has to be in UTC time. As a result the events, inside the selected time span to the specified date and time, will be selected and shown on the screen.

From the button “Go to Time/Date”, events which took place at/on a specific time/date can be displayed. Note that the entered time has to be in UTC time.

When a filter is no longer needed, remember to remove it (by pressing the button again), otherwise it might seem like the event log is frozen and does not receive new events.

2.2.4 Exporting the Event Log

From the toolbar “Export Event Log”, displayed when the “Export” button is pressed, it is possible to print a copy of the Event Log or make a back-up Dump used for information to external parties or the engine crew themselves.

Should external parties ask for an Event Log record (for trouble shooting purposes), the Event Log record can be saved on a USB memory stick (or Hard Disc Drive if no USB memory stick is available) as a zip file. Be aware of the risk of using USB-sticks generally.

The file name will be: **EventLog<DateTime>.zip** when the file is **saved** on a USB memory stick.

(Is the Event Log **dumped** to a USB memory stick (or Hard disc Drive) the file name will be: **EventLogDump<DateTime>.zip**).

In both cases the **DateTime** is the UTC time when the file was saved.

The USB memory stick (containing the zip file) can then be hand carried to the ships mail PC and the zip file mailed to external parties for evaluation.

2.3 Manual Cut-Out List (See drawing 6655-0140)

Manual cut-out of alarms may be used, for instance, if the engineer has observed a failure of a sensor that is not detected automatically (see below) or if, for instance, a tachometer pick-up is failing (the engine running on the redundant tachometer system) and is continuously giving an alarm and cannot be replaced immediately.

Alarms are sometimes cutted-out automatically. Automatic cut-out may be used by the system to suppress alarms which are unimportant in specific states, e.g. when a sensor is invalidated by the operator.

The manually cut-out alarms are shown in a separate list, which can be accessed from the navigation bar. The manual cut-out screen is in functionality equivalent to the channel list screen. An alarm can be cut-out manually from the screens Alarm List, Manual cut-out List or Channel list.

All alarm channels that have the status "Manual cut-out" are shown in the manual cut-out screen.

Removing ("Re-activating") an entry from the Manual cut-out list is done by highlighting the alarm(s) involved on the screen and then pressing the button "Reactivate" in the toolbar.

2.4 Channel List (See drawing 6655-0145)

The channel list screen contains status information of all alarm channels within the ECS, no matter the status of the individual alarm channel. As default, the alarm channels are listed in tag-name alphabetic order. From the channel list screen, it is possible to cut out (and re-activate) alarm channels.

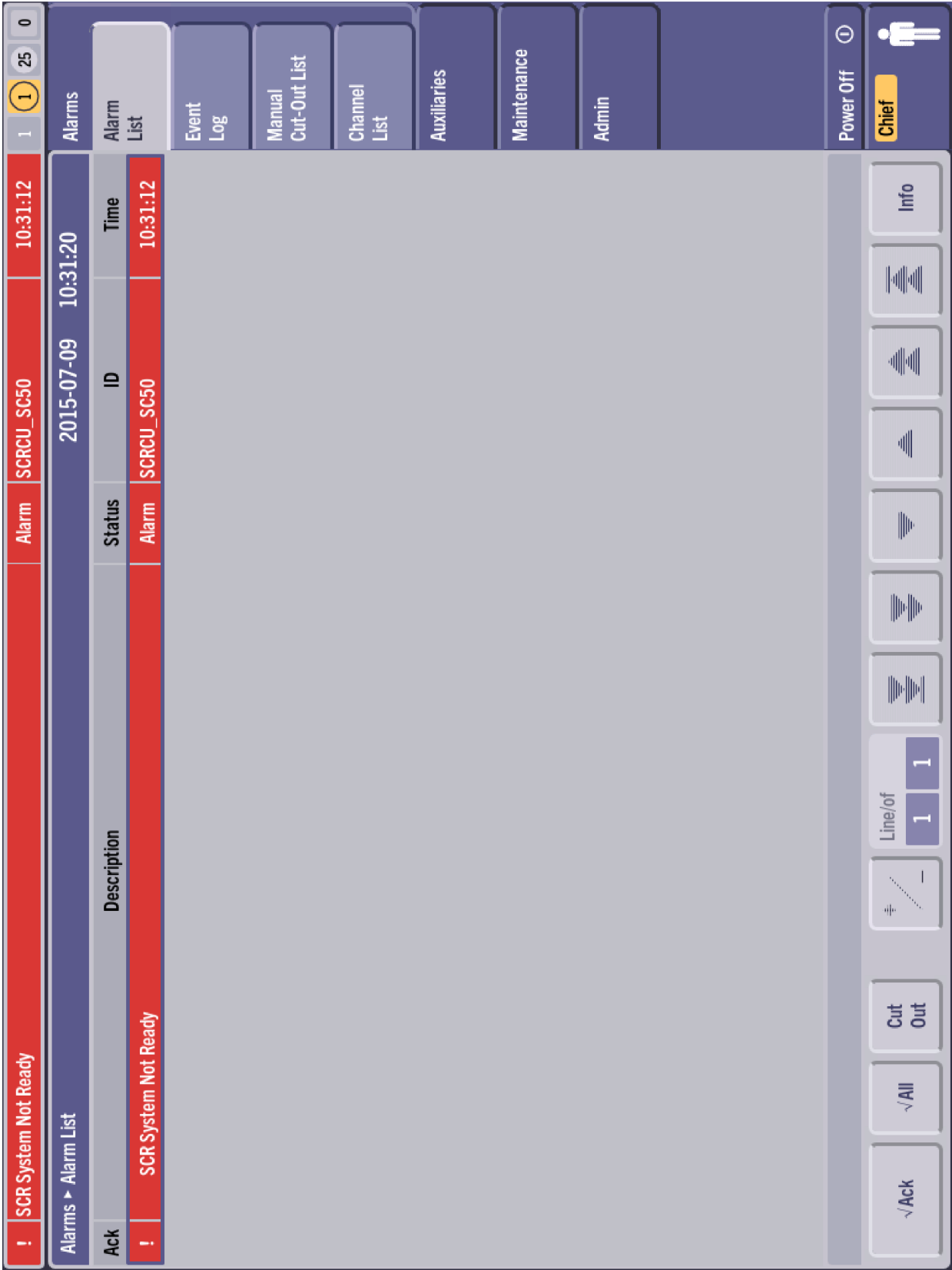
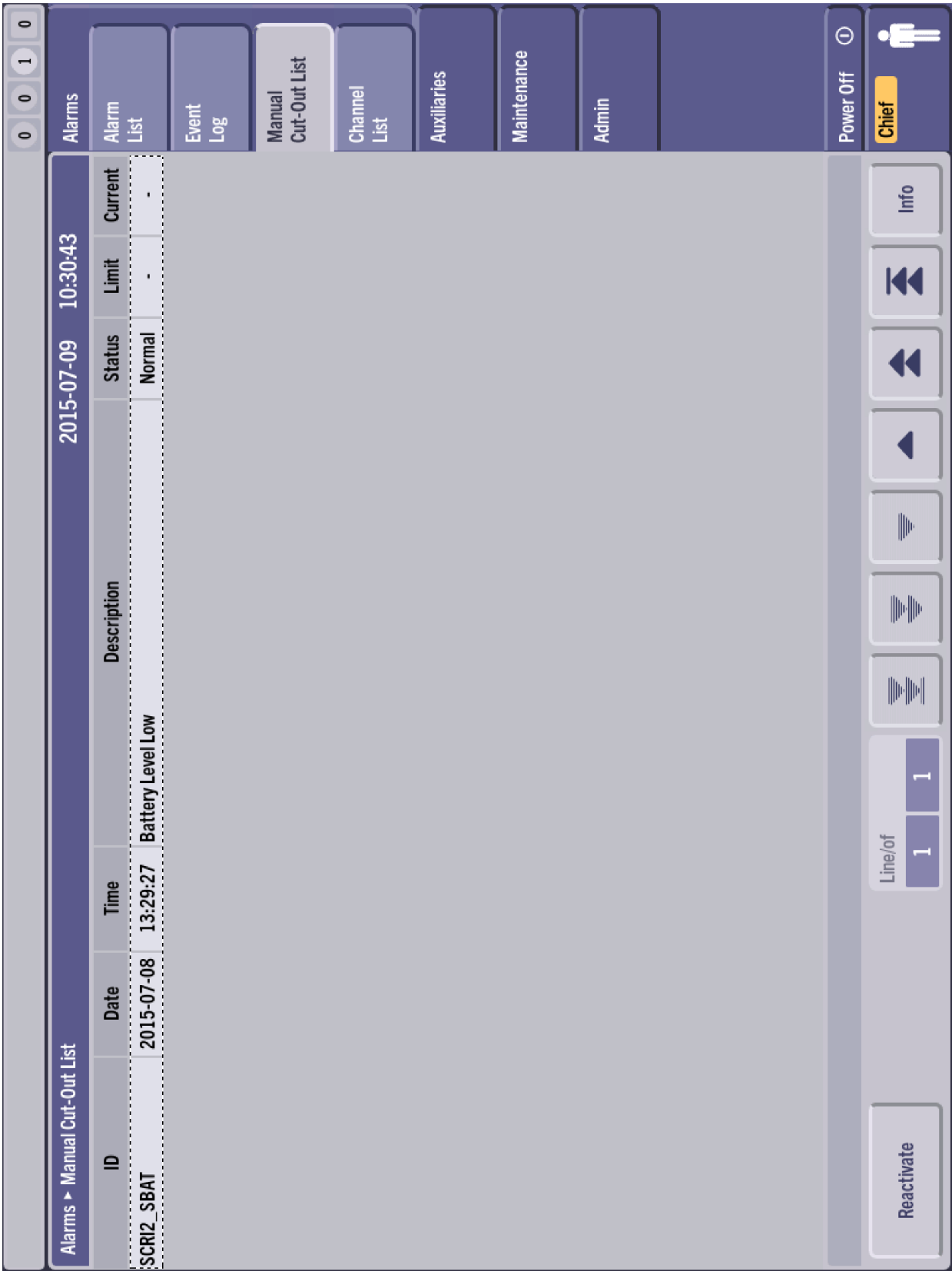


Figure 1: ERCS MOP alarm list.

Alarms										0	0	25	0												
Alarms ► Event Log										2015-07-09 10:28:58															
D: Unit_Tag	Date	Time	Description	Status	MCo	ACo	Ack	Alarms Alarm List Event Log Manual Cut-Out List Channel List Auxiliaries Maintenance Admin																	
SSCRCU_VSM01ev	2015-07-08	13:29:31,97	Sensor Stabilizing Timeout	Normal			X																		
SSCRCU_PSM33ev	2015-07-08	13:29:30,69	Dosing Enable timed out	Normal			X																		
SSCRCU_PSM32ev	2015-07-08	13:29:30,67	Flushing timed out	Normal			X																		
SSCRCU_SU70	2015-07-08	13:29:30,62	SCR Stop supervision off	Normal			X																		
SSCRCU_SU71	2015-07-08	13:29:30,62	SCR Shut Down supervision off	Normal			X																		
SSCRCU_GS13A	2015-07-08	13:29:30,61	Fuel sulfur content too high	Normal			X																		
SSCRCU_GS1265	2015-07-08	13:29:30,60	Limiter saturation timed out alarm	Normal			X																		
SSCRCU_SNA-MOPA	2015-07-08	13:30:25,15	MOPA unavailable	Normal																					
SSCRCU_SN1-MOPA	2015-07-08	13:30:25,14	Net B not connected to MOPA	Normal																					
SSCRCU_SNO-MOPA	2015-07-08	13:30:25,14	Net A not connected to MOPA	Normal																					
SSCRCU_SNA-SCU1	2015-07-08	13:29:34,01	SCU1 unavailable	Normal			X																		
SSCRCU_SN1-SCU1	2015-07-08	13:29:34,01	Net B not connected to SCU1	Normal			X																		
SSCRCU_SNO-SCU1	2015-07-08	13:29:34,00	Net A not connected to SCU1	Normal			X																		
SSCRCU_SAR-SCU1	2015-07-08	13:29:33,99	App. not running on SCU1	Normal			X																		
SSCRCU_SNA-SCRI2	2015-07-08	13:29:33,98	SCRI2 unavailable	Normal			X																		
SSCRCU_SN1-SCRI2	2015-07-08	13:29:33,97	Net B not connected to SCR12	Normal			X																		
SSCRCU_SNO-SCRI2	2015-07-08	13:29:33,96	Net A not connected to SCR12	Normal			X																		
SSCRCU_SAR-SCRI2	2015-07-08	13:29:33,96	App. not running on SCR12	Normal			X																		
SSCRCU_SNA-SCRI1	2015-07-08	13:29:33,95	SCRI1 unavailable	Normal			X																		
SSCRCU_SN1-SCRI1	2015-07-08	13:29:33,94	Net B not connected to SCR11	Normal			X																		
Power Off ⓘ										Chief ⓘ															
Unit/Tag Filter										Time Span Filter				Go to Date/Time				Export...				Info			



SCR MOP Manual Cut-Out List

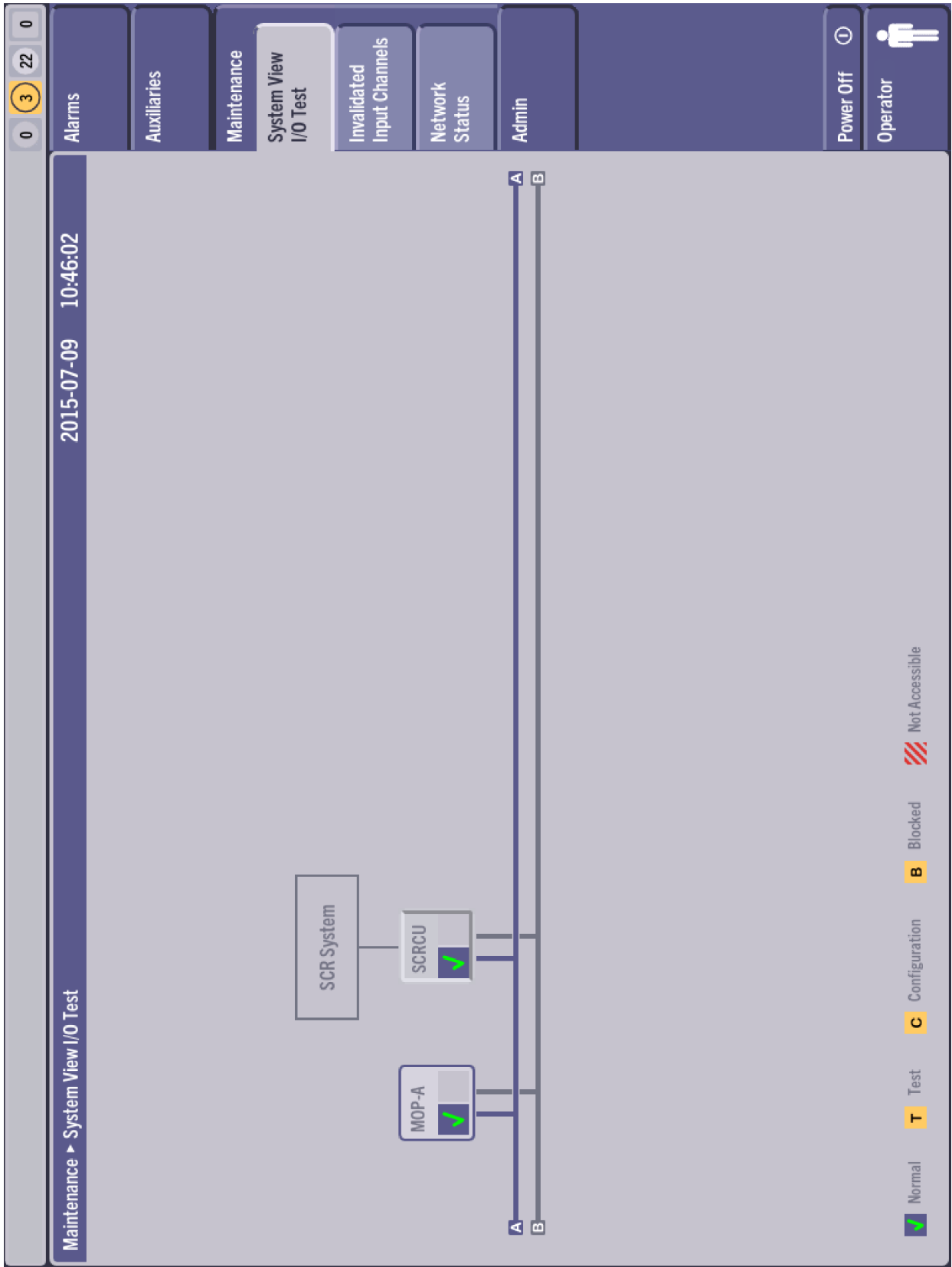
0		3		22		0	
Alarms		Alarm List		Event Log		Manual Cut-Out List	
Channel List		Auxiliaries		Maintenance		Admin	
Power Off		Operator		Info			
Alarms > Channel List		2015-07-09 10:53:28					
ID	Date	Time	Description	Status	MCo	ACo	Ack
SCRUCU_6605-104	2015-07-09	10:44:12	Suprv. Ch21,6605-1,Temp. at SCR inl	Normal			X
SCRUCU_660704	2015-07-09	10:44:12	Suprv. Ch24,6607,Temp. reactor inle	Normal			X
SCRUCU_6622-104	2015-07-09	10:44:12	Suprv. Ch26,6622-1,NOx Conc. SCR ou	Normal			X
SCRUCU_6622-204	2015-07-09	10:44:12	Suprv. Ch27,6622-2,NOx Conc. SCR ou	Normal			X
SCRUCU_663204	2015-07-09	10:44:12	Suprv. Ch25,6632,Reducing Agent FB.	Normal			X
SCRUCU_664004	2015-07-09	10:44:12	Suprv. Ch30,6640,Temp. at SCR outle	Normal			X
SCRUCU_860904	2015-07-09	10:44:12	Suprv. Ch31,8609,Scavenge Air Temp.	Normal			X
SCRUCU_861204	2015-07-09	10:44:12	Suprv. Ch35,8612,Compressor in. Tem	Normal			X
SCRUCU_880204	2015-07-09	10:44:12	Suprv. Ch33,8802,Ambient Pressure [	Normal			X
SCRUCU_881904	2015-07-09	10:44:12	Suprv. Ch36,8819,Compressor in. Hum	Normal			X
SCRUCU_GS03A	2015-07-09	10:44:13	Ext. Dosing handling sys. not ready	Normal			X
SCRUCU_GS080141	2015-07-09	10:44:13	Engine Load Signal Failure	Normal			X
SCRUCU_GS080241	2015-07-09	10:44:13	Engine speed signal failure	Normal			X
SCRUCU_GS080341	2015-07-09	10:44:13	Engine speed SP signal failure	Normal			X
SCRUCU_GS080441	2015-07-09	10:44:13	P scav signal failure	Normal			X
SCRUCU_GS080541	2015-07-09	10:44:13	Fuel index signal failure	Normal			X
SCRUCU_GS080641	2015-07-09	10:44:13	TC speed signal failure	Normal			X
SCRUCU_GS080741	2015-07-09	10:44:13	Prepare SCR cmd signal failure	Normal			X
SCRUCU_GS080841	2015-07-09	10:44:13	Tier II SCR cmd signal failure	Normal			X
SCRUCU_GS080941	2015-07-09	10:44:13	Engine mode cmd signal failure	Normal			X
Cut-Out		Reboot		Line/of		82 203	

Figure 1: ERCS MOP Channel List

SCR MOP Channel List

Drawing

6655-0145-0009



SCR MOP System View I/O Test

Drawing
6655-0190-0010

Figure 1: System View I/O Test. LP SCR.

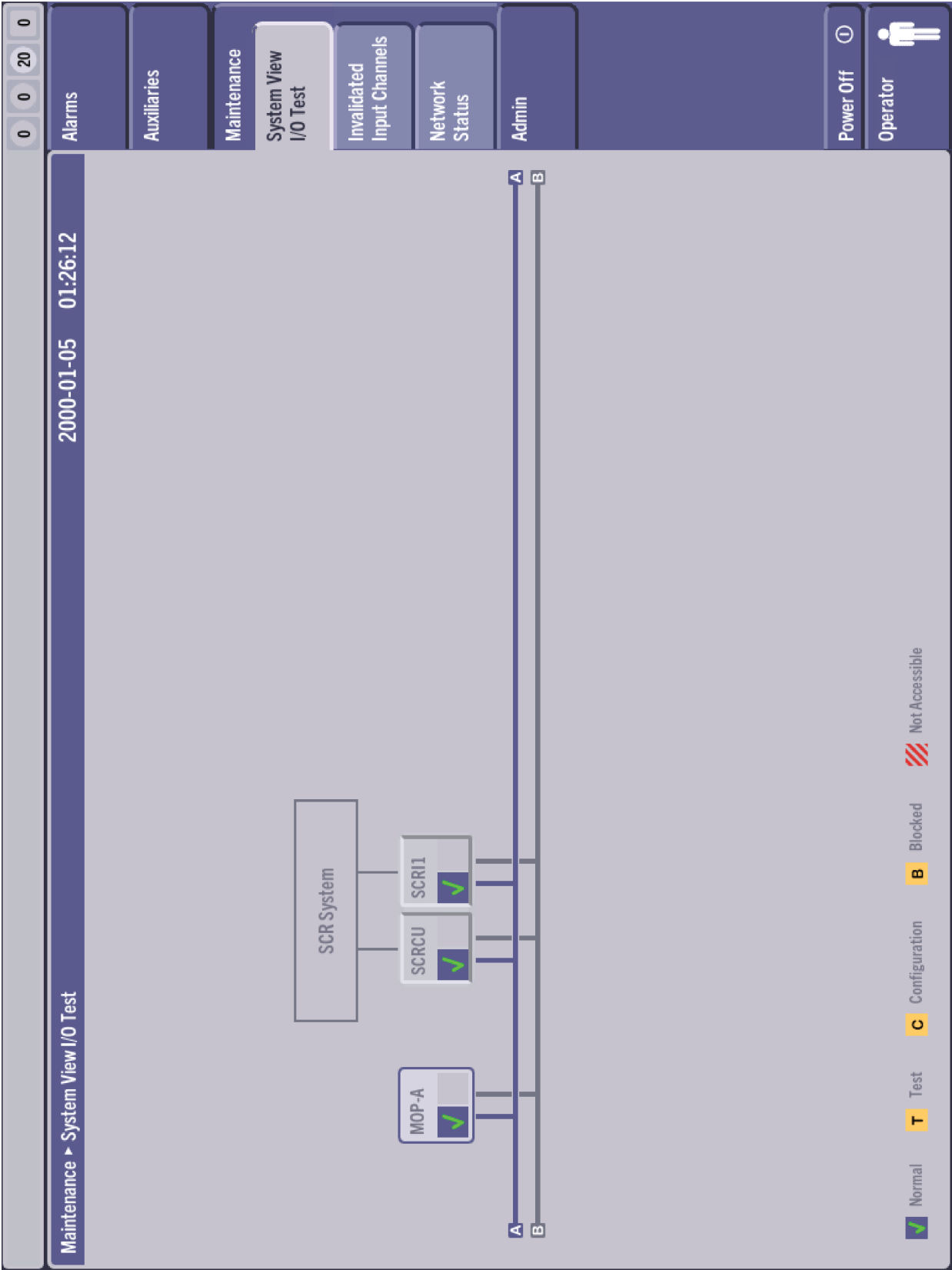


Figure 2: System View I/O Test. HP SCR med maximum 1 RBV.

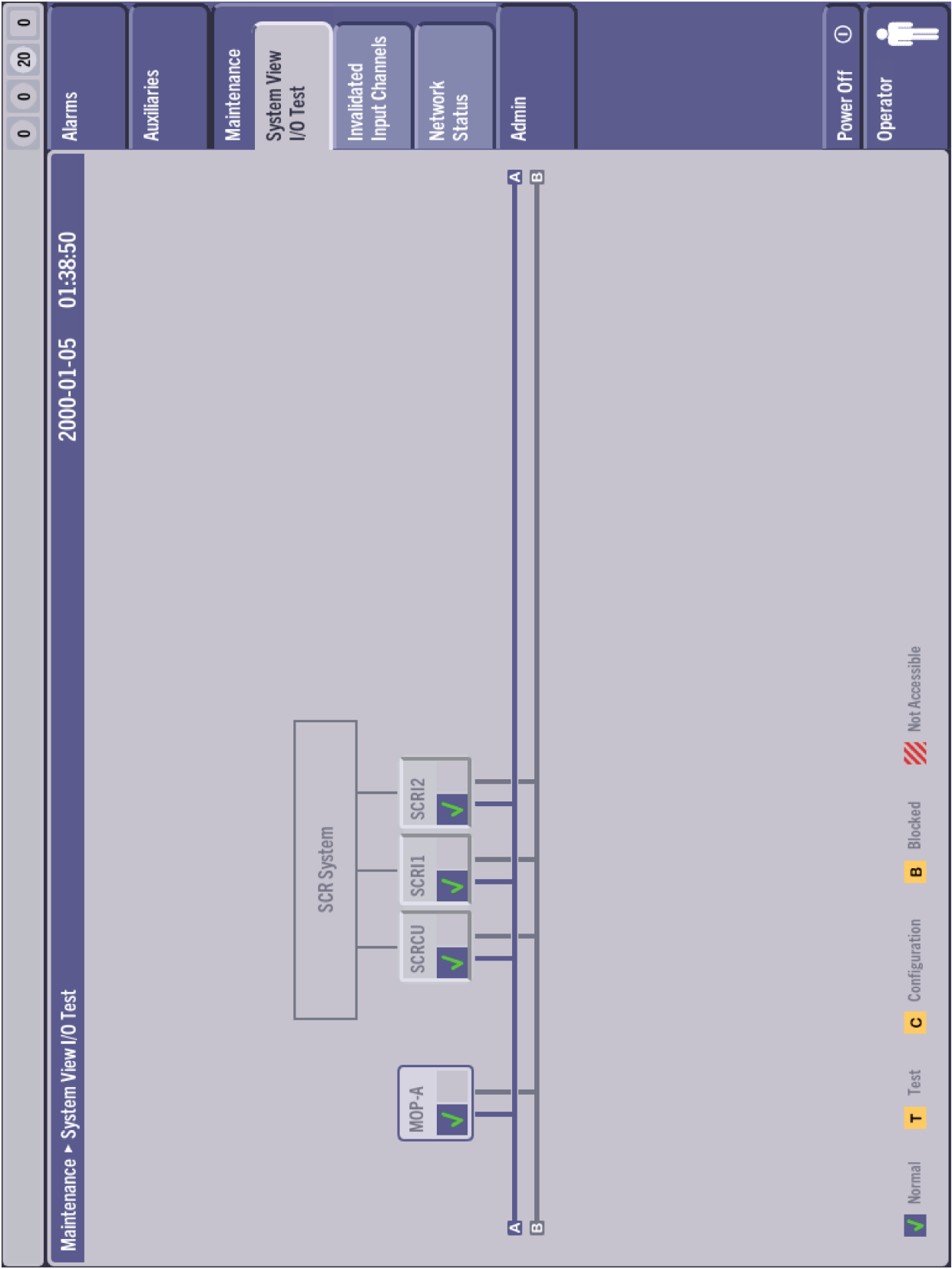


Figure 3: System View I/O Test. HP SCR with maximum 3 RBVs.

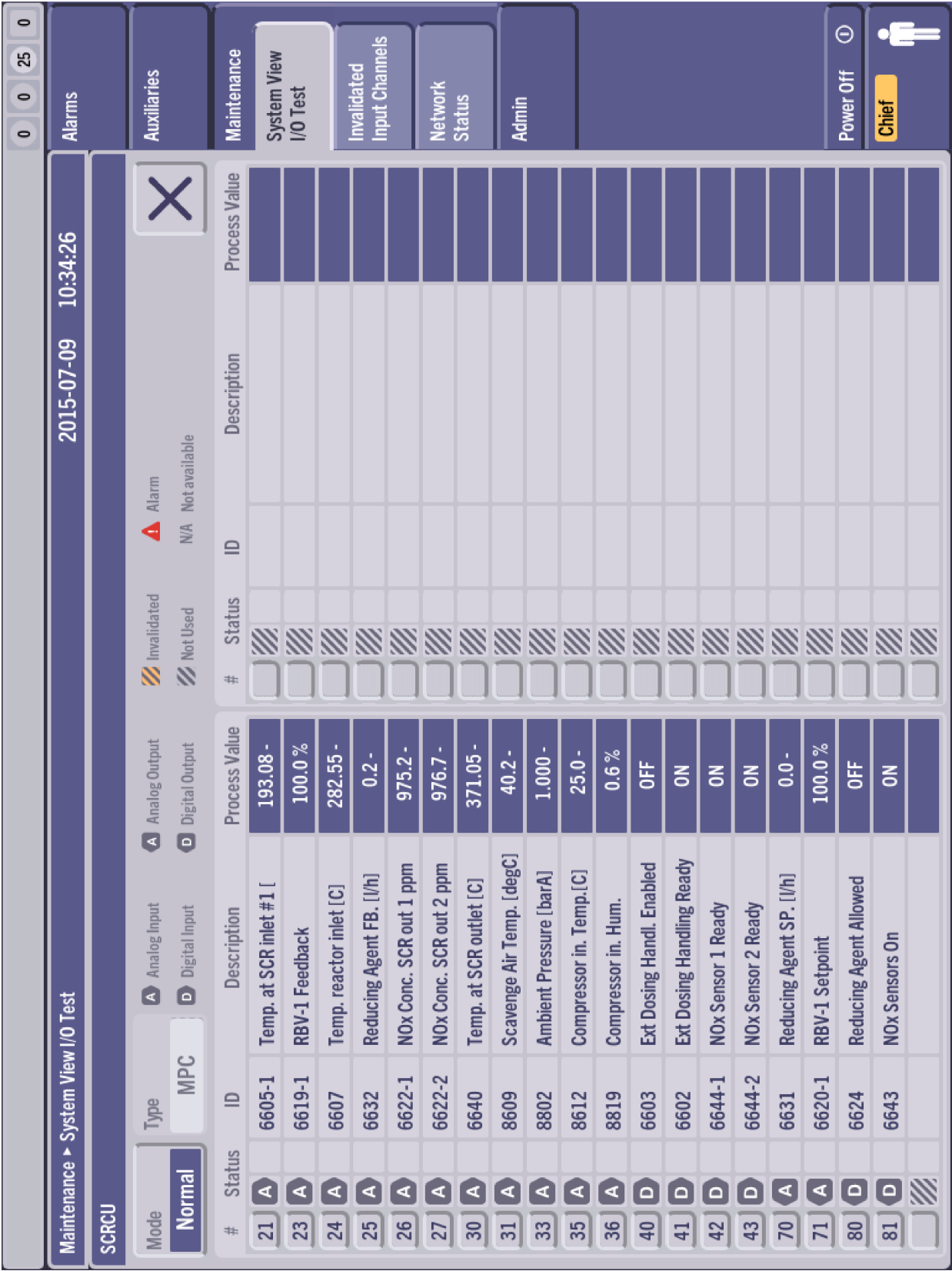


Figure 4: SCRI1 System View I/O Test. SCRCU.



Figure 5: System View I/O Test. SCRI1.

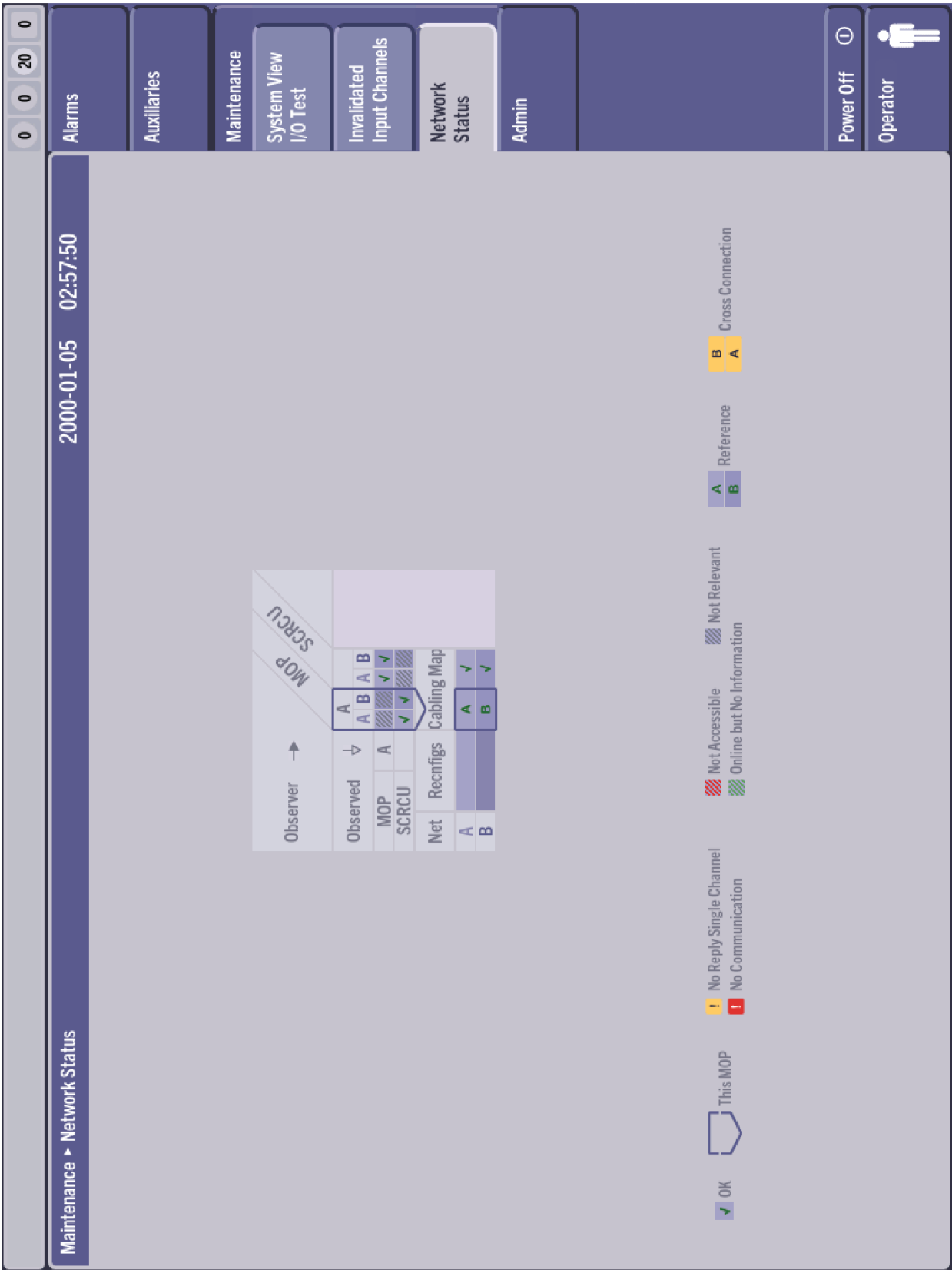


Figure 1: LP SCR network status.

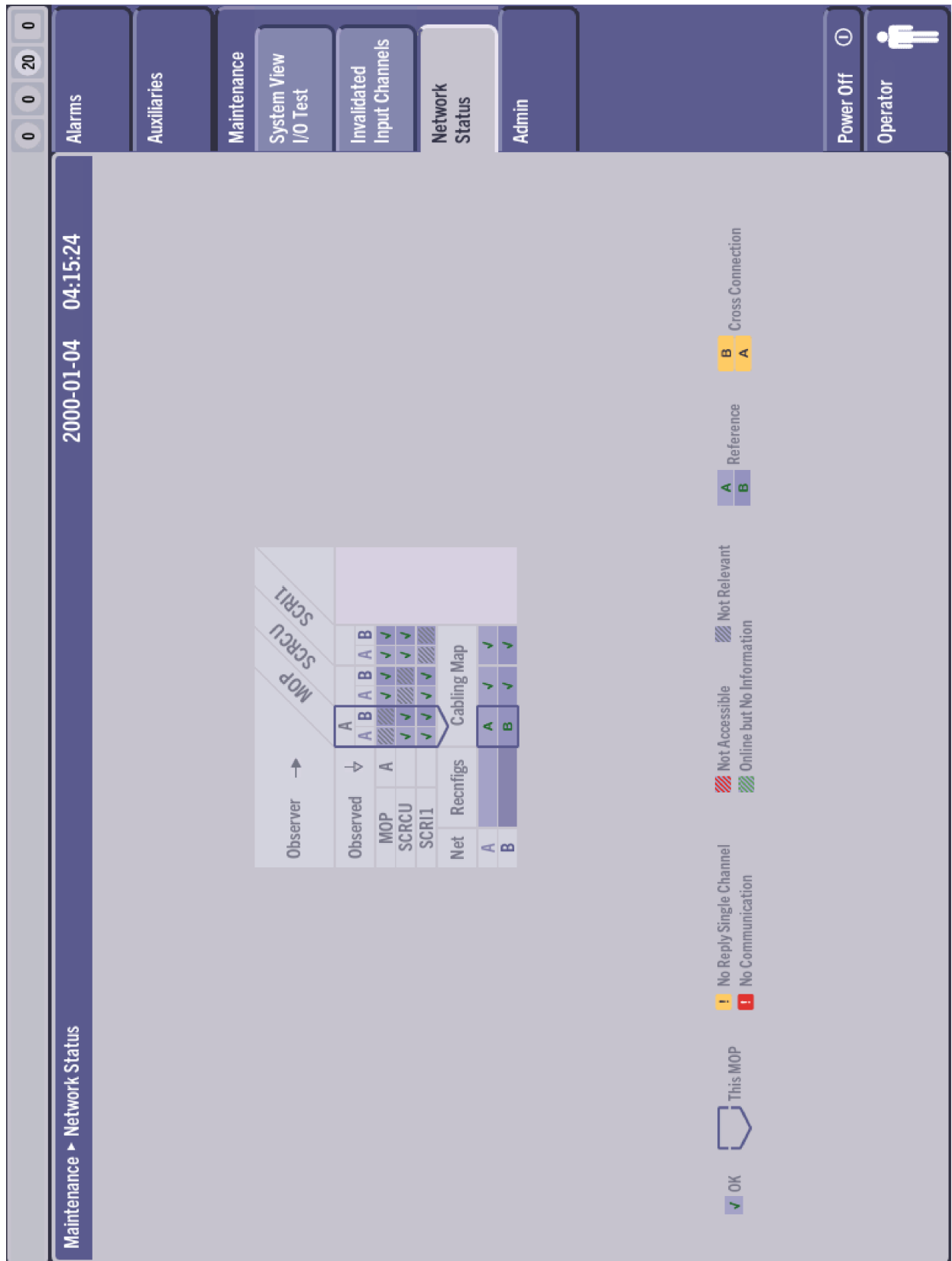


Figure 2: HP SCR network status 1 RBV.

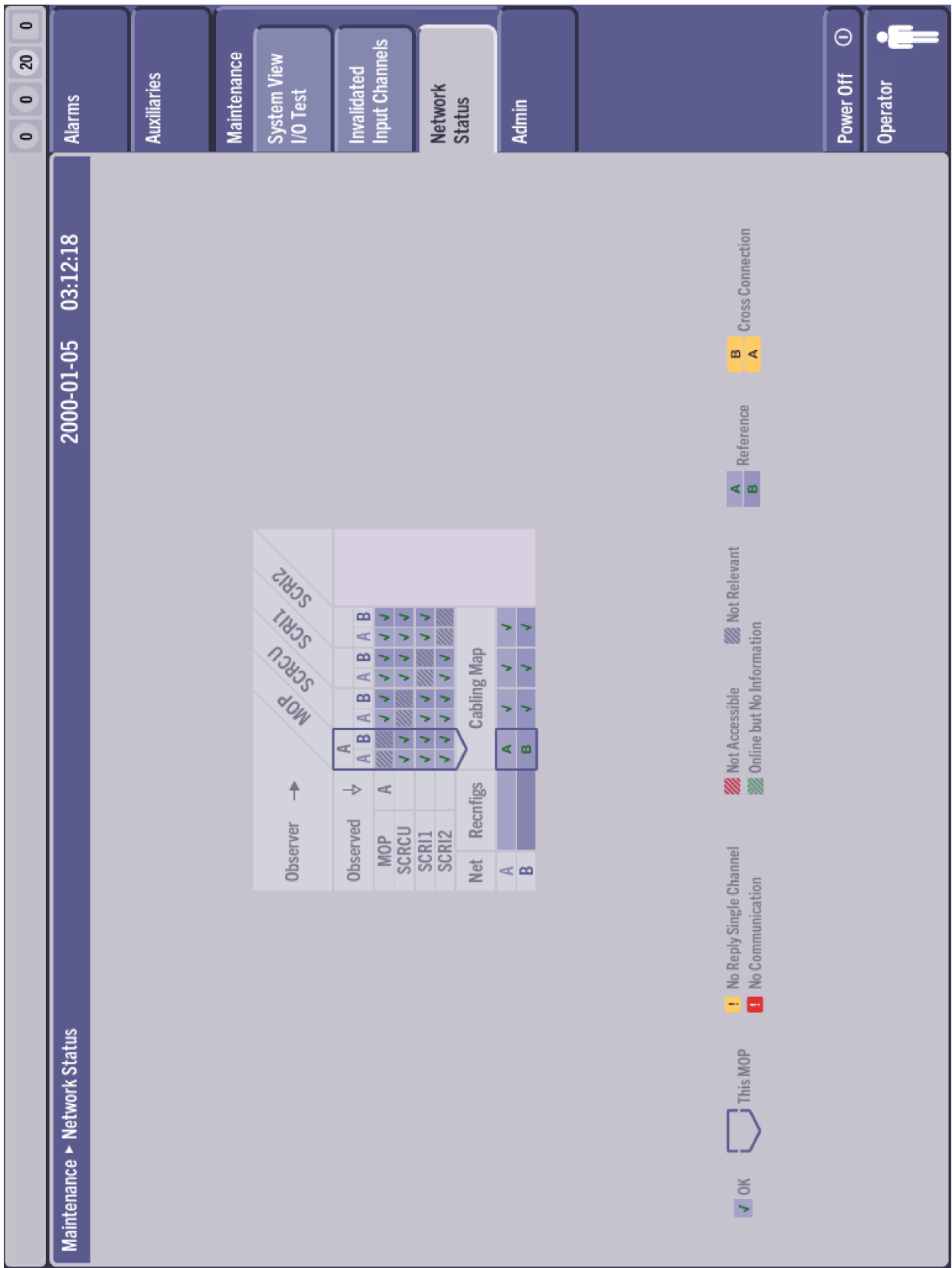


Figure 3: HP SCR network status 2-3 RBVs.

1 SCR Electrical Diagrams

Note Regarding Use of the Following Electrical Diagrams

With reference to the individual electrical diagrams, the following guidelines are applied:

- Refer always to the diagrams as supplied by engine builder.
- Electrical diagrams are subject to constant revision and change and can vary with the actual, individual installations.

For these reasons, we supply here only the Overview drawings as these can be useful as orientation for where to seek guidance in the installations actual, supplied diagrams.

Terminology and Abbreviations

EX-ARCS	External Ammonium Bisulphate Regeneration Control Ssystem
EX-VS	External Valve Ssystem
AMS	Alarm and Monitor Ssystem
MOP-SCR	Main Operating Panel SCR
ERCS-UPS	ERCS Uninterrupted power source
SCR NOx Cabinet	SCR NOx Cabinet
SCR-CU	SCR Control Unit
SCR-CU-CB	SCR CU Cabinet
EX-DHS	External Dsoing Handling Ssystem
ACU-1	Auxiliary Control Unit 1
ECC1	Engine Control Cabinte 1
8612/8819/8802	Ambient Sensor

Table 1: For the LP drawings:

6613	SCR Reactor Throttle Valve
6619-1	SCR Reactor Bypass Valve 1, RBV-1
6619-2	SCR Reactor Bypass Valve 2, RBV-2
6619-3	SCR Reactor Bypass Valve 3, RBV-3
6635	SCR Cylinder bypass valve
ACU-1	Auxiliary Control Unit 1
AMS	Alarm & Monitor System
CP AUX	Control Panel Aux. Blower System
ECC1	Engine control cabinet 1
EX-DHS	External Dosing Handling System
EX-HCS	External Heating Control System
EX-SBCS	External Soot Blowing Control System
EX-VCS	External Valve Control System
JB 6616	JB-SCR Reactor Sealing Valve
MOP-SCR	Main Operating Panel SCR
SCR NOx CB	SCR NOx Cabinet
SCR-CU	SCR Control Unit
SCR-CU-CB	SCR CU Cabinet
SCR-I1	SCR Interface Unit 1
SCR-I1-CB	SCR I1 Cabinet
SCR-I2	SCR Interface Unit 2
SCR-I2-CB	SCR I2 Cabinet
UPS	Uninterrupted power supply
XT8819-C	Humidity sensor

Table 2: For the HP drawings:

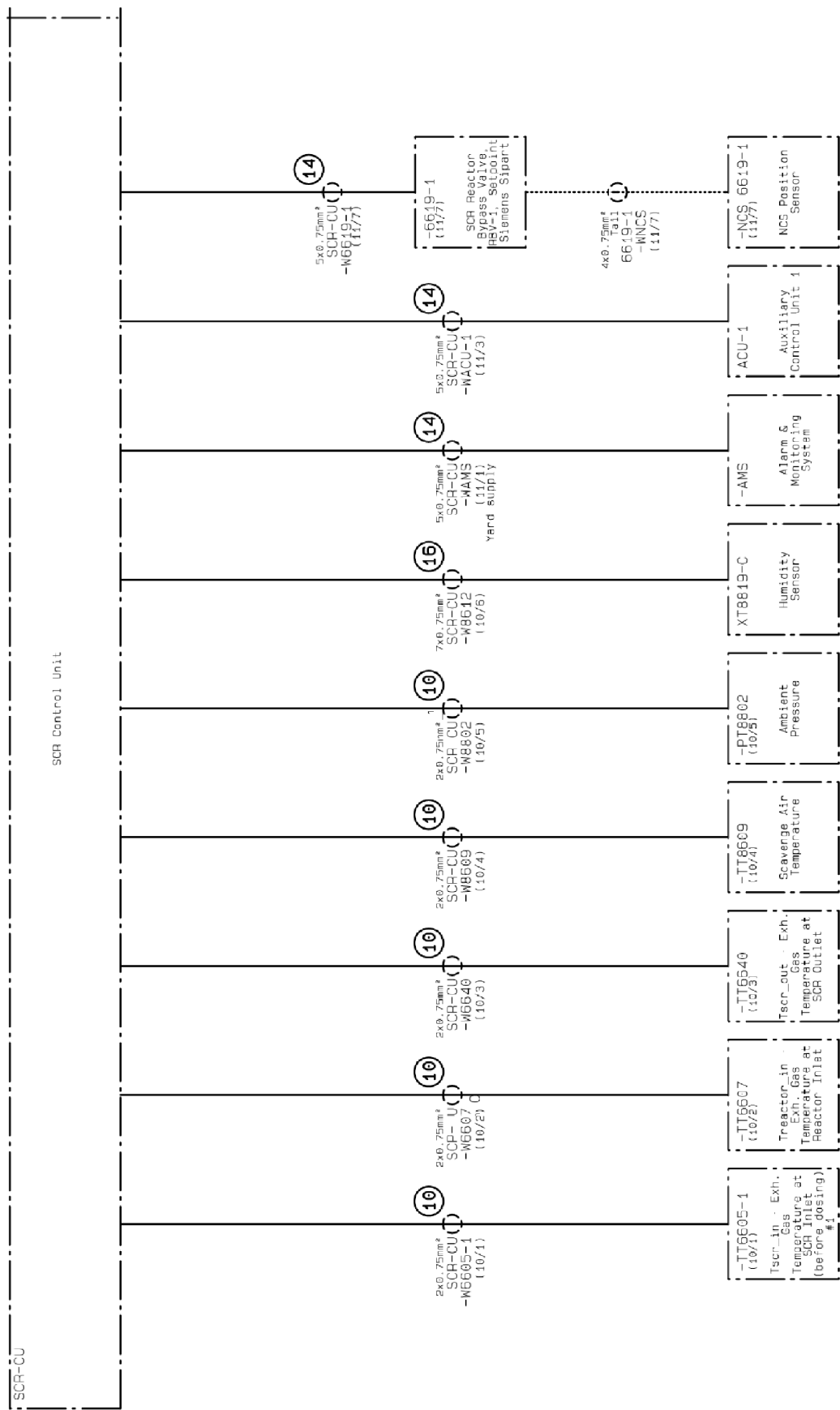
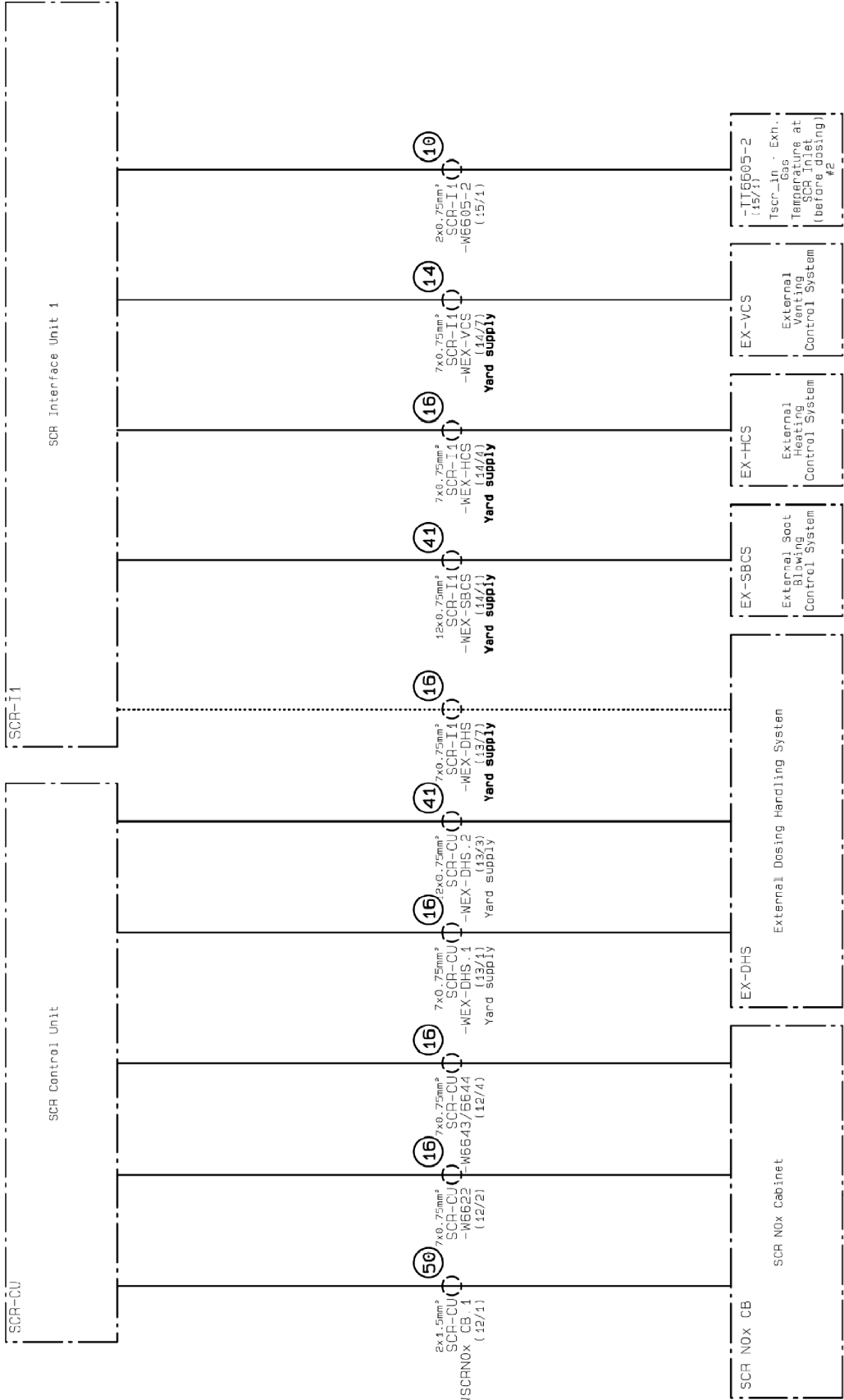


Figure 1: Overview SCR-CU installation. HP.



Figure 2: Overview SCR-CU & SCR-I1 installation. HP.



2016-06-08 - en

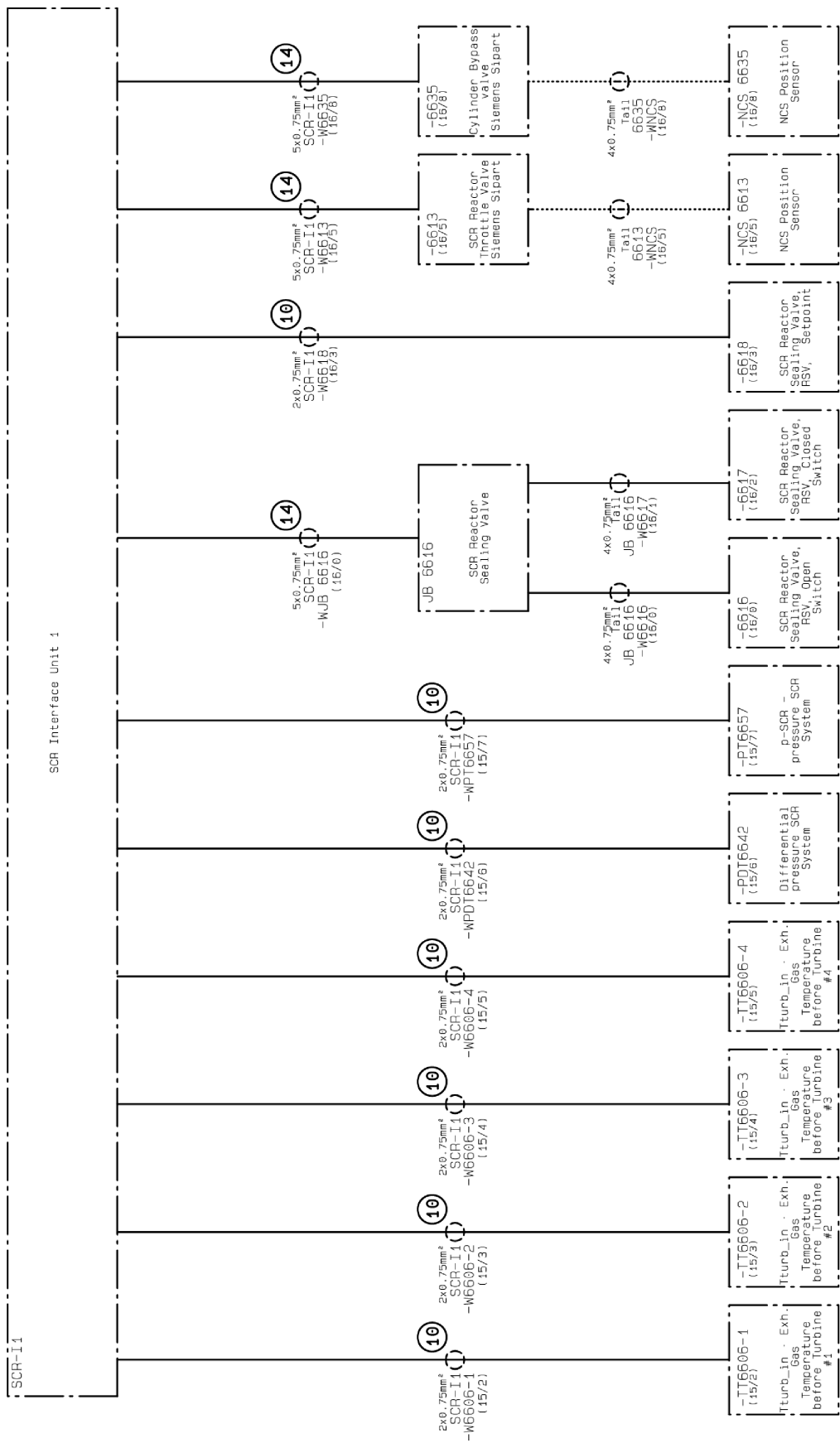


Figure 3: Overview SCR I1 installation. HP.



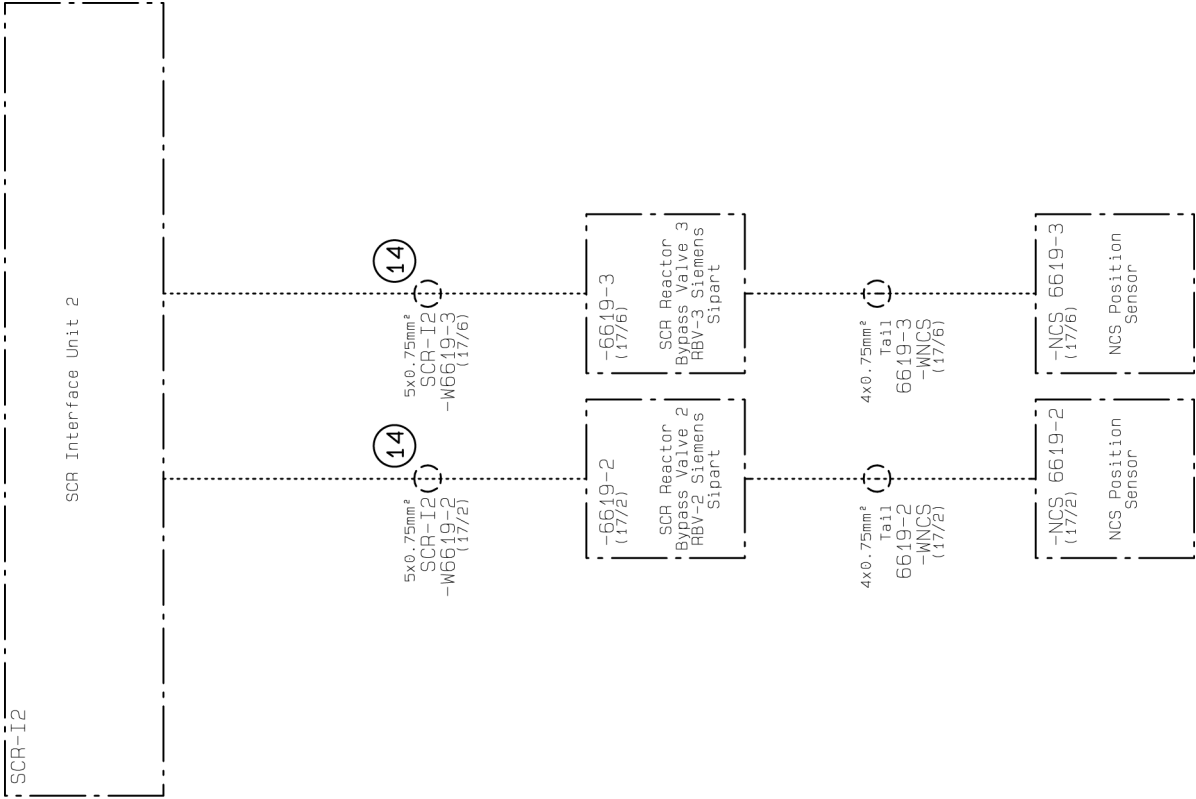


Figure 4: Overview. SCR-I2 installation. HP.

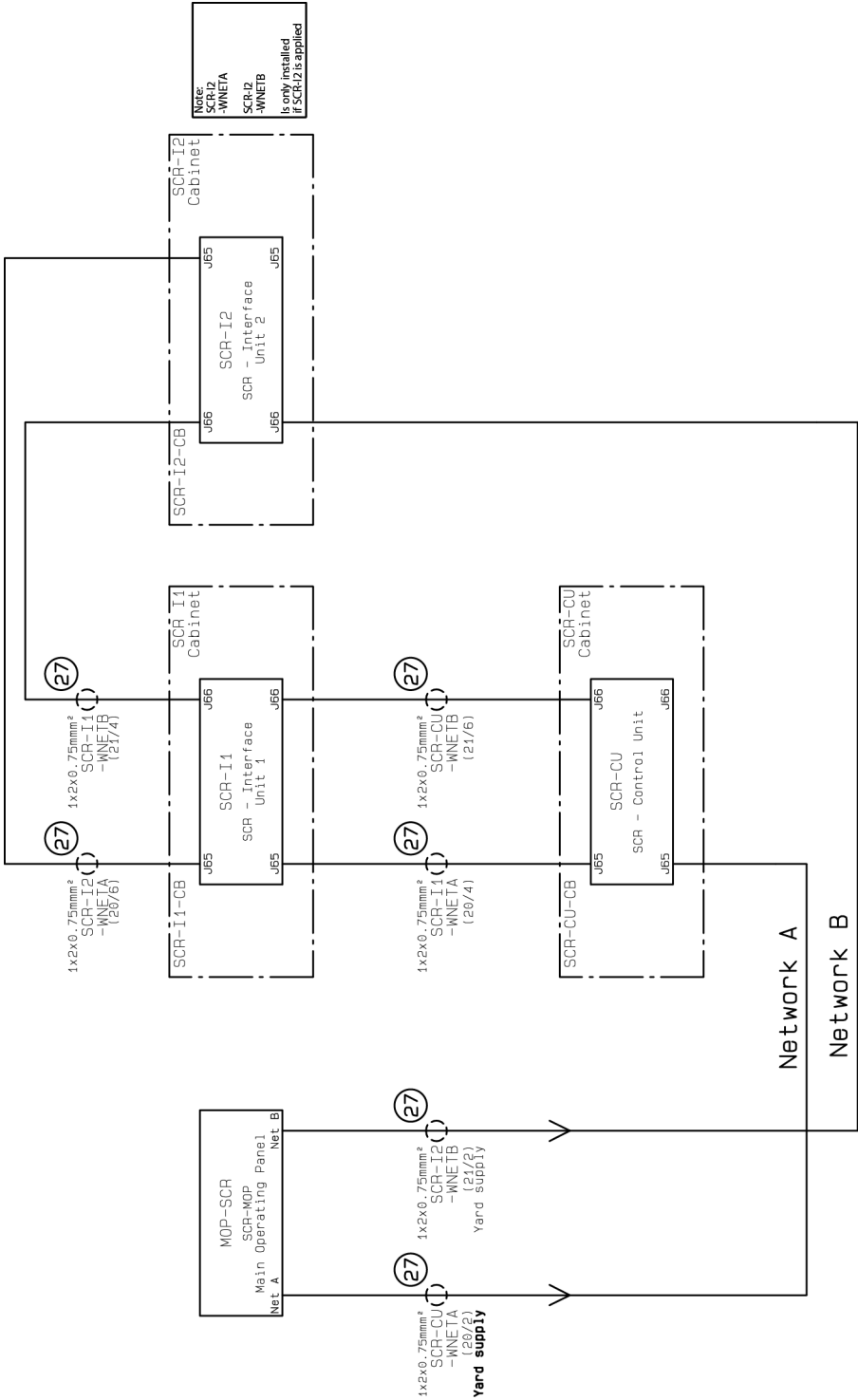


Figure 5: Network overview. HP.

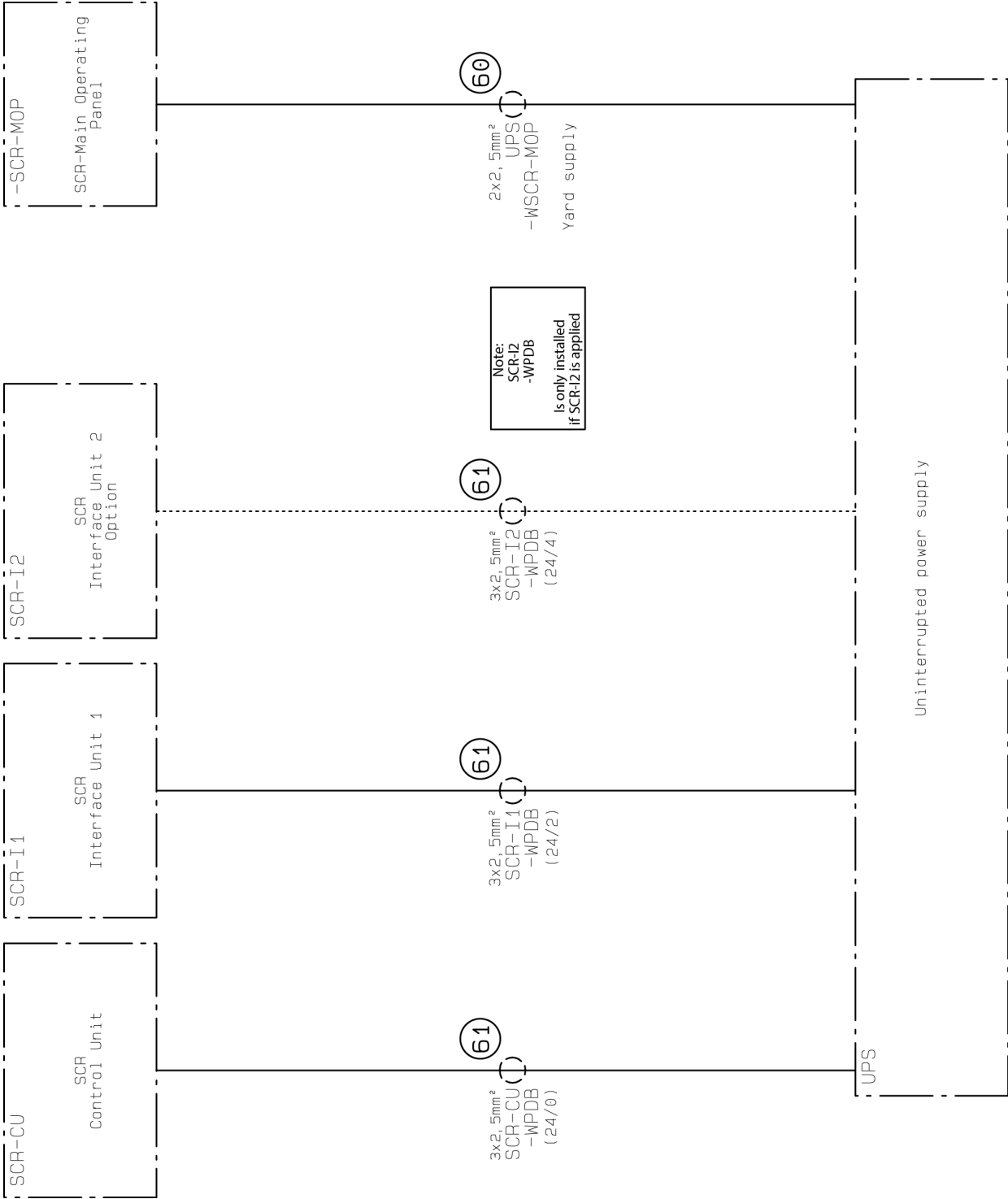


Figure 6: Overview Power connections. HP.

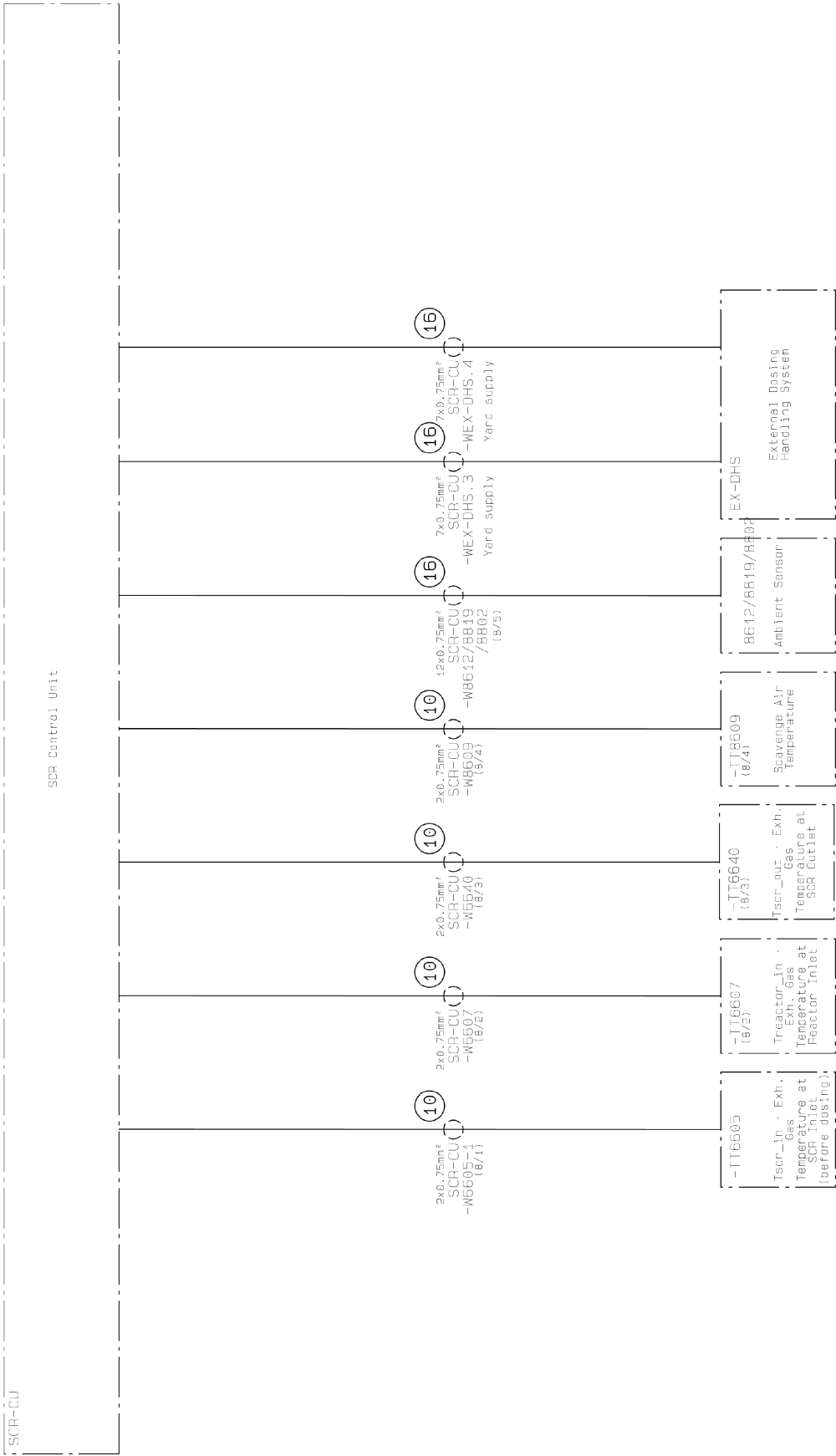


Figure 7: Overview SCR installation. LP.



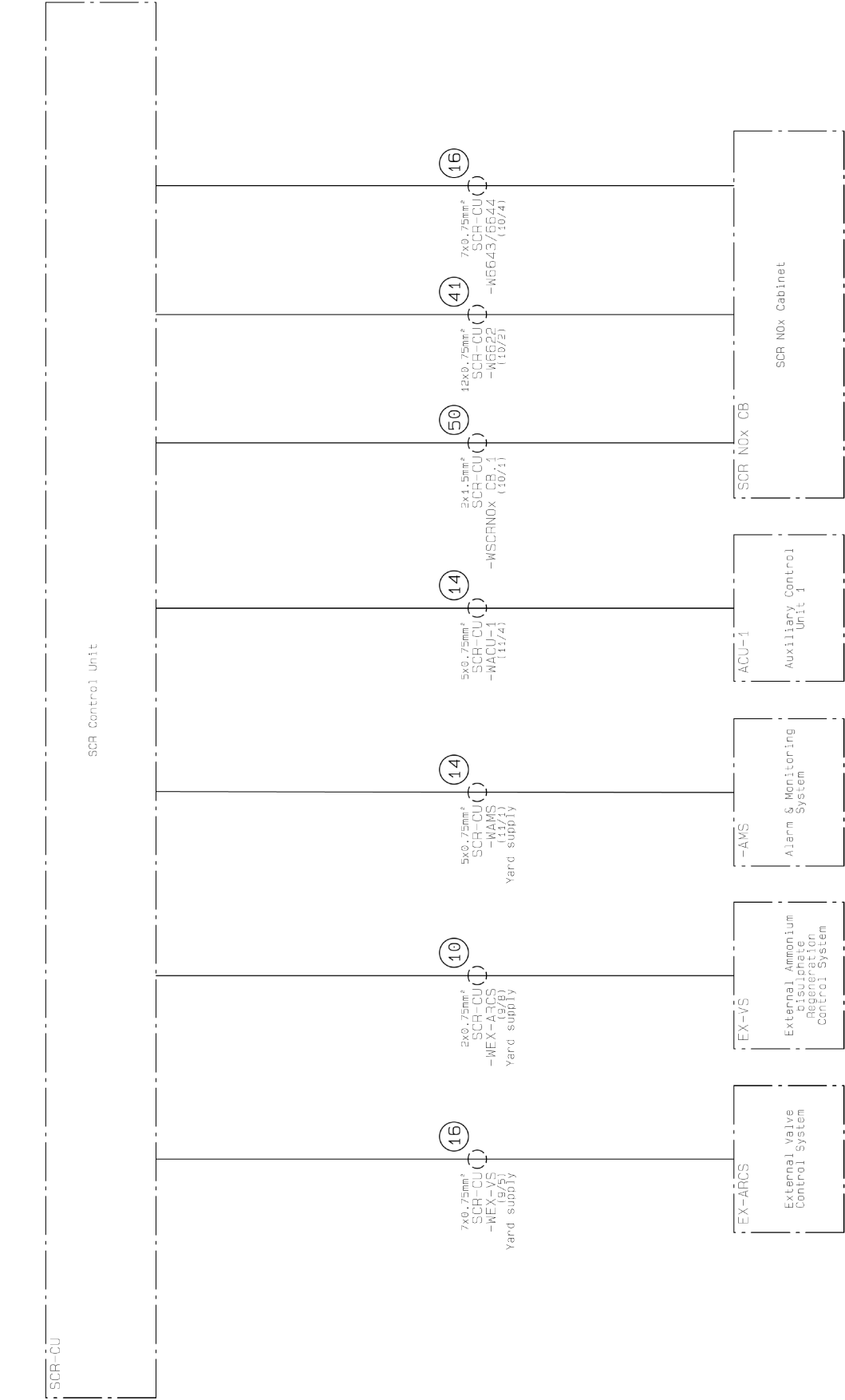


Figure 8: Overview SCR installation. LP

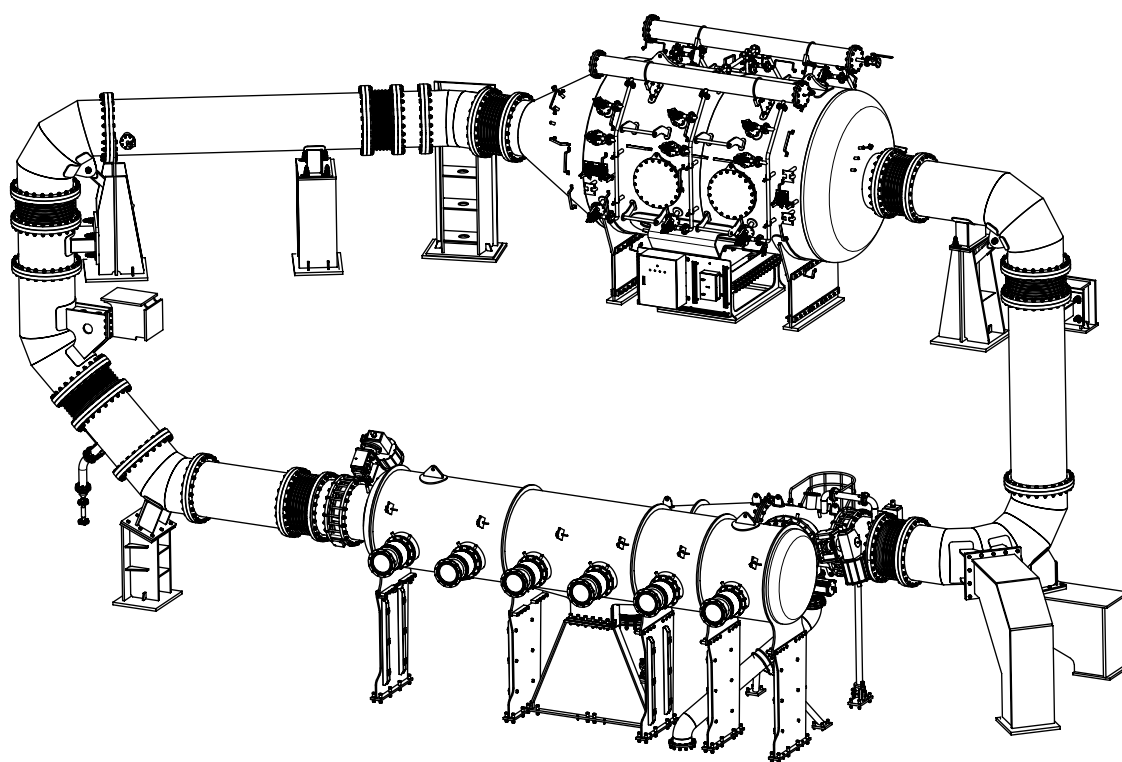


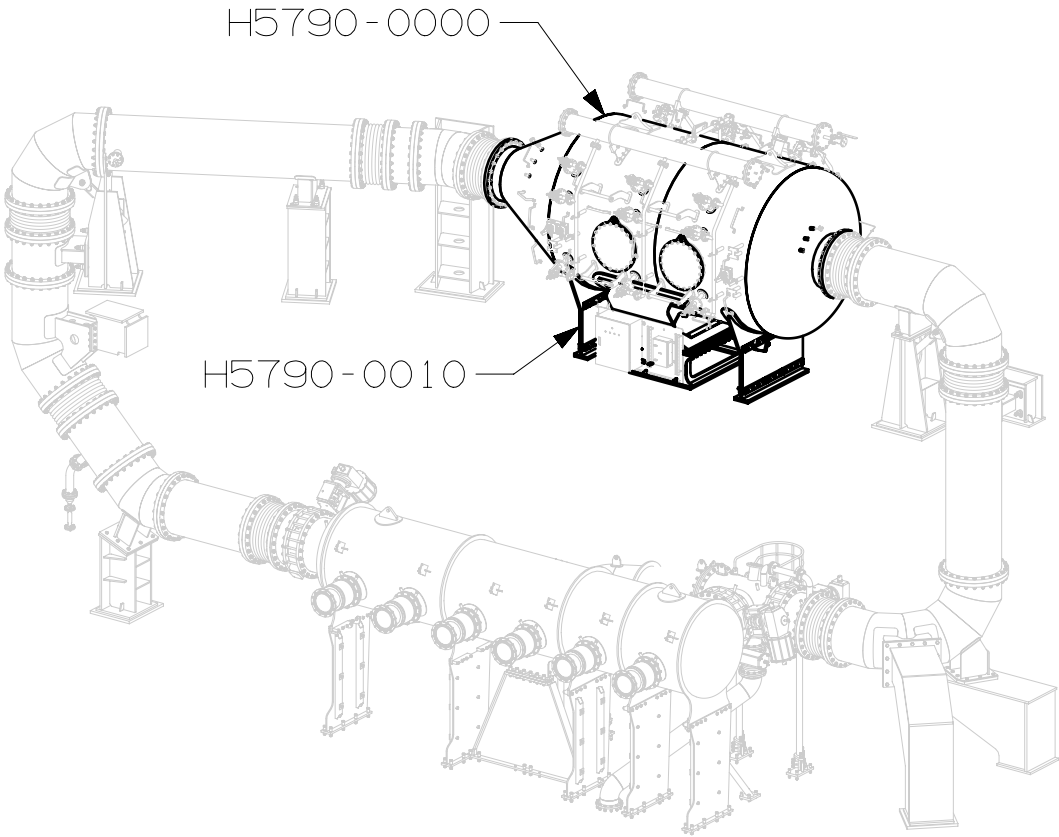
HHM-HPSCR

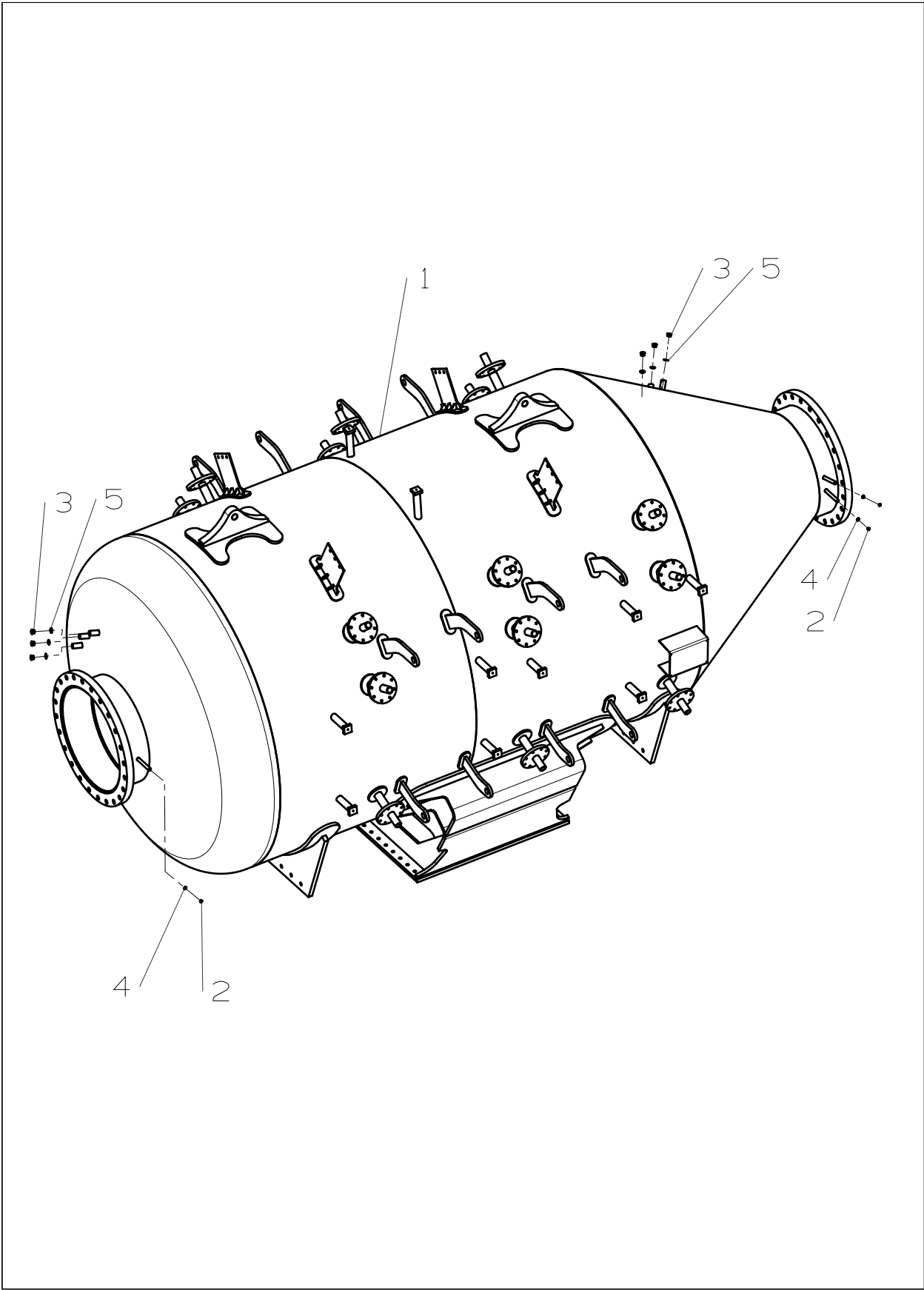
HHM-HPSCR

Components Description

No.	Title
	HPSCR System
1	Reactor Assembly
H5790-0000	Reactor Body.....03
H5790-0010	Reactor Accessories.....05
H5790-0200	Reactor Instruments.....07
H5790-0250	Reactor Wiring Support.....09
H5790-0300	Sootblowing System11
H5790-0400	Stand By Heat System.....14
H5790-0500	Catalyst Elements Assembly.....16
H5790-0200	Junction Box.....18
2	Reductant Injection System
H5790-1000	Reductant pump unit.....21
H5790-1010	Reductant Dosing Unit.....23
H5790-2900	Mixing Unit.....25
3	Venting System..... 27
4	Emission Control System
H5790-2810-1	SCR-CU/I1 Box 30
H5790-2810-2	Pneumatic valve control.....32
H5790-2810-3	Regulation unit.....33
H5790-2810-4	I/P Convertor Unit 1.....35
H5790-2810-5	I/P Convertor Unit 2.....37
H5790-2810-6	Auxiliary System Control Cabinet39



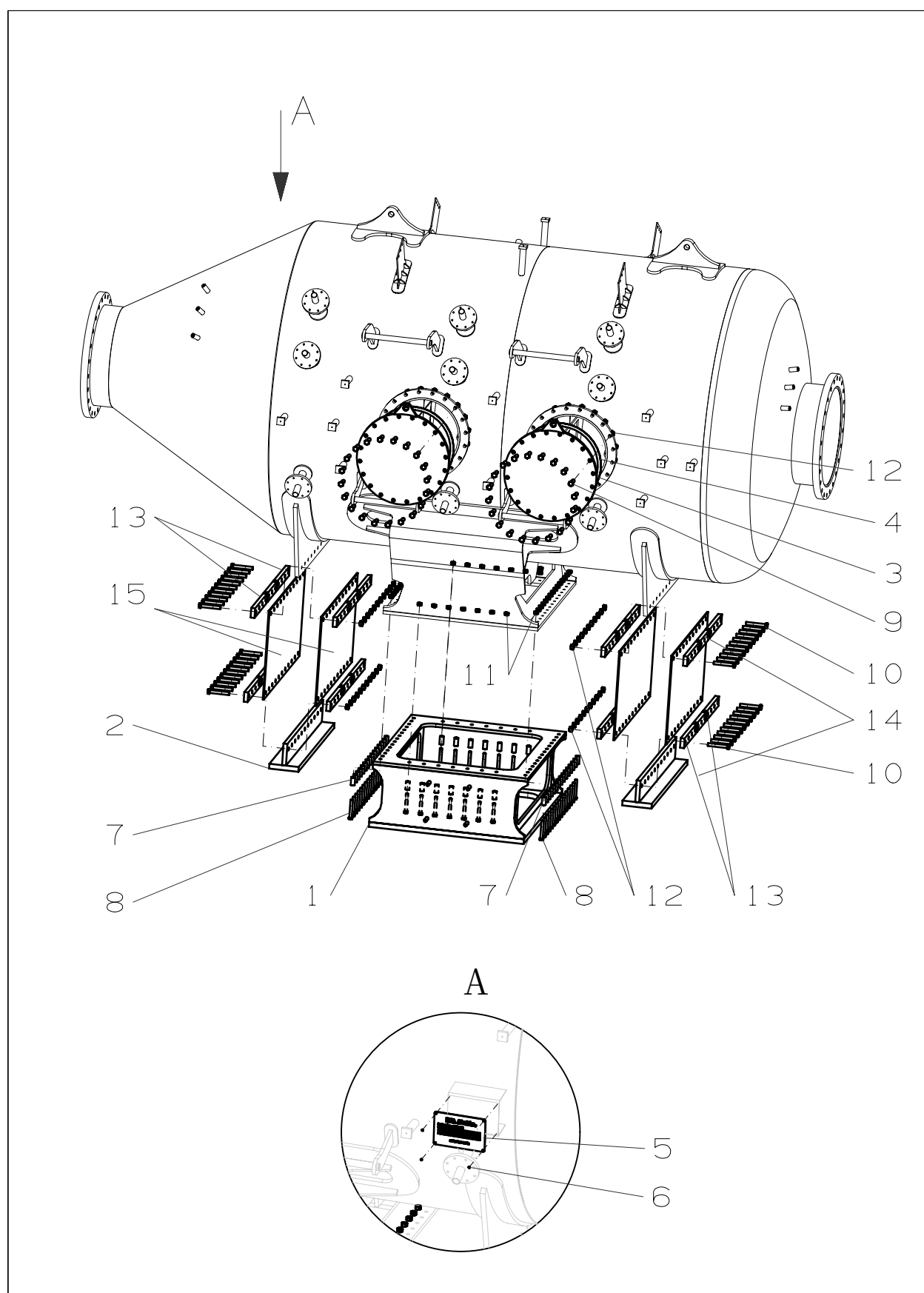




ITEM	DESCRIPTION	QTY	MDT order no
1	SCR REACTOR MACHINING	1	
2	PACKING ROUND	3	
3	PACKING ROUND	6	
4	PLUG SCREW	3	
5	PLUG SCREW	6	
6			
7			
8			
9			
10			
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REACTOR BODY

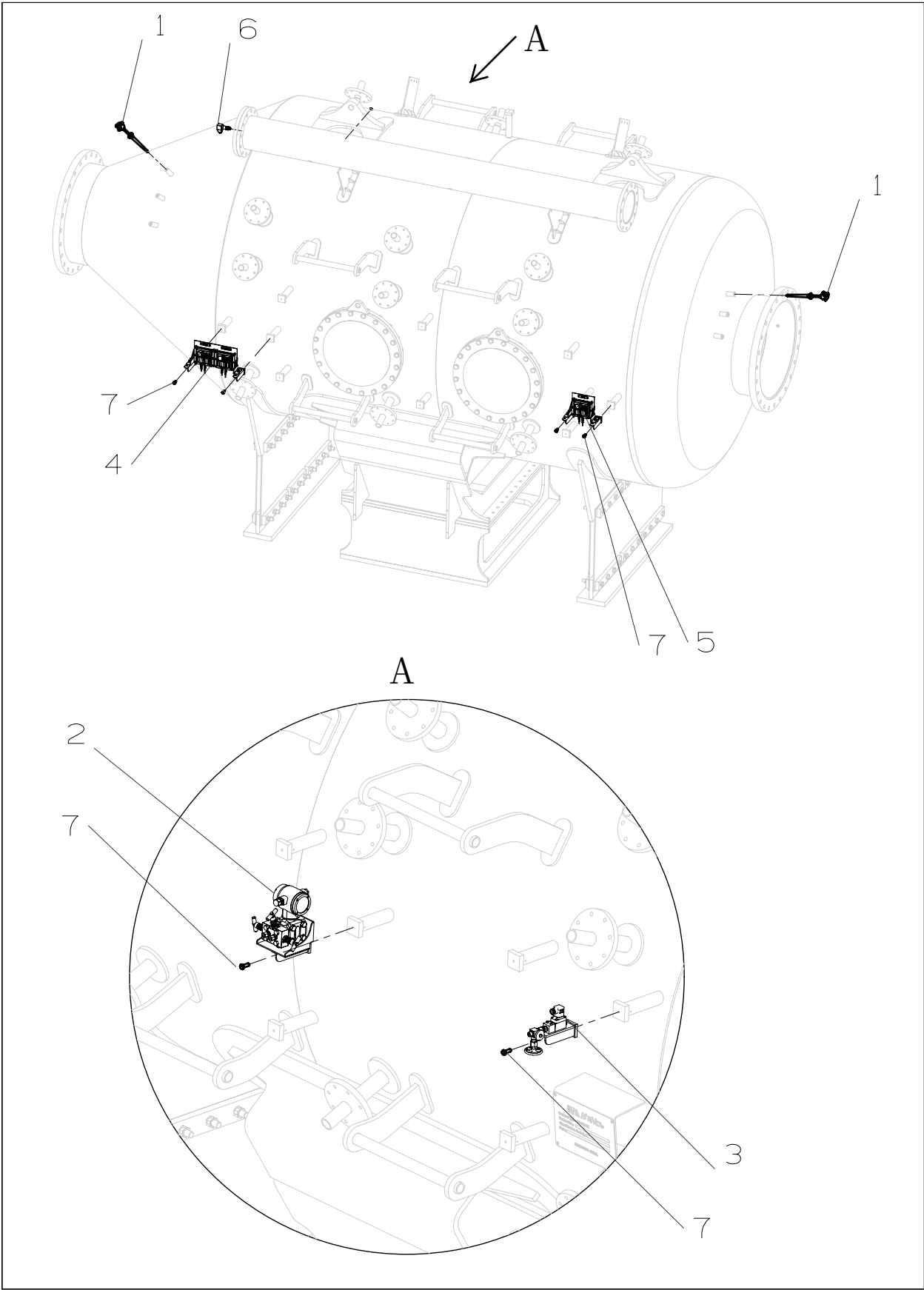
Plate
H5790-0000



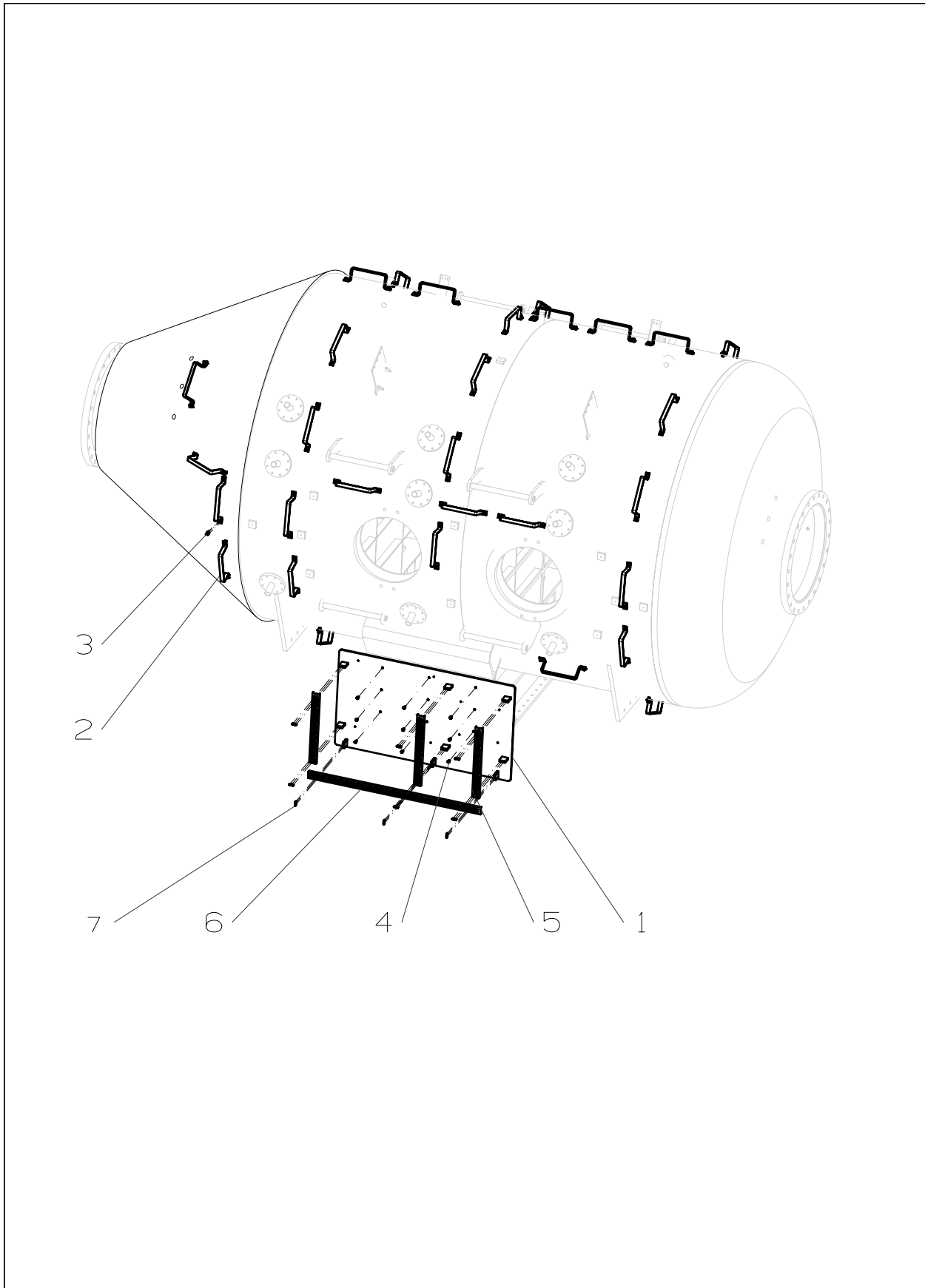
REACTOR ACCESSORIES

Plate
H5790-0010

ITEM	DESCRIPTION	QTY	MDT order no
1	SUPPORT FOR SCR REACTOR,MACH.	1	
2	SUPPORT FOR SCR REACTOR,MACH.	2	
3	COVER	2	
4	PACKING	2	
5	NAME PLATE	1	
6	HEAD SCREW	4	
7	SPACER TUBULAR	44	
8	HEXAGON HEAD SCREW	44	
9	HEXAGON HEAD SCREW	40	
10	HEXAGON HEAD SCREW	44	
11	NUT	44	
12	NUT	84	
13	PLATE (SHAPED)	16	
14	PLATE (SHAPED)	8	
15	PLATE (SHAPED)	4	
16			
17			
18			
19			
20			
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22			
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ITEM	DESCRIPTION	QTY	MDT order no
1	TEMPERATURE SENSOR	2	
2	DIFFERENTIAL PRESSURE TRANSMITTE	1	
3	PRESSURE TRANSMITTE	1	
4	TEMPERATURE SENSOR	1	
5	TEMPERATURE SENSOR	1	
6	PRESSURE TRANSMITTE	1	
7	Hexagon head screw	6	
8			
9			
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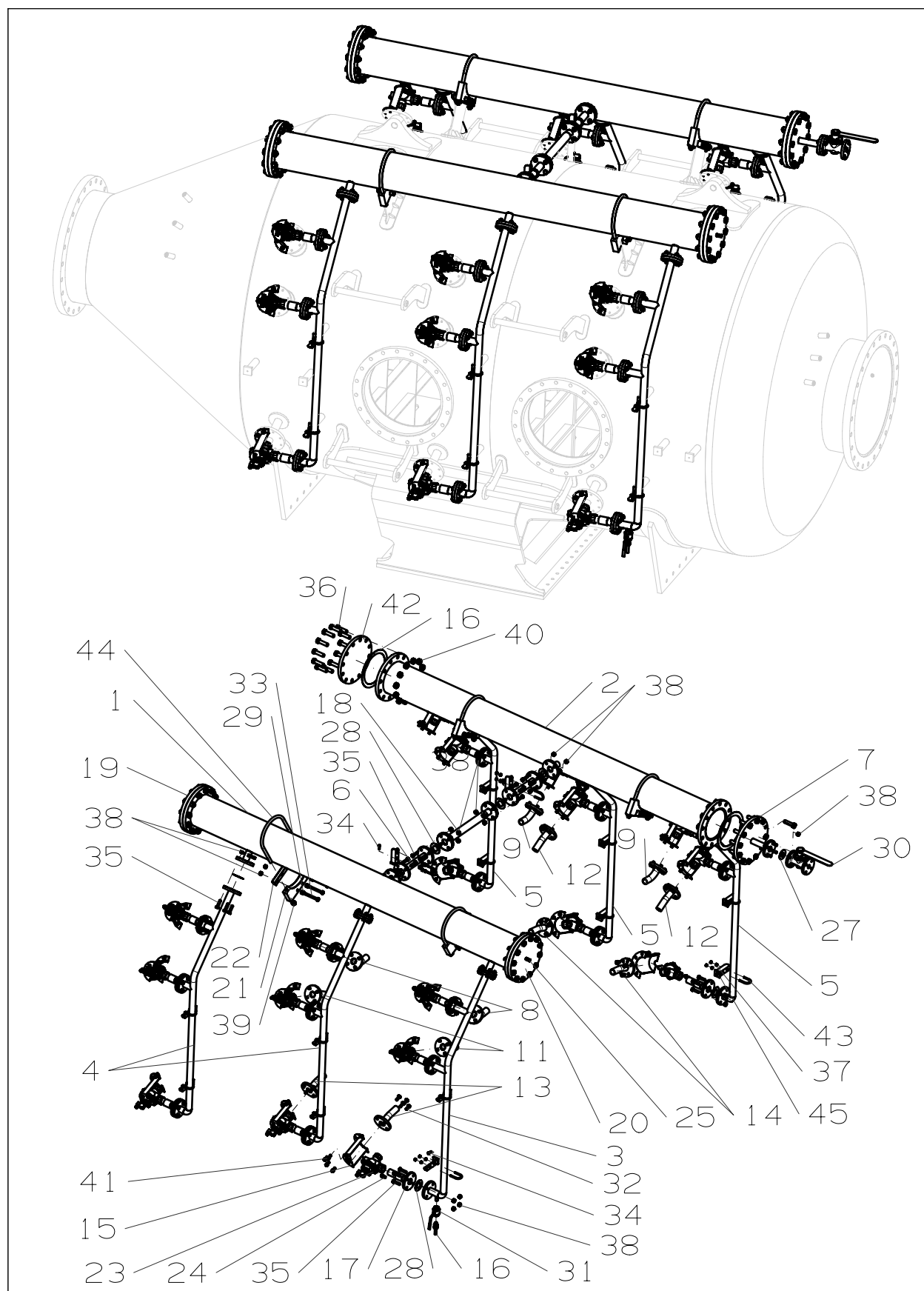
SCR REACTOR WIRING SUPPORT

Plate
H5790-0250

ITEM	DESCRIPTION	QTY	MDT order no
1	SUPPORT	1	
2	SUPPORT	46	
3	HEXAGON	277	
4	HEXAGON HEAD SCREW	9	
5	CABLE DUCTS	3	
6	CABLE DUCTS	1	
7	HEXAGON SOCKET BUTTON HEAD SCREW	27	
8			
9			
10			
11			
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SCR REACTOR WIRING SUPPORT

Plate
H5790-0250



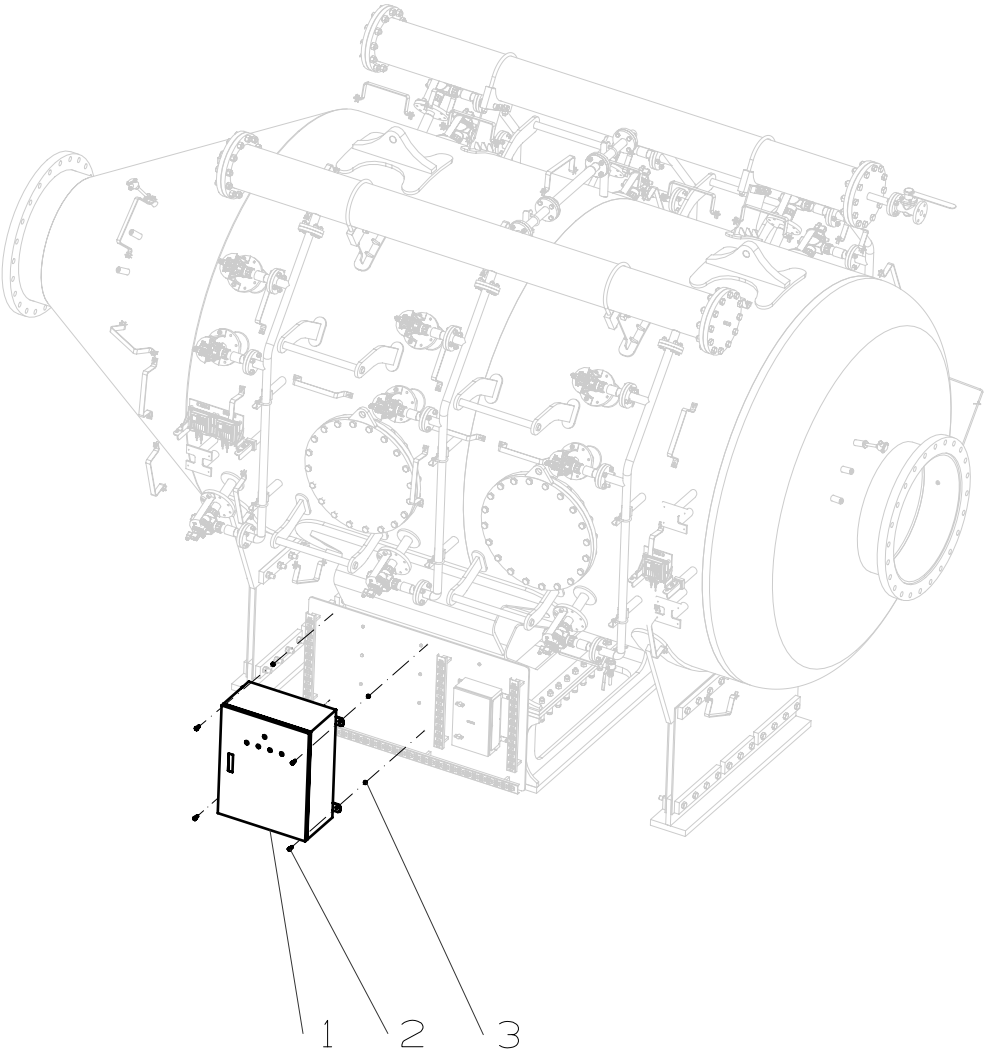
SOOTBLOWING SYSTEM

Plate
H5790-0300

ITEM	DESCRIPTION	QTY	MDT order no
1	AIR PIPES	1	
2	AIR PIPES	1	
3	AIR PIPES	1	
4	AIR PIPES	2	
5	AIR PIPES	3	
6	AIR PIPES	2	
7	AIR PIPES	1	
8	SPRAY GUN	2	
9	SPRAY GUN	2	
10	SPRAY GUN	2	
11	SPRAY GUN	2	
12	SPRAY GUN	2	
13	SPRAY GUN	2	
14	SPRAY GUN	2	
15	SHIELD	18	
16	DRAIN PIPES	1	
17	HOSE	18	
18	HOSE	1	
19	FLANGE	1	
20	FLANGE	1	
21	PLATE (SHAPED)	4	
22	PLATE (SHAPED)	4	
23	BLOWING VALVE	18	
24	MUFFLER	18	
25	RELIEF VALVE	1	
26	GASKET	4	
27	GASKET	1	
28	GASKET	28	
29	SPACER TUBULAR	12	
30	THROUGH COCK	1	
31	BALL VALVE	1	
32	HEXAGON HEAD SCREW	48	
33	HEXAGON HEAD SCREW	12	
34	HEXAGON HEAD SCREW	14	
35	HEXAGON HEAD SCREW	116	
36	HEXAGON HEAD SCREW	48	

SOOTBLOWING SYSTEM

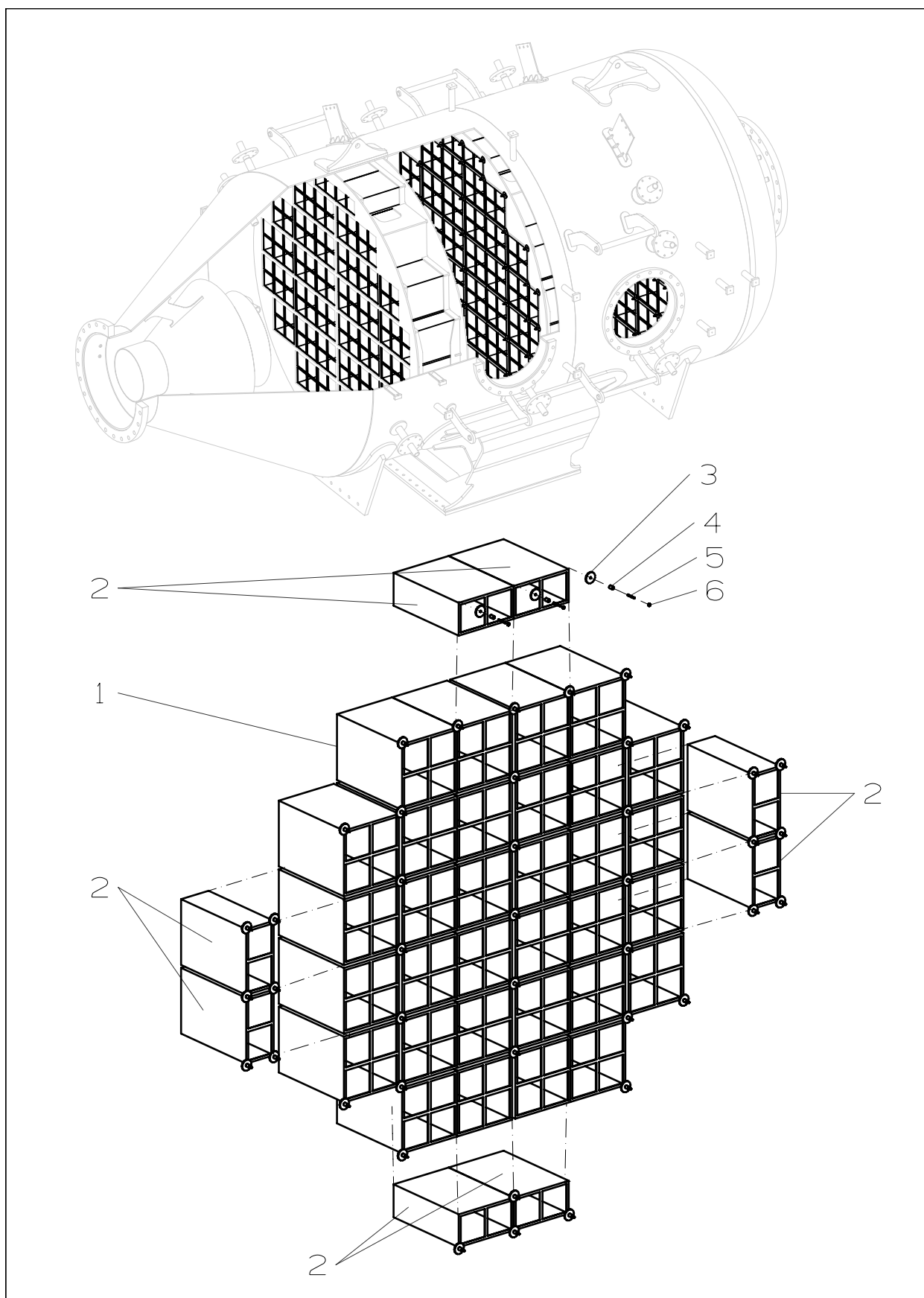
Plate H5790-0300



ITEM	DESCRIPTION	QTY	MDT order no
1	STAND BY HEAT SYSTEM	1	
2	HEXAGON HEAD SCREW	4	
3	SPACER TUBULAR	4	
4			
5			
6			
7			
8			
9			
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STAND BY HEAT SYSTEM

Plate
H5790-0400



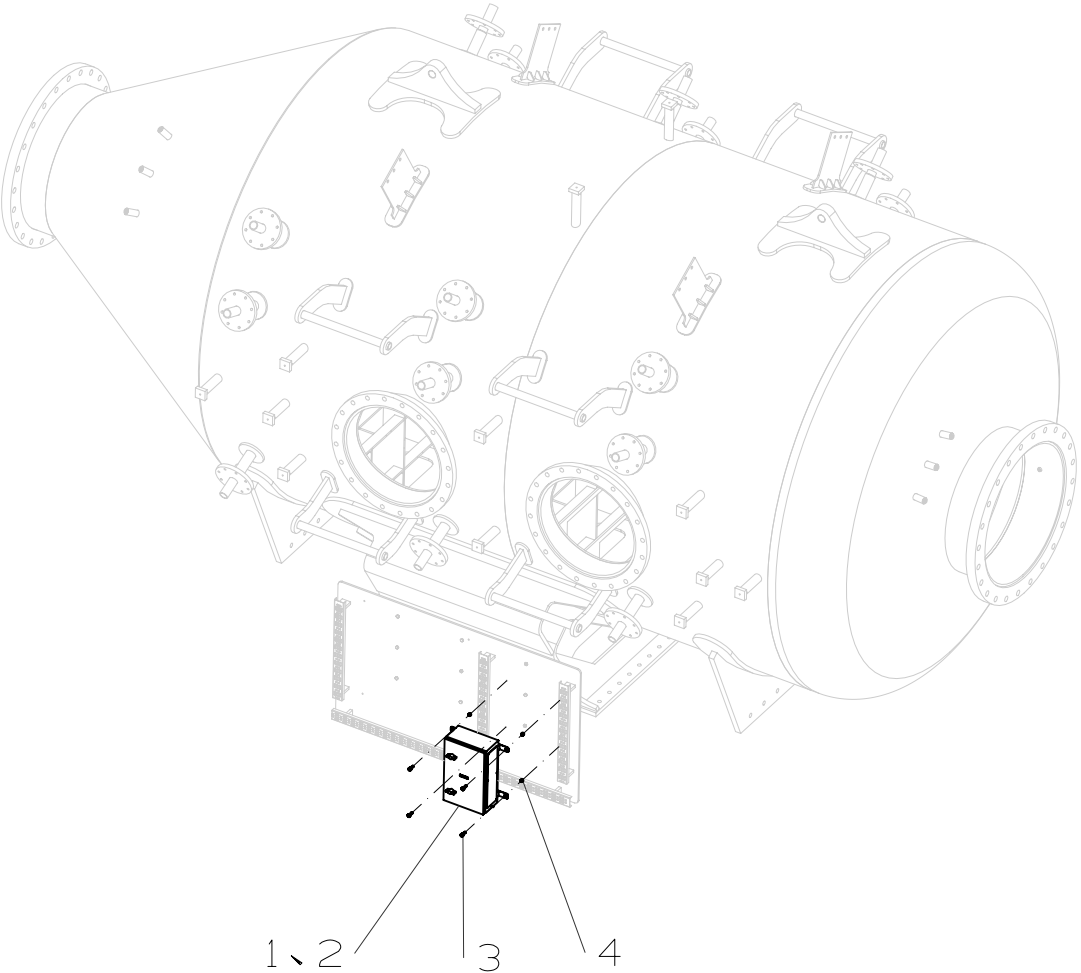
CATALYST ELEMENTS ASSEMBLY

Plate
H5790-0500

ITEM	DESCRIPTION	QTY	MDT order no
1	CATALYST BLOCK	96	
2	CATALYST BLOCK	24	
3	PLATE-ROUND-MACHINED	135	
4	DISTANCE PIPE	135	
5	STUD, THREAD BOTH ENDS	135	
6	NUT, HEXAGON	135	
7			
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9			
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CATALYST ELEMENTS ASSEMBLY

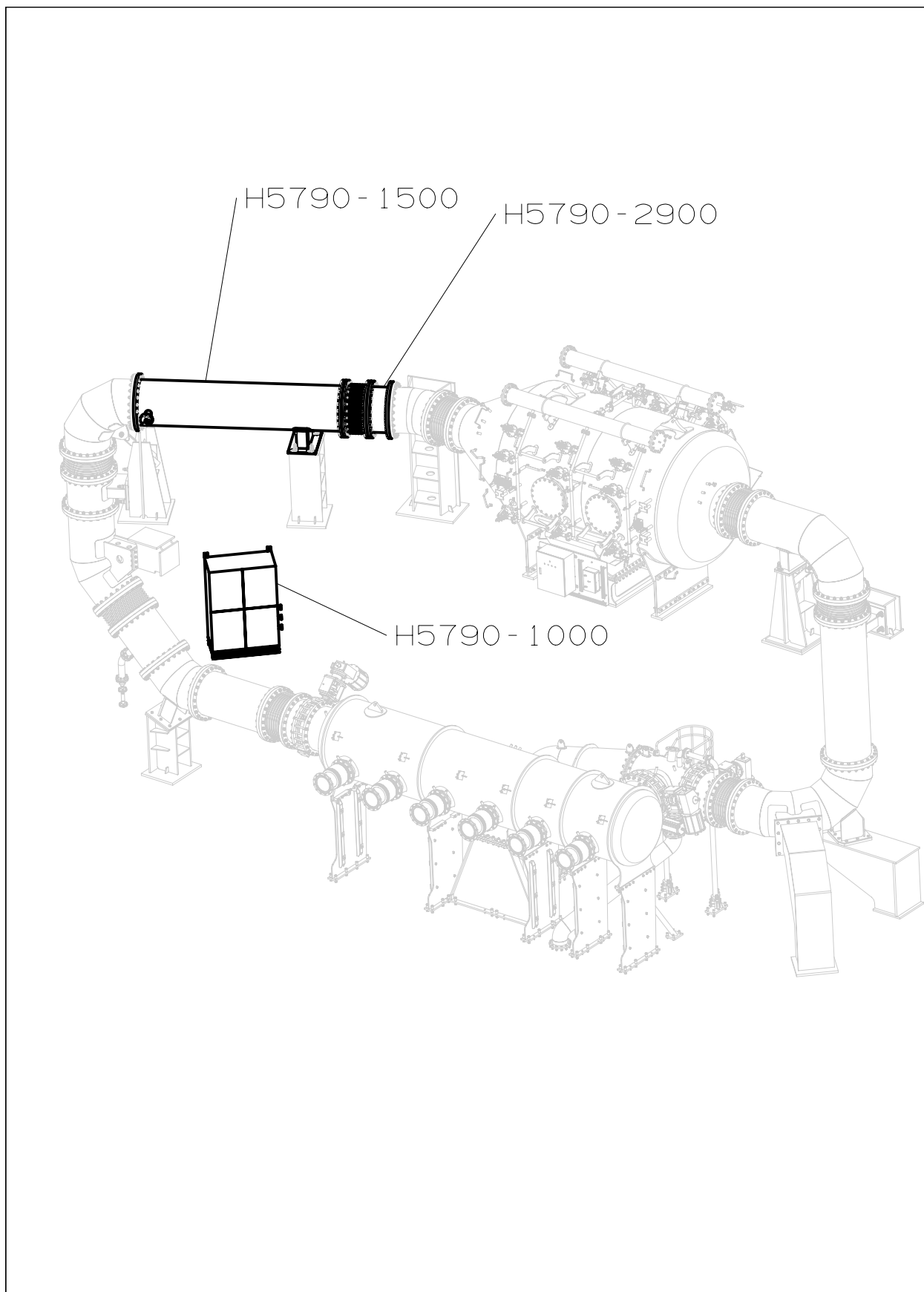
Plate
H5790-0500

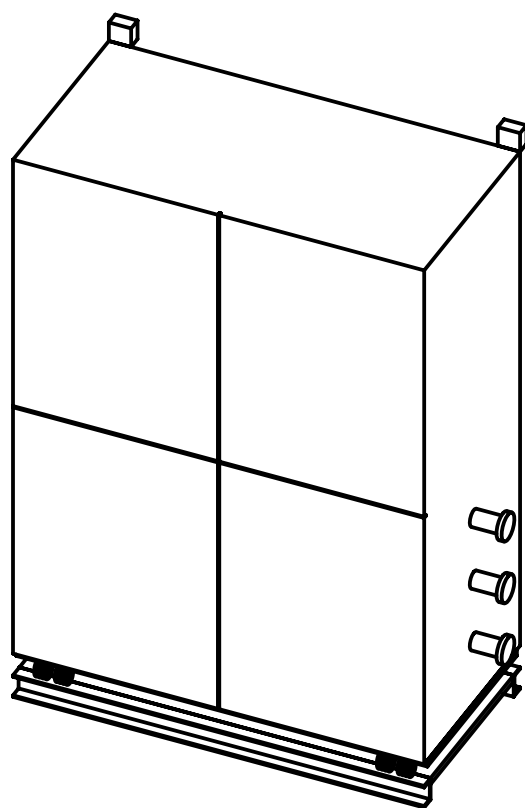


ITEM	DESCRIPTION	QTY	MDT order no
1	JUNCTION BOX	1	
2	CABLE	3	
3	HEXAGON HEAD SCREW	4	
4	SPACER TUBULAR	4	
5			
6			
7			
8			
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JUNCTION BOX

Plate
H5790-0200





REDUCTANT PUMP UNIT

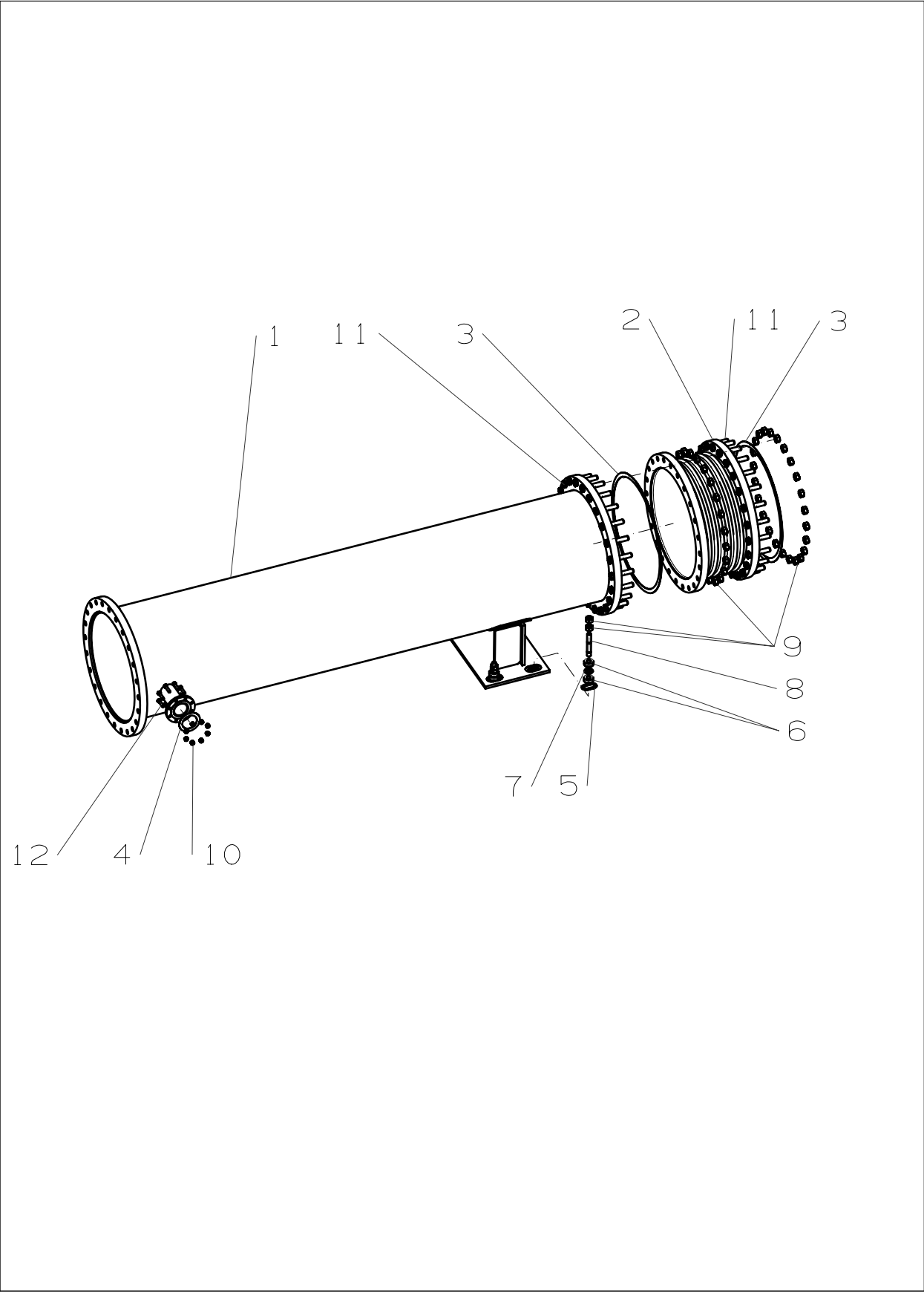
Plate
H5790-1000

ITEM	DESCRIPTION	QTY	MDT order no
1	SCR REDUCING AGENT PUMP STATION	1	
2			
3			
4			
5			
6			
7			
8			
9			
10			
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REDUCTANT PUMP UNIT

Plate
H5790-1000





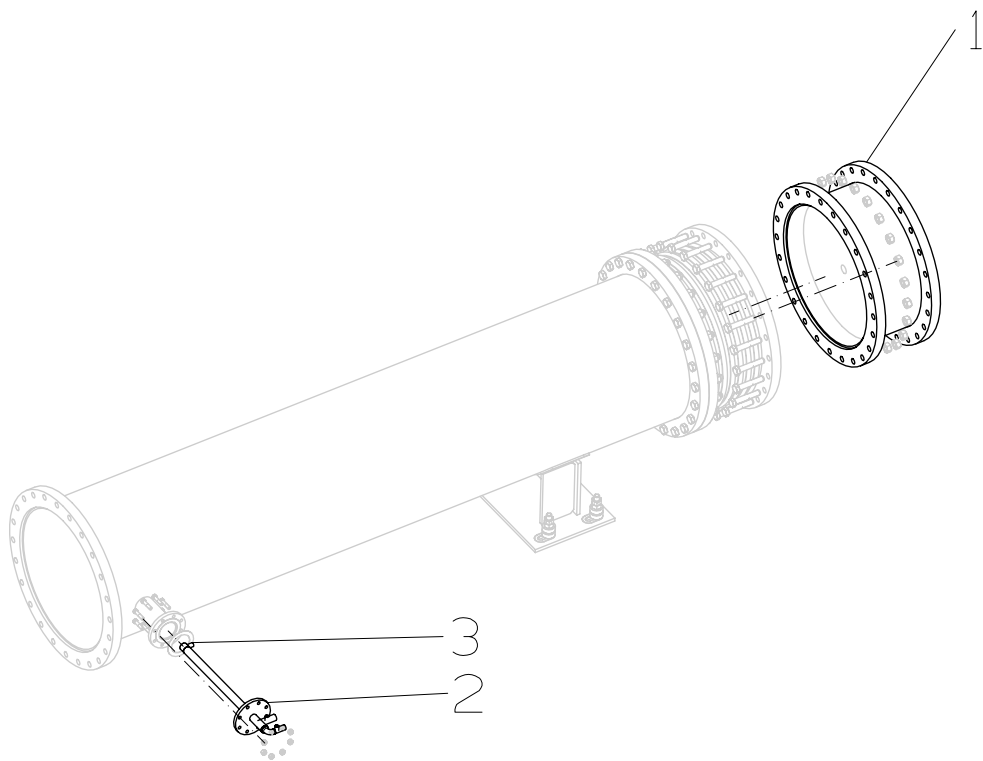
ITEM	DESCRIPTION	QTY	MDT order no
1	MIXER&MIXING PIPE	1	
2	EXPANSION JIONT	1	
3	GASKET	2	
4	GASKET	1	
5	PLATE-ROUND-MACHINED	8	
6	PLATE-ROUND-MACHINED	4	
7	BUTTERFLY SPRING	4	
8	STUD, THREAD BOTH ENDS	4	
9	NUT	56	
10	NUT	8	
11	HEXAGON HEAD SCREW	48	
12	HEXAGON HEAD SCREW	8	
13			
14			
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MIXER & MIXING PIPE

Plate
H5790-1500

MIXING UNIT

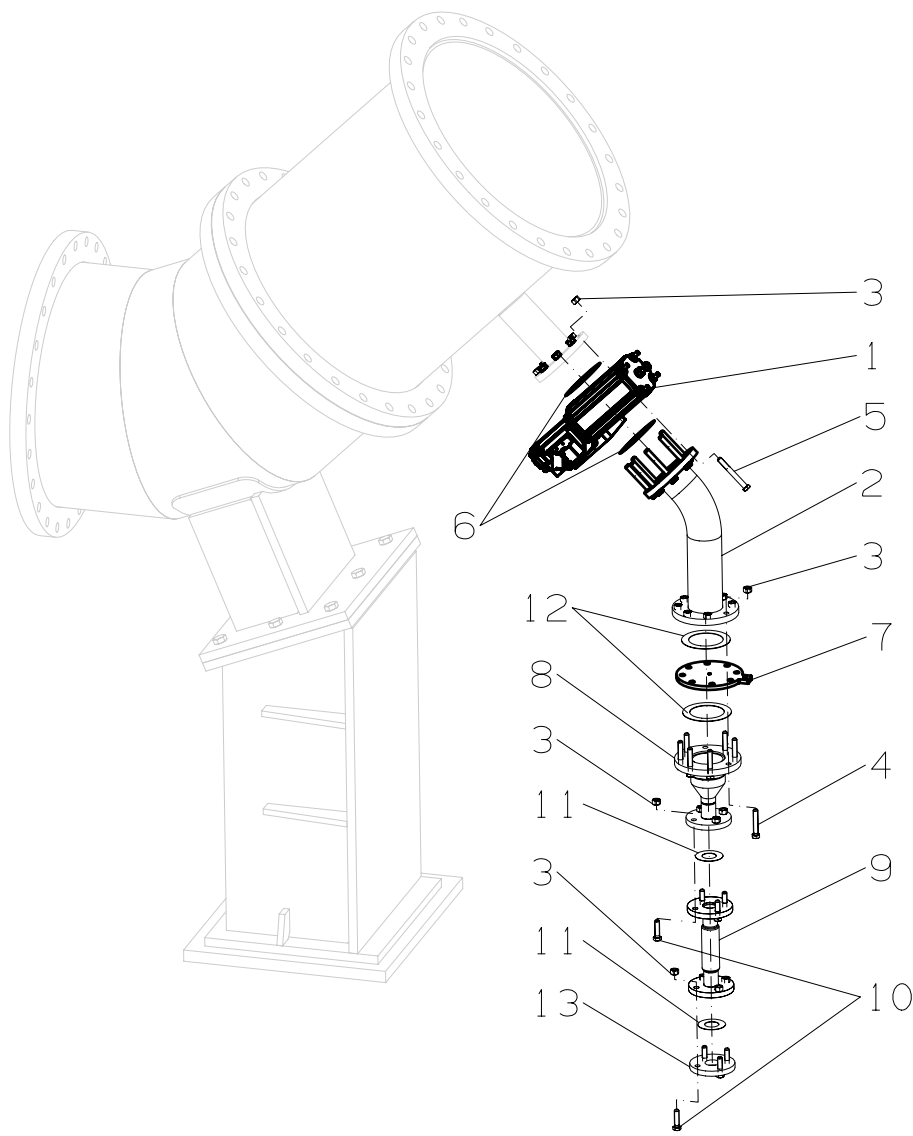
Plate
H5790-2900



ITEM	DESCRIPTION	QTY	MDT order no
1	STATIC MIXER ASSEMBLY	1	
2	SPRAY GUN	1	
3	SCR NOZZLE	1	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
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MIXING UNIT

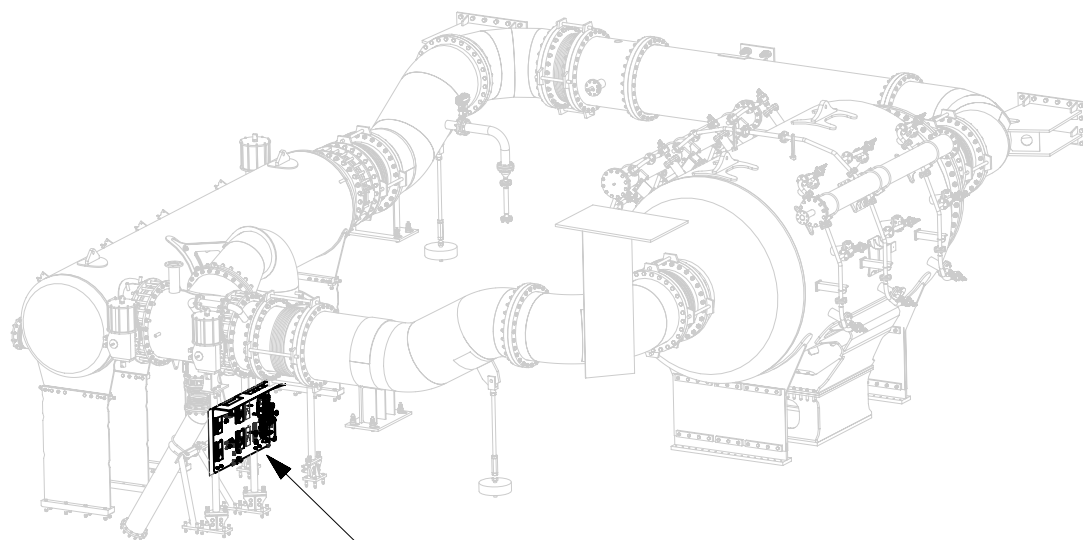
Plate
H5790-2900



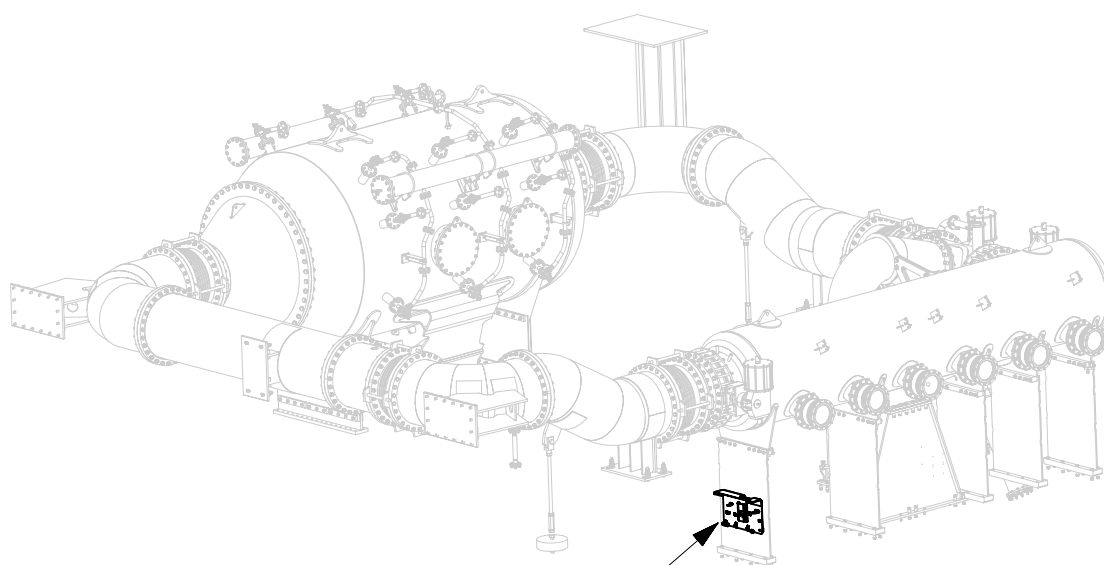
ITEM	DESCRIPTION	QTY	MDT order no
1	VALVE WITH ACTUATOR	1	
2	RELIEF PIPE	1	
3	NUTS	24	
4	HEXAGON HEAD SCREW	8	
5	HEXAGON HEAD SCREW	8	
6	SHIM	2	
7	ORIFICE PLATE	1	
8	RELIEF PIPE	1	
9	TUBE	1	
10	HEXAGON HEAD SCREW	8	
11	PICJING RING	2	
12	PICJING RING	2	
13	FLANGE	1	
14			
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VENTING SYSTEM

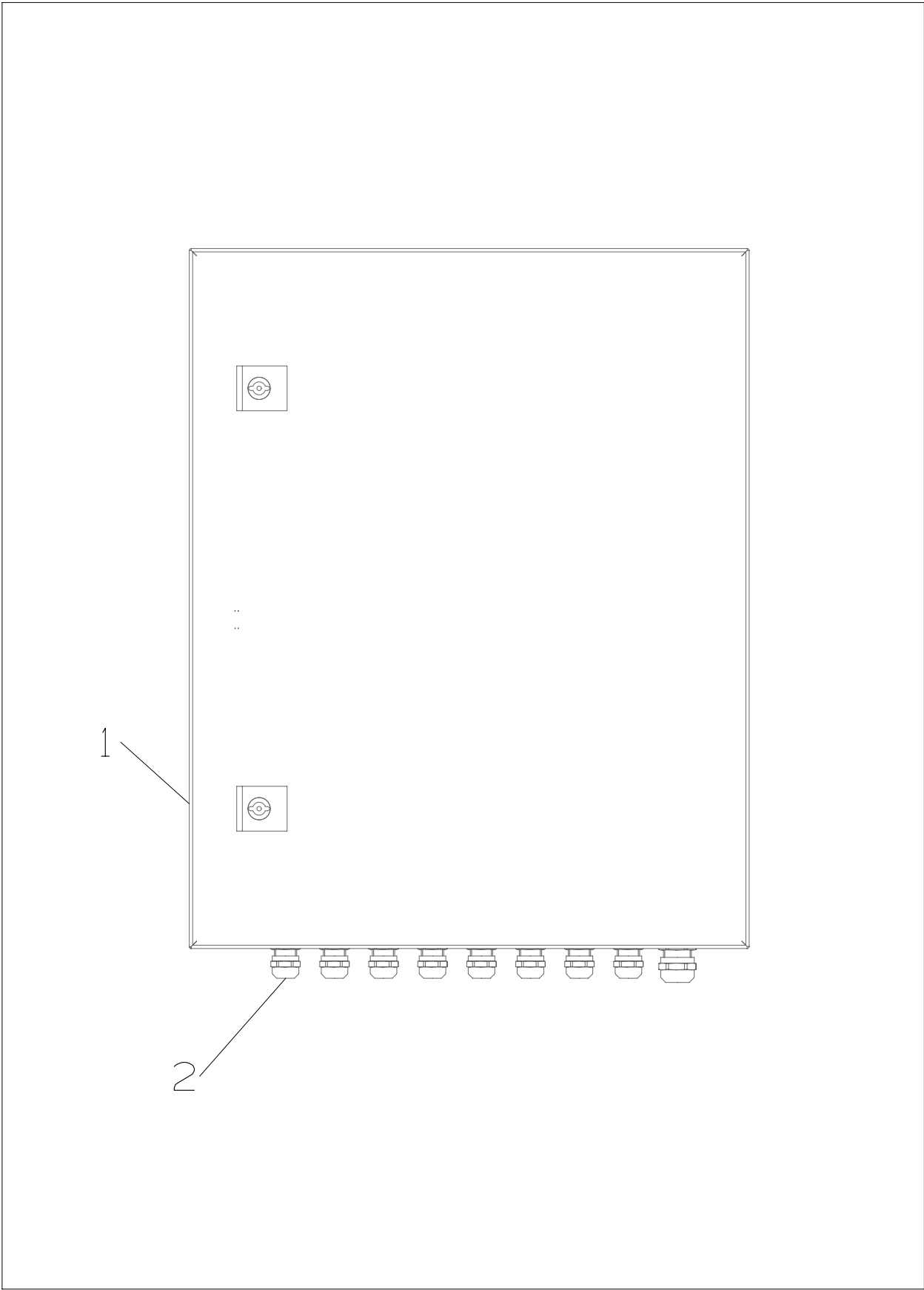
Plate
H5790-0100



H5790-2810



H5790-2810



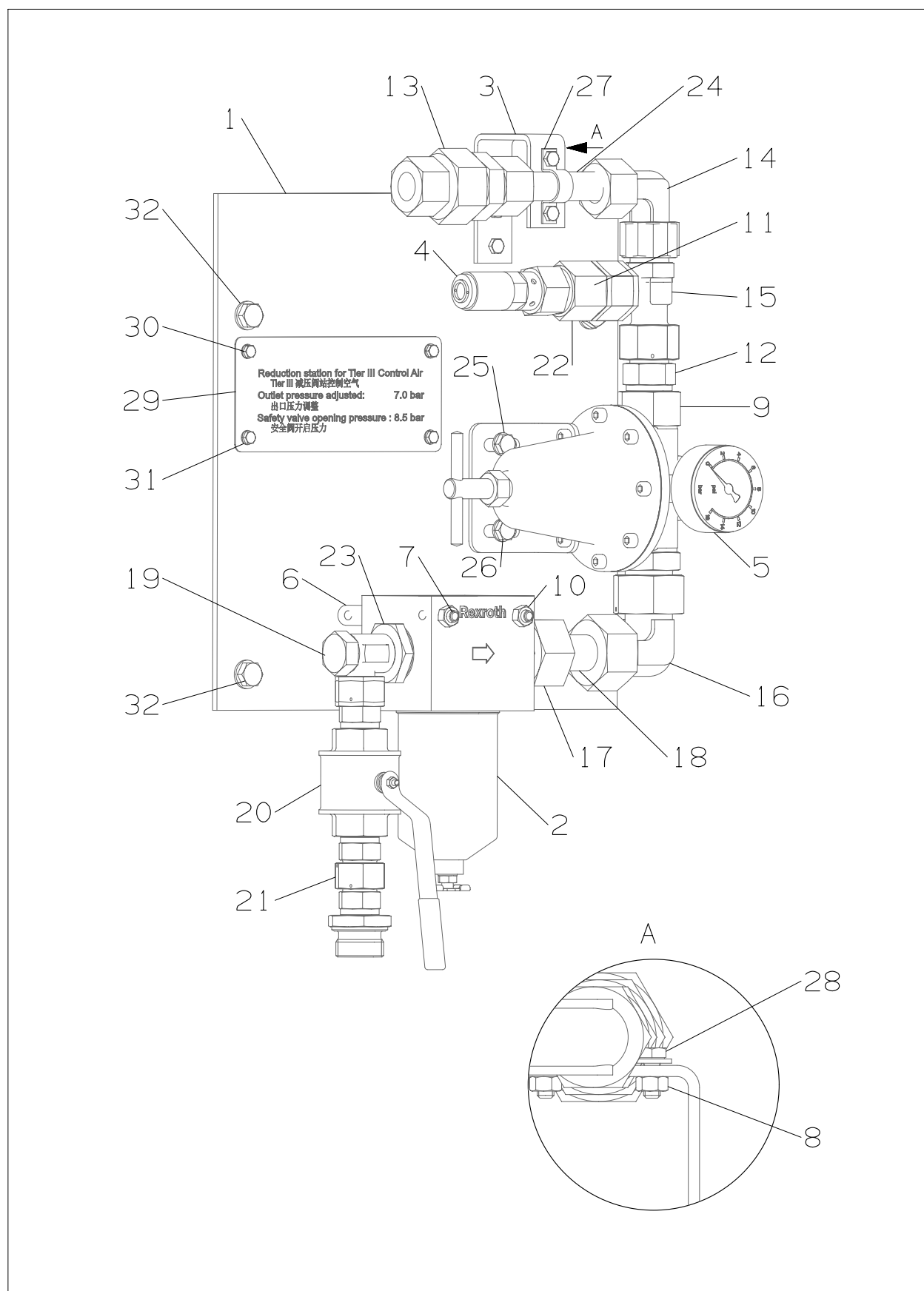
ITEM	DESCRIPTION	QTY	MDT order no
1	ENCLOSURE, COMPLETE	1	
2	PLATE FOR COMPONENTS	1	

SCR-CU/I1 BOX

Plate
H5790-2810-1







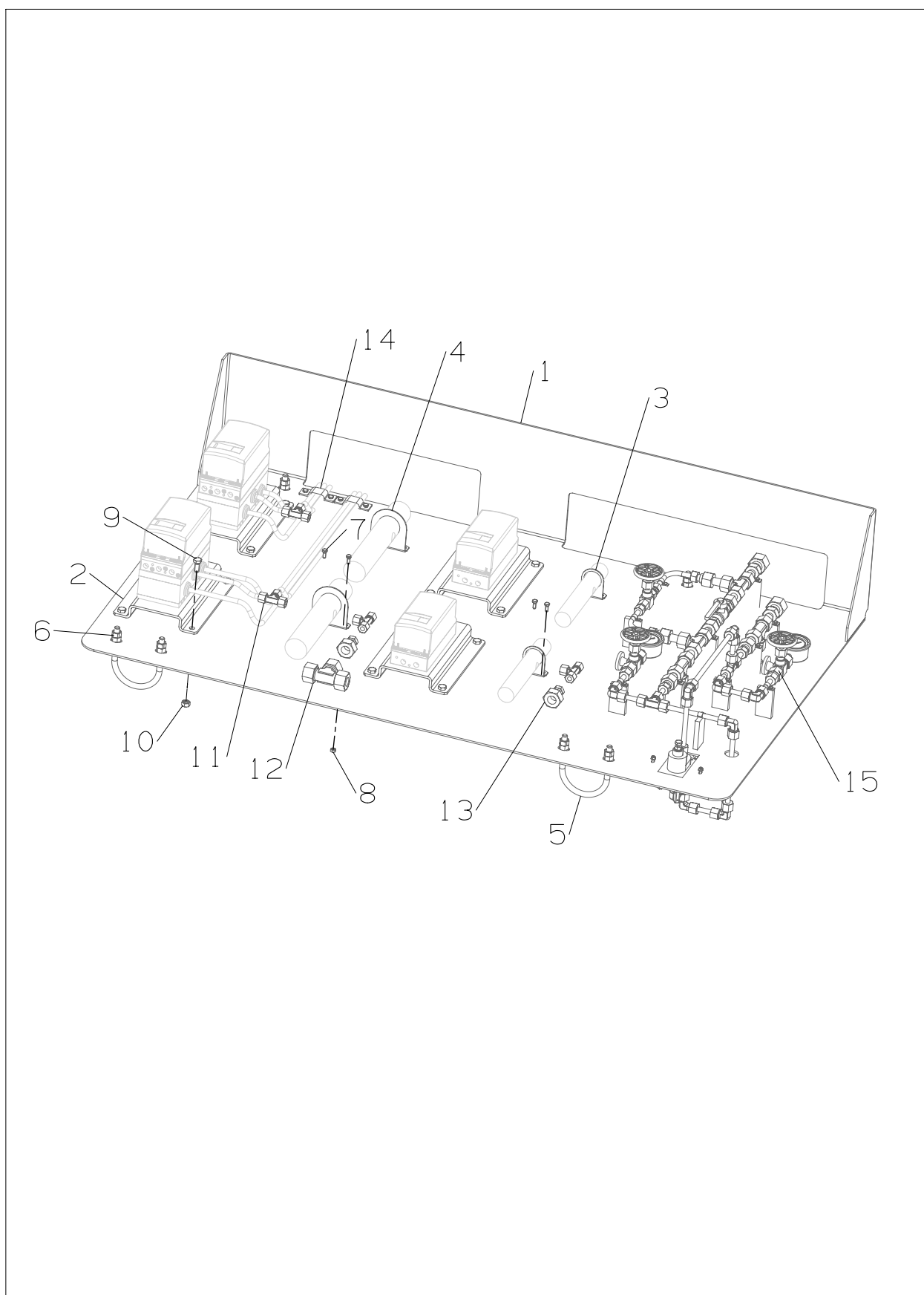
REGULATION UNIT

Plate
H5790-2810-3

ITEM	DESCRIPTION	QTY	MDT order no
1	PLATE	1	
2	FILTER UNIT	1	
3	BRACKET	1	
4	SAFETY VALVE	1	
5	REDUCING VALVE	1	
6	STEELPIPE	2	
7	Stud	2	
8	NUT	2	
9	Reducing adaptor	1	
10	NUTS	2	
11	Straight female coupling, complete	1	
12	Adjustable straight male stud coupling	1	
13	Non-return valve	1	
14	Adjustable elbow coupling, complete	1	
15	STRAIGHT MALE STUD COMPL.	1	
16	ADJUST.ELBOW COUPL.COMPL.	1	
17	STRAIGHT MALE STUD COMPL.	1	
18	STEELPIPE	1	
19	Banjo Coupling, Complete	1	
20	Ball valve, with certificate	1	
21	Adjustable straight male stud coupling	3	
22	Reducing adaptor, male/female	1	
23	Reducing adaptor, male/female	2	
24	STEELPIPE	1	
25	Washer	2	
26	Hexagon head screw	2	
27	Pipe holder	1	
28	Hexagon head screw	4	
29	NAME PLATE	1	
30	Hexagon head screw	4	
31	Washer	4	
32	Hexagon head screw	4	
33	Washer	4	

REGULATION UNIT

Plate
H5790-2810-3



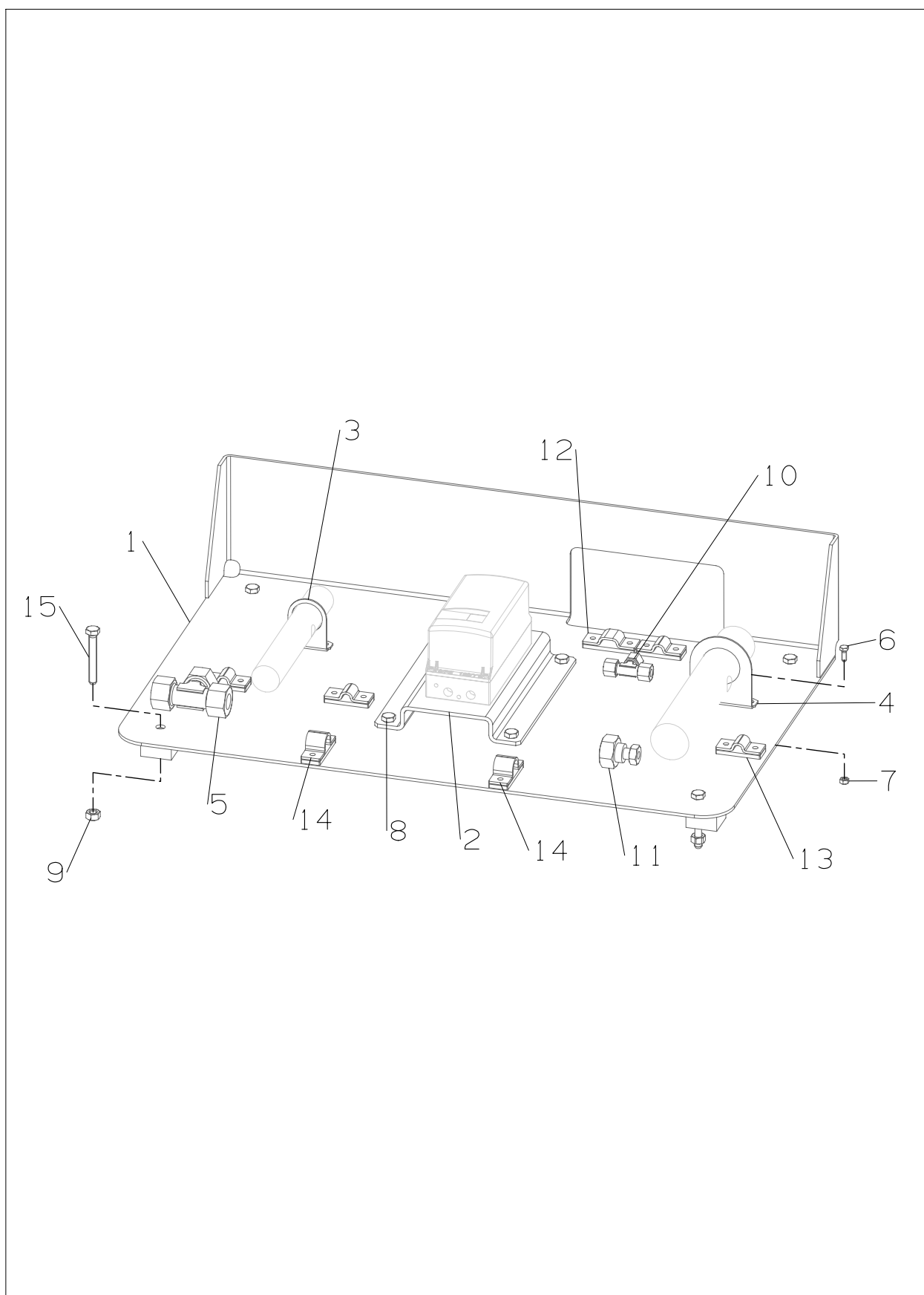
I/P CONVERTOR UNIT 1

Plate
H5790-2810-4

ITEM	DESCRIPTION	QTY	MDT order no
1	TOP FLANGE	1	
2	SUPPORT,BASEFORSUPPORT	4	
3	SUPPORT,BASEFORSUPPORT	2	
4	SUPPORT,BASEFORSUPPORT	2	
5	Double U-shaped pipe clamp nut	4	
6	NUTS	16	
7	Hexagon head screw	12	
8	NUTS	8	
9	Hexagon head screw	16	
10	NUTS	16	
11	Union coupling	4	
12	Union coupling	1	
13	Union coupling	2	
14	Pipe clamp	3	
15	PTV differential pressure	1	

I/P CONVERTOR UNIT 1

Plate
H5790-2810-4



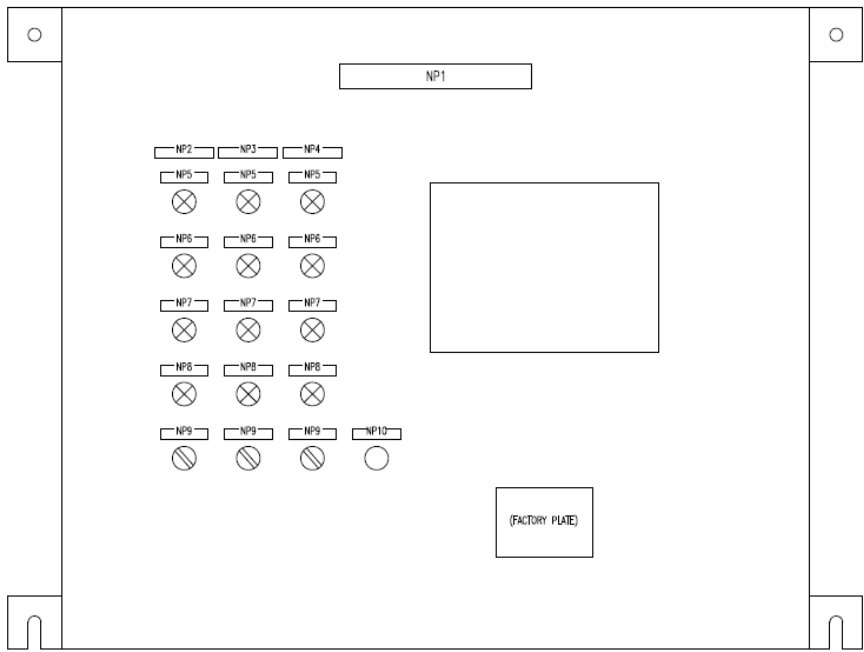
I/P CONVERTOR UNIT 2

Plate
H5790-2810-5

ITEM	DESCRIPTION	QTY	MDT order no
1	SUPPORT	1	
2	SUPPORT,BASEFORSUPPORT	1	
3	SUPPORT,BASEFORSUPPORT	1	
4	SUPPORT,BASEFORSUPPORT	1	
5	Union coupling	1	
6	SCREWS	4	
7	NUTS	4	
8	SCREWS	4	
9	NUTS	8	
10	Union coupling	1	
11	Union coupling	1	
12	Pipe clamp	1	
13	Pipe clamp	4	
14	Pipe clamp	2	
15	SCREWS	4	

I/P CONVERTOR UNIT 2

Plate
H5790-2810-5



AUXILIARY SYSTEM CONTROL CABINET

Plate
H5790-2810-6

ITEM	DESCRIPTION	QTY	MDT order no
1	AUXILIARY SYSTEM CONTROL CABINET		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
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21			
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25			
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27			
28			

AUXILIARY SYSTEM CONTROL CABINET

Plate
H5790-2810-6