Semi-hermetic
Scroll Refrigerant Compressor

Technical Manual

ChynTec International Co., Ltd.
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Contents

ISO9001:2000

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Note: This manual is for technical reference only.
ChynTec International reserves the right to revise the details shown herein without notification in advance.

General Technical Information:

1. Deliberately discharge of environmentally harmful refrigerants shall be avoided.
2. When selecting a refrigerant, the potential influence on global warming and the depletion of ozone in the stratosphere shall be taken into account.
3. For local and global environmental protection, refrigerating systems shall be designed with due care in such a way that each refrigerant charge is kept as minimum as reasonably practicable.
4. Refrigerating systems shall be equipped with devices necessary for testing, servicing, maintenance and recovery of refrigerant, and constructed that even in the case of fire or leakage, the loss of refrigerant is minimized.
5. Refrigerating systems shall be so designed and installed that liquid refrigerant or oil cannot return back to compressors in excessive quantity to damage the compressors.
6. Piping in refrigerating systems shall be so designed and installed that liquid hammer (hydraulic shock) will not damage the piping system.
7. Discharge of refrigerant into the atmosphere shall be minimized. Discharges of refrigerant that cannot be avoided shall take place so that personnel are not endangered.
8. Personnel who is responsible for design, construction, installation, inspection, testing, operation, maintenance, repair, disposal and assessment of refrigerating systems and their parts shall have necessary training and knowledge of the task to achieve competence.
9. If it is necessary to use refrigerants with an ODP (Ozone Depletion Potential) or a GWP (Global Warming Potential) greater than zero (0), the charge of refrigerant shall be minimized.
10. Recovery, reuse, recycle, reclaim and disposal of refrigerants shall only be undertaken by competent personnel.
11. All refrigerants shall be recovered, recycled, and reclaimed for reuse, or be disposed properly. CFCs, HCFCs, HFCs, PFCs, and HCs shall not be released into the atmosphere. If other refrigerants are released, it shall be done in a controlled manner in order to prevent any hazard to personnel or damage to property.
12. The pressure switch and relief valve are always required for safety concern.

1. Operating Principle of Scroll Compressor

Benefited from rapid development of precision machining process, more and more positive displacement compressors evolved into rotary type for better efficiency and lower vibration and noise. As rotary type has distinctively higher efficiency, it is spreading out world-wide, and its application is expanding quickly. For instance, reciprocating type (over 40 USRT) has been replaced by screw type, and the applications of scroll refrigerant compressors boomed as well.

Operating Principle of Scroll Compressor:
The scroll compressor consists of two mating involute scrolls as the diagram shown, which describes the compression process. One scroll is fixed in place (Stationary Scroll), and the other scroll orbits within this fixed scroll. (Orbiting Scroll)

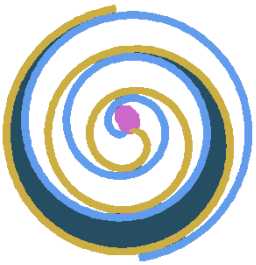
Scroll compressor design is based on the principle of involutes or scrolls which revolve around each other in a “rolling” motion. By reducing the need for hydrodynamic lubrication that is required to reduce friction at internal contact points, the scroll compressor provides an inherently smooth operation and improves thermodynamic efficiency.

The compressor is the “engine” inside HVAC system, and how it operates plays an important role in determining the effectiveness and efficiency of the system as a whole. The main benefits of the scroll compressor are the quieter, smoother and more efficient operation along with greater reliability and durability.

Scroll compression cycle can be illustrated as following:

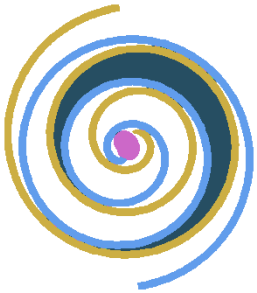
1. Suction

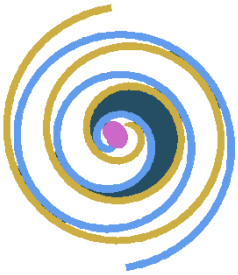
When compressor starts operating, at certain angle the maximum suction chamber formed between orbiting and fixed scrolls, and suction stage starts with the suction chamber connected with low pressure side in system. Intake volume of compressor is calculated by the maximum geometric space formed.



2. Initial Compression

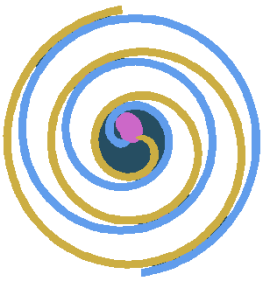
After suction, compression chamber of scroll sealed and separated from low pressure side completely, orbiting scroll keeps revolving around stationary scroll and continues to compress the chamber smoothly, which means working fluid proceeds to be compressed continuously.





3. 4. Intermediate Compression

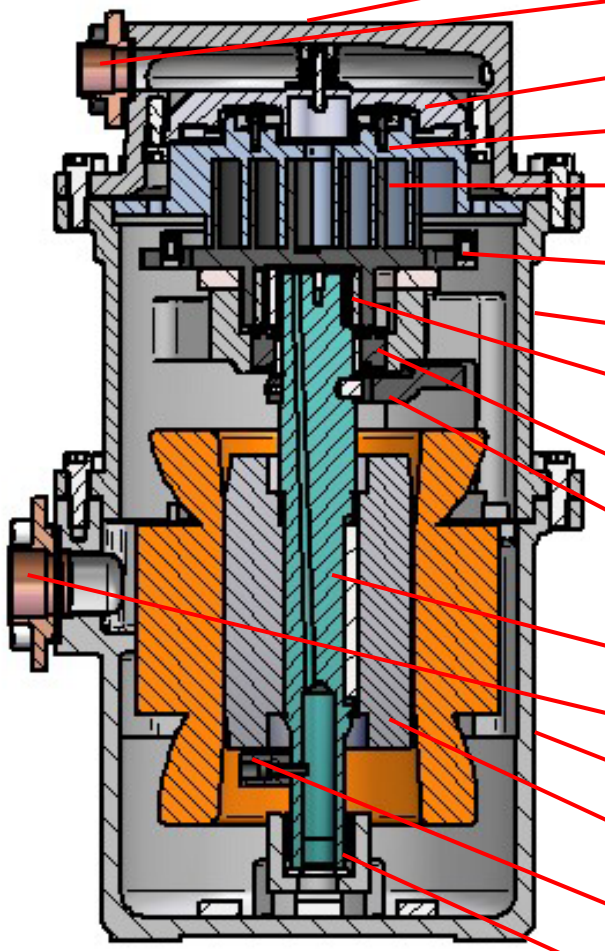
There are many advantages for the scroll compressor such as less leakage, smooth discharge etc. Refrigerant is compressed progressively in the crescent-shape pockets formed between two scrolls. Within commercial positive displacement compressors, scroll type has the best compression efficiency.



5. Discharge

When the refrigerant pressure achieves target level, the chamber will be induced into discharge port. Medium pressure chamber and low pressure chamber keep compressing and suction continuously. Impulse of discharge is not obvious compared with other types of compressors.

2. Sectional View of Compressor



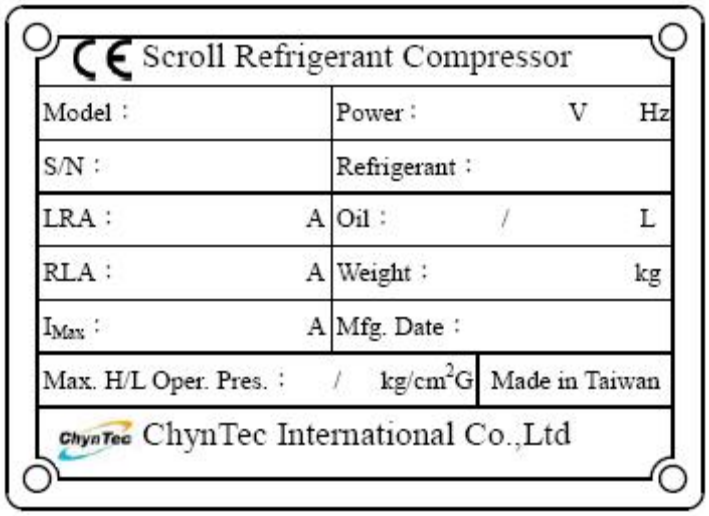
(1) Upper Shell
(2) Outlet
(3) Baffle
(4) Stationary Scroll
(5) Orbiting Scroll
(6) Oldham Coupling
(7) Middle Shell
(8) Upper Bearing & Sliding Bushing
(9) Main Bearing
(10) Upper Counterweight
(11) Shaft
(12) Intake
(13) Lower Shell
(14) Motor
(15) Lower Counterweight
(16) Lower Bearing

Features of ChynTec Compressor

1. Semi-hermetic design.
2. Precision machining with benefit of lower vibration, lower noise, and higher efficiency.
3. Patented involutes design with the characteristics of high efficiency and low leakage.
4. Patented axial and radial compliance designs and special alignment mechanism reduce vibration and noise during compression.
5. Special passage design provides sufficient oil for lubrication and gastight efficiency.
6. Two power connection options: DOL start-up (standard) and Y-△ start-up (optional) design application.
7. Designed with high precision roller bearing to serve for heavy duty application.

3. Compressor Nomenclature & Illustration

a) Illustration of Nameplate



b) Compressor Nomenclature

TS xxx x

Special series code:
S: Standard **W: Water-cooled**
L: Refrigeration application **C: R134a Refrigerant**
H: Heat pump/hot water machine application

· Cooling capacity with refrigerant R22 under 60Hz/ARI operating condition (X1,000 BTU)

· For C Series, cooling capacity with refrigerant R134a under 60Hz/ARI operating condition (X1,000 BTU)

ChynTec TS Model
ChynTec semi-hermetic scroll refrigerant compressor

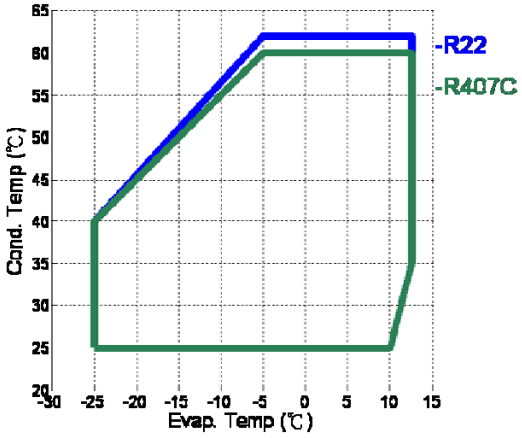
c) Power Supply

Power supply: _V_Hz	Voltage and Frequency			
	60Hz		50Hz	
	Applied voltage	Specification	Applied voltage	Specification
	220V/60Hz	220V-3-60Hz	380V/50Hz	380V-3-50Hz
	230V/60Hz	230V-3-60Hz		
	380V/60Hz	380V-3-60Hz	400V/50Hz	400V-3-50Hz
	440V/60Hz	440V-3-60Hz		
	460V/60Hz	460V-3-60Hz	415V/50Hz	415V-3-50Hz
	480V/60Hz	480V-3-60Hz		

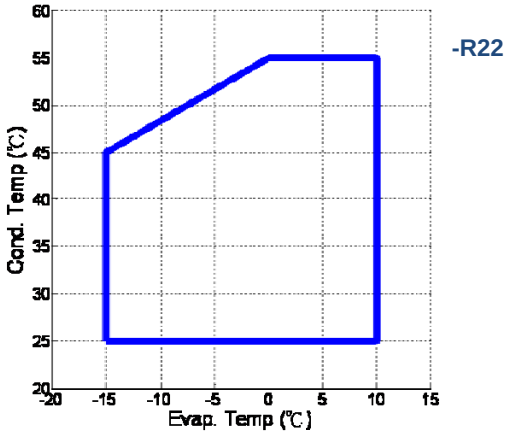
4. Operating Envelopes and Limitations

Compressor operating envelop depends on which refrigerant the compressor operates with. It indicates that within the specified saturated suction and discharge temperature the compressor can operate adequately for long term. It is the key element to ensure compressors operating life. If the suction temperature is too low, it might cause the problem for motor to be cooled properly. If the operating condensing temperature is too high, the motor is overloaded and it will shorten the operating life of compressor.
The diagram below shows the operating envelopes of ChynTec scroll compressor for different refrigerants.

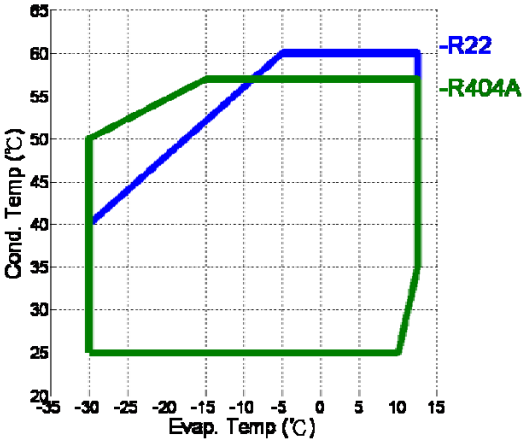
S type



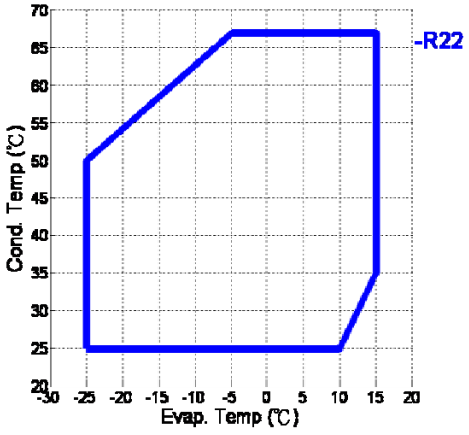
W type



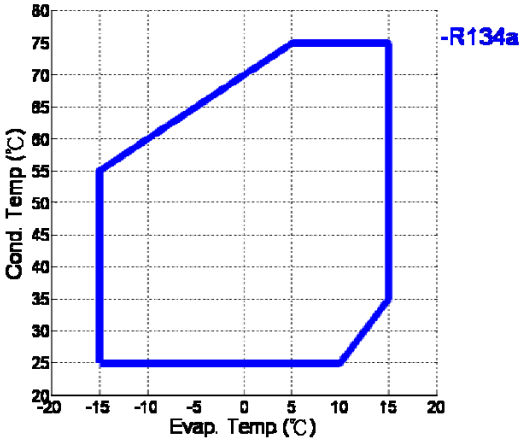
L type



H type

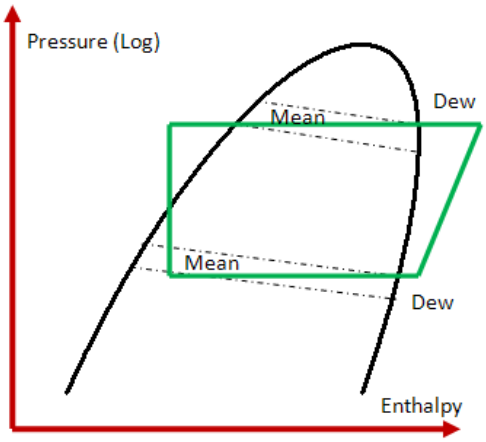


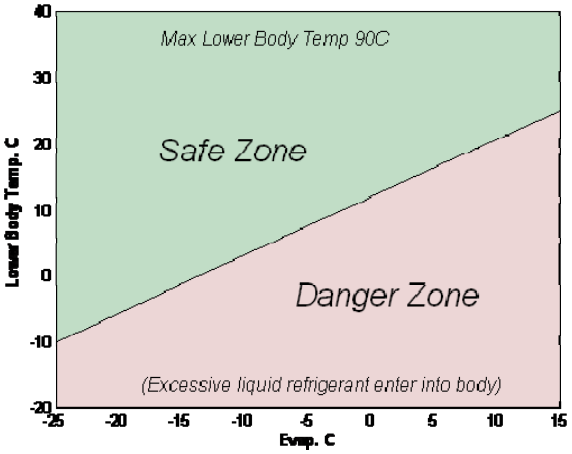
C type



Remarks:

1. The envelope above is based on superheat at 5K.
2. Thermostat of motor winding is attached as the standard protector for each compressor.
3. The superheat for the suction line of the compressor is kept at 5~10 K. Maximum compressor discharge temperature: 125°C.
4. To prevent liquid refrigerant from entering into compressor and cause loss of lubrication, the recommended minimum discharge superheat is 15K. The discharge temperature should be maintained at least 15K higher than condensing temperature. Normally, discharge superheat is 25K for R134a, and 35K for R22 and R407C.
5. Due to R134a refrigerant molecule is tiny, special gasket should be applied for refrigerant passage in the system to prevent from refrigerant leakage after long period of operation. R407C and R404A are mixture of different refrigerants which contains R134a. The requirement is the same as R134a.
6. Lubricant POE oil for the model operates with refrigerant R-134a is hygroscopic. It will absorb the moisture in the air and cause damage to the system. Less than 1 hour exposure of POE oil to the air is strongly recommended.
7. The operating envelope above is marked by Dew point. R407C is a zeotropic mixture. R404A is an azeotropic mixture. There is a temperature glide in R407C and R404A. When mentioning about evaporating and condensing temperature, it is necessary to indicate DEW point or MEAN point. The figure below shows the definite difference between Mean and Dew temperature. The dotted line means isotherm not isobar. For R407C as an example, Mean point temperature is 2~3℃ lower than Dew point temperature.
8. When compressors operate within operating envelop, if lower body temperature is too low, excessive amount of liquid refrigerant may enter into compression chamber and cause damage to compressors. We can estimate the safety range of lower body temperature with respect to evaporating temperature as shown on figure below on the right. However, the highest temperature of lower body cannot exceed 90℃.





5. Mechanical Specifications:

Standard Series, R22

Model				TS165S	TS185S	TS210S	TS250S	TS280S	TS310S
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Cooling Capacity (kcal/hr)*		41,600	46,300	51,400	63,100	71,200	79,200
		Power Input (kW)		13.9	15.4	17.2	21.1	23.6	26.3
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Cooling Capacity (kcal/hr)*		34,700	38,600	42,800	52,600	59,300	66,000
		Power Input (kW)		11.6	12.8	14.3	17.6	19.7	21.9
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			155	160	165	195	205	215
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	261	304	401	460	545	545
			380V	151	176	232	266	315	315
			440V	131	152	201	230	273	273
		50Hz	380V	125	146	192	220	261	261
	Nominal current (Amp) *	60Hz	220V	44	49	53	66	73	81
			380V	25	28	31	38	42	47
			440V	22	25	27	33	37	41
		50Hz	380V	22	24	26	32	35	39
	Max current (I-max)*	60Hz	220V	51	56	63	77	85	96
			380V	29	32	36	44	49	55
			440V	26	28	32	39	43	48
		50Hz	380V	25	27	31	37	41	46
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			SUNISO_4GS					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					

Remark:

1. **Cooling Capacity：The rated capacity under ARI operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ARI operating condition. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

Standard Series, R407C

Model				TS165S	TS185S	TS210S	TS250S	TS280S	TS310S
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Cooling Capacity (kcal/hr)*		38,800	43,100	47,700	59,100	66,600	73,700
		Power Input (kW)		13.9	15.4	17.0	21.1	23.8	26.3
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Cooling Capacity (kcal/hr)*		32,300	35,900	39,800	49,300	55,500	61,400
		Power Input (kW)		11.6	12.8	14.2	17.6	19.8	21.9
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			155	160	165	195	205	215
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	261	304	401	460	545	545
			380V	151	176	232	266	315	315
			440V	131	152	201	230	273	273
		50Hz	380V	125	146	192	220	261	261
	Nominal current (Amp) *	60Hz	220V	44	49	54	66	73	82
			380V	25	28	31	38	42	47
			440V	22	25	26	33	37	41
		50Hz	380V	21	24	27	32	36	40
	Max current (I-max)*	60Hz	220V	49	54	61	75	84	92
			380V	28	31	35	43	48	53
			440V	25	27	31	38	42	46
		50Hz	380V	24	26	30	36	41	45
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			CPI_CP-2931AW					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					

Remark:

1. **Cooling Capacity：The rated capacity under ARI operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ARI operating condition. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

Standard Series, R134a

Model				TS110C	TS125C	TS130C	TS160C	TS185C	TS200C
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Cooling Capacity (kcal/hr)*		27,400	29,900	33,400	41,700	46,700	51,700
		Power Input (kW)		9.4	10.3	11.5	14.3	16.1	17.8
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Cooling Capacity (kcal/hr)*		22,900	25,000	27,900	34,800	39,000	43,100
		Power Input (kW)		7.8	8.6	9.6	11.9	13.4	14.8
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			155	155	160	185	195	205
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	261	261	304	401	460	460
			380V	151	151	176	232	266	266
			440V	131	131	152	201	230	230
		50Hz	380V	125	125	146	192	220	220
	Nominal current (Amp) *	60Hz	220V	30	33	37	45	51	56
			380V	17	19	21	26	29	32
			440V	15	17	19	23	26	28
		50Hz	380V	15	16	18	22	25	27
	Max current (I-max) *	60Hz	220V	42	47	52	64	71	80
			380V	24	27	30	37	41	46
			440V	21	24	26	32	36	40
		50Hz	380V	21	23	26	31	35	39
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			CPI_CP-2931AW					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					

Remark:

1. **Cooling Capacity：The rated capacity under ARI operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ARI operating condition. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

Water-cooled Series, R22

Model				TS165W	TS185W	TS210W	TS250W	TS280W	TS310W
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Cooling Capacity (kcal/hr)*		40,700	46,100	50,300	61,000	70,300	77,800
		Power Input (kW)		10.3	11.6	12.7	15.6	17.5	19.3
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Cooling Capacity (kcal/hr)*		33,900	38,400	41,900	50,800	58,600	64,800
		Power Input (kW)		8.6	9.7	10.6	13.0	14.6	16.1
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			155	155	160	190	200	210
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	261	261	304	401	460	460
			380V	151	151	176	232	266	266
			440V	131	131	152	201	230	230
		50Hz	380V	125	125	146	192	220	220
	Nominal current (Amp) *	60Hz	220V	33	39	42	51	56	61
			380V	19	22	24	29	32	35
			440V	17	20	21	26	28	31
		50Hz	380V	17	19	21	25	27	30
	Max current (I-max)*	60Hz	220V	46	51	56	68	77	84
			380V	26	29	32	39	44	48
			440V	23	26	28	34	39	42
		50Hz	380V	22	25	27	33	37	41
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			SUNISO_4GS					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					

Remark:

1. **Cooling Capacity：The rated capacity under ET: 3℃, CT: 38℃, Subcooling:5K, Superheat:5K operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ET: 3℃, CT: 38℃. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

Refrigeration, L Series, R22

Model				TS165L	TS185L	TS210L	TS250L	TS280L	TS310L
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Cooling Capacity (kcal/hr)*		25,200	27,800	30,700	38,500	42,800	47,400
		Power Input (kW)		9.8	10.9	12.1	15.4	16.8	18.6
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Cooling Capacity (kcal/hr)*		21,000	23,200	25,600	32,100	35,700	39,500
		Power Input (kW)		8.2	9.1	10.1	12.8	14.0	15.5
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			155	160	165	190	200	210
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	261	304	401	460	460	545
			380V	151	176	232	266	266	315
			440V	131	152	201	230	230	273
		50Hz	380V	125	146	192	220	220	261
	Nominal current (Amp) *	60Hz	220V	32	35	39	49	54	59
			380V	18	20	22	28	31	34
			440V	16	18	20	25	27	30
		50Hz	380V	16	17	19	24	26	29
	Max current (I-max)*	60Hz	220V	49	54	59	75	82	90
			380V	28	31	34	43	47	52
			440V	25	27	30	38	41	46
		50Hz	380V	24	26	29	36	40	44
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			SUNISO_3GS					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					
	Shutoff Valve			Intake/Out Shutoff Valve					

Remark:

1. **Cooling Capacity：The rated capacity under ET: -10℃, CT: 40, Subcooling:5K, Superheat:5K operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ET: -10℃, CT: 40℃. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

Refrigeration, L Series, R404A

Model				TS165L	TS185L	TS210L	TS250L	TS280L	TS310L
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Cooling Capacity (kcal/hr)*		26,000	28,500	32,100	38,500	44,600	49,400
		Power Input (kW)		11.4	12.3	13.9	17.5	19.4	21.4
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Cooling Capacity (kcal/hr)*		21,700	23,800	26,800	32,100	37,200	41,200
		Power Input (kW)		9.5	10.3	11.6	14.6	16.2	17.8
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			155	160	165	190	200	210
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	261	304	401	460	460	545
			380V	151	176	232	266	266	315
			440V	131	152	201	230	230	273
		50Hz	380V	125	146	192	220	220	261
	Nominal current (Amp) *	60Hz	220V	37	39	44	56	59	66
			380V	21	22	25	32	34	38
			440V	19	20	22	28	30	33
		50Hz	380V	18	19	21	27	29	32
	Max current (I-max)*	60Hz	220V	51	56	63	78	85	94
			380V	29	32	36	45	49	54
			440V	26	28	32	39	43	47
		50Hz	380V	25	27	31	38	41	46
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			CPI_CP-2931AW					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					
	Shutoff Valve			Intake/Out Shutoff Valve					

Remark:

1. **Cooling Capacity：The rated capacity under ET: -10℃, CT: 40℃, Subcooling:5K, Superheat:5K, operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ET: -10℃, CT: 40℃. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

Heat Pump, H Series, R22

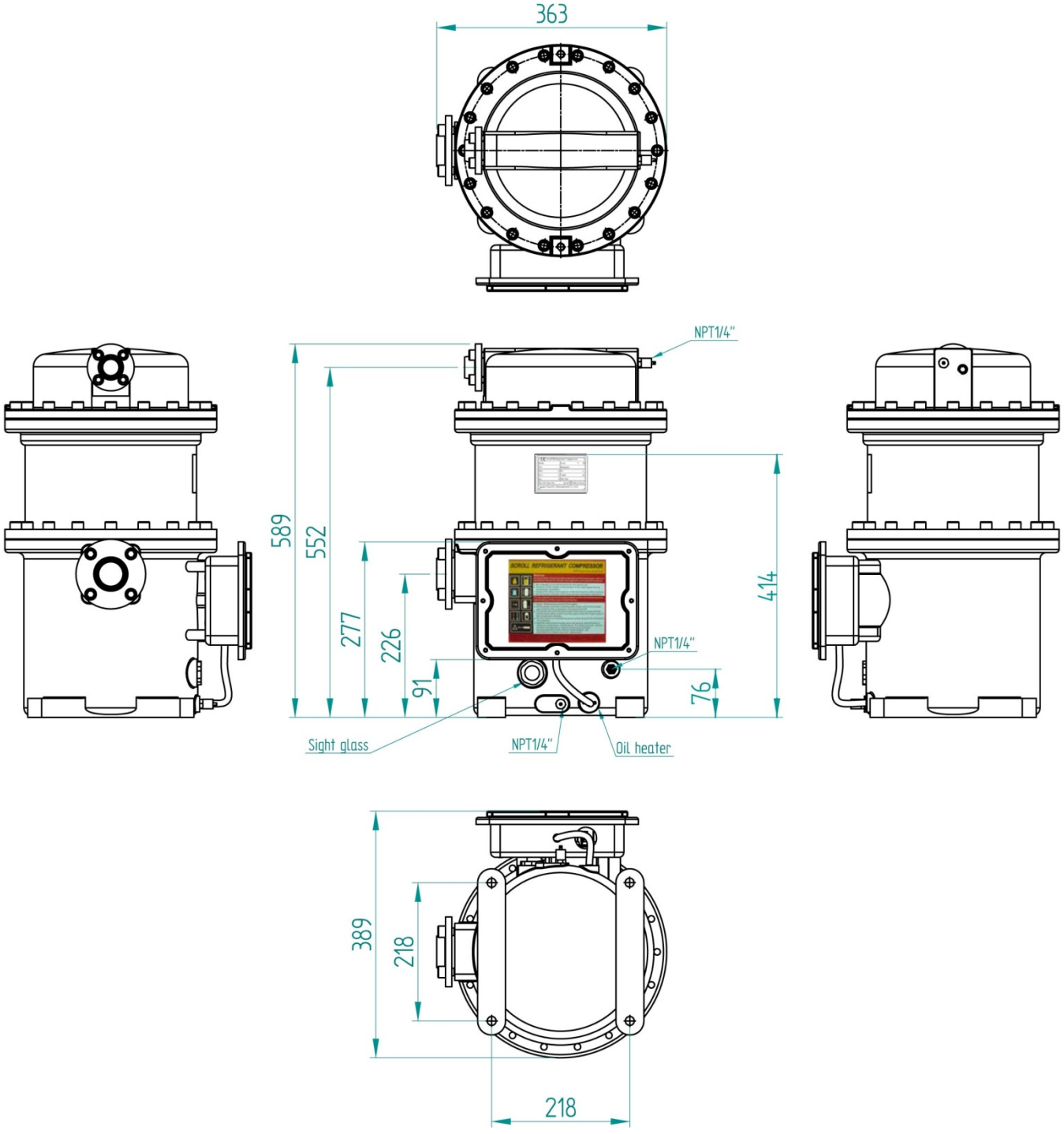
Model				TS165H	TS185H	TS210H	TS250H	TS280H	TS310H
Capacity	60Hz	Speed (rpm)		3500					
		Displacement (m^3/hr)		45.6	49.8	56.1	69.5	78.3	86.7
		Heating Capacity (kcal/hr)*		44,400	49,300	54,800	68,000	75,700	84,200
		Power Input (kW)		14.8	16.3	18.3	22.4	25.0	27.8
	50Hz	Speed (rpm)		2900					
		Displacement (m^3/hr)		38.4	41.5	46.7	57.9	65.3	72.3
		Heating Capacity (kcal/hr)*		37,000	41,100	45,700	56,700	63,100	70,200
		Power Input (kW)		12.3	13.6	15.3	18.7	20.8	23.2
Outline Scheme	Height, mm			589			701		
	Width, mm			389			427		
	Body flange diameter, mm			363			382		
	Net weight, kg			160	165	170	195	205	215
	Installation hole, mm			14					
Piping	Suction pipe, mm			41.3 (1-5/8")			41.3 (1-5/8")		
	Discharge pipe, mm			28.6 (1-1/8")			34.9(1-3/8")		
	Electric hose diameter, mm			25.4					
Motor	Lock rotor current (LRA)	60Hz	220V	304	401	401	460	545	545
			380V	176	232	232	266	315	315
			440V	152	201	201	230	273	273
		50Hz	380V	146	192	192	220	261	261
	Nominal current (Amp) *	60Hz	220V	47	51	58	70	77	85
			380V	27	29	33	40	44	49
			440V	24	26	29	35	39	43
		50Hz	380V	23	25	28	34	37	41
	Max current (I-max)*	60Hz	220V	54	59	68	82	90	101
			380V	31	34	39	47	52	58
			440V	27	30	34	41	45	51
		50Hz	380V	26	29	33	40	44	49
	Start-up method	Standard		Standard direct start-up					
		Optional		None			Y-Δ		
Lubricant	Standard			SUNISO_4GS					
	Oil charged(Liter)			3	3	3	4	4	4
Standard	Oil heater			100W 220V					

Remark:

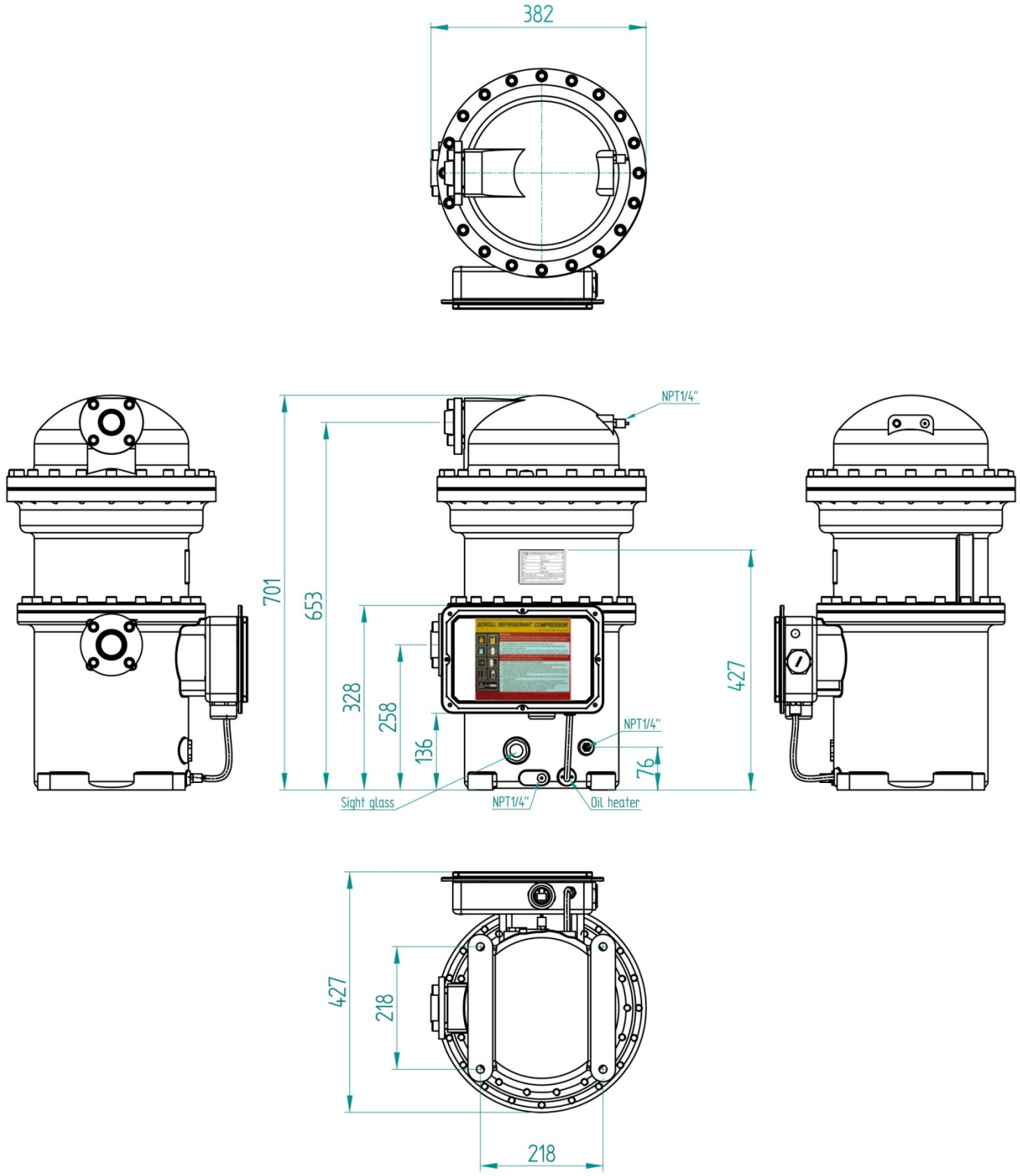
1. **Cooling Capacity：The rated capacity under ET: 2℃, CT: 60℃, Subcooling:5K, Superheat:5K operating condition. Measuring norm refers to the regulations specified in CNS 11870B7273.**
2. **Nominal current：The nominal running current under ET: 2℃, CT:60℃. Measuring norm is as above.**
3. **Max. current：The maximum running current under the sufficiently cooling of motor.**

6. Dimensions of Compressors

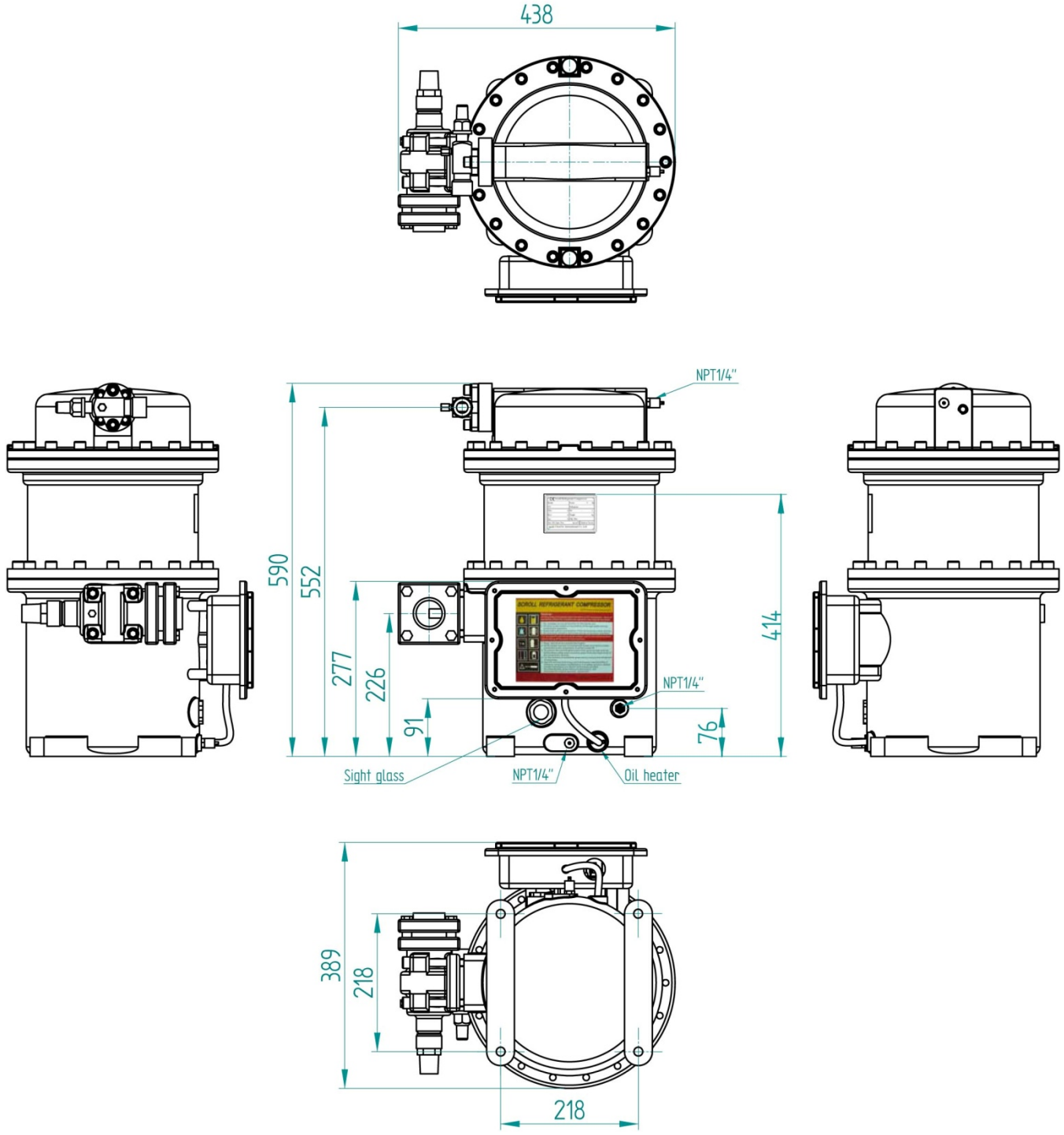
TS165/185/210（S / W / H）　TS110/125/130（C）



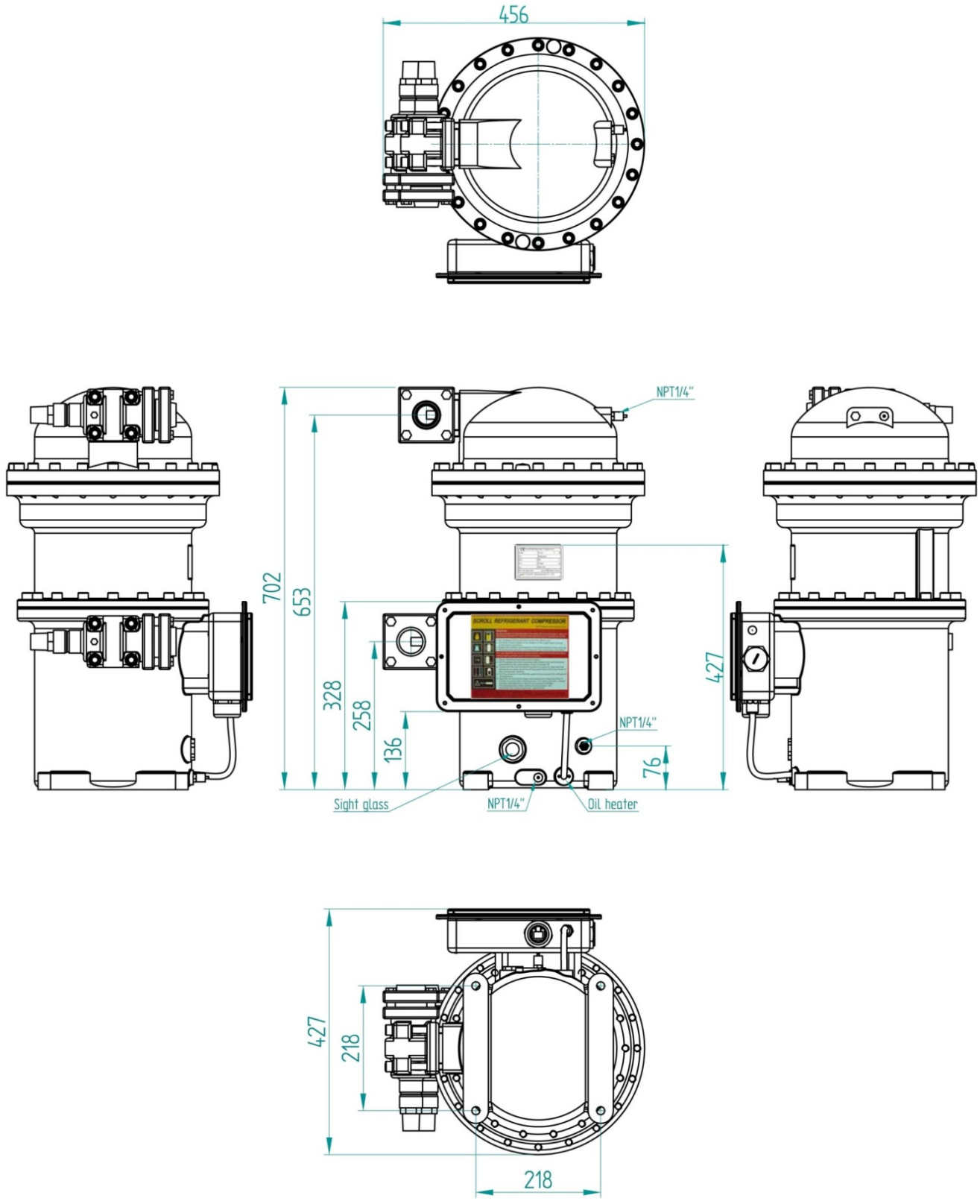
TS250/280/310（S / W / H）　TS160/185/200（C）



TS165/185/210（L）



TS250/280/310（L）



7. Electrical Design

1. Explanation to Electrical Current

Compressor motor designs and illustrations are different among various compressor manufacturers. It often confuses HVAC system electrical control designers. Electrical data included in this manual are defined and specified as following:

a. Operating Envelopes

Normally, for air conditioning equipment, the system operating condition depends on both ambient temperature and interior temperature setting. The operating envelope (please refer to Section 4 of this manual) means the design envelop of compressor which maximum running envelope is certified by strict running tests.

Do not exceed the envelope when setting the required operating point under the approved envelope of compressor, or it will reduce life of system and compressor.

b. Performance Table

Performance table is the measured results of power input and refrigeration capacity for various points within the compressor operating envelope.

The data are helpful for the HVAC system designers to know the maximum running current of system for choosing proper electrical components and overload protections for each individual system.

c. Nominal Condition

Nominal condition is that the compressor operates under different standard system designed operating condition. All kinds of air conditioning system have different design concepts and different nominal conditions, such as the following:

	S type	W type	L type	H type
Nominal Condition	ARI	--	--	--
Evaporating Temp(℃)	7.2	3	-10	2
Condensing Temp(℃)	54.4	38	40	60
Sub-cooling (K)	8.3	5	5	5
Superheat (K)	11.1	5	5	5

d. LRA (Locked Rotor Ampere)

LRA is the starting current of direct start-up. The other ways for start-up can be calculated by electrical law. (Such as Y-△ start-up is 1/3 of LRA)

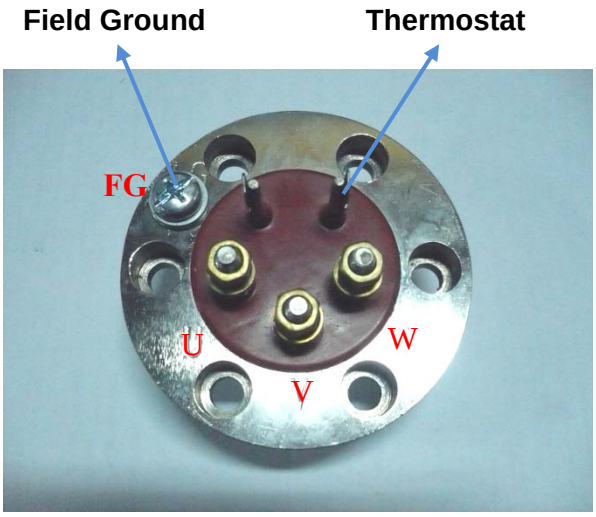
e. Amp (Nominal Current)

Amp is the current of the compressor operating under the nominal (rated) condition. To avoid confusing with the RLA of standard motor, some of the compressor manufacturers do not provide Amp values. The Amp of ChynTec compressor is average current tested under ARI condition, which is not only internationally applicable but also serves for good reference for system electrical design.

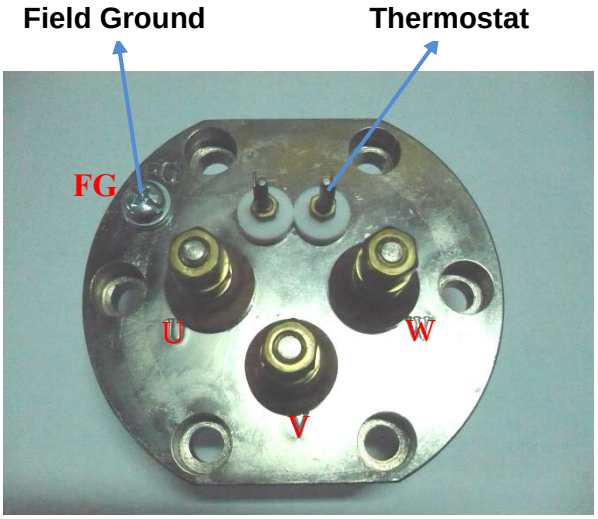
f. I-max

I-max is the maximum current of the compressor's motor under normal cooling condition. This is only for the reference of HVAC system designers who design their own electrical protection circuit.

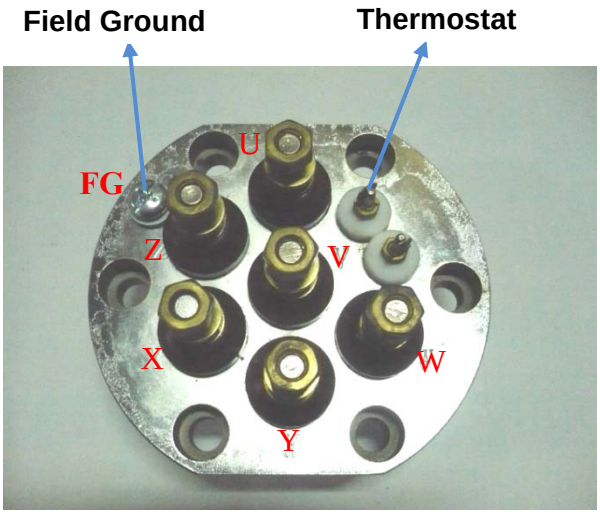
2. Motor Electrical Connection Board



3 power-bolts terminal board
Application：TS165/185/210（S/W/L/H）
TS110/125/130（C）
U/V/W main power lines and motor coil thermostat connection as illustration, M8 bolt for field ground.



3 power-bolts terminal board
Application：TS250/280/310（S/W/L/H）
TS160/185/200（C）
U/V/W main power lines and motor coil thermostat connection as illustration, M8 bolt for field ground.

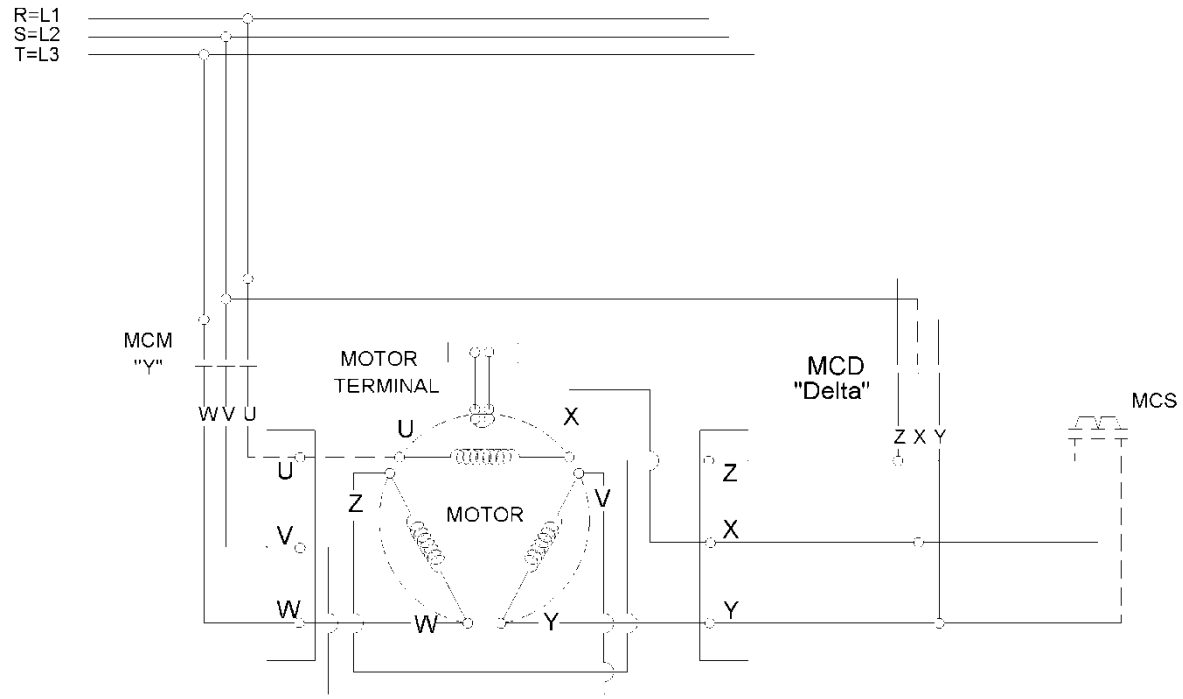


6 power-bolts terminal board
Application：TS250/280/310（S/W/L/H）
TS160/185/200（C）
U/V/W and X/Y/Z main power lines and motor coil thermostat connection as illustration, M8 bolt for field ground.

3. Start-up Options

ChynTec compressors provide optional Y-Δ starting to customers. Y-Δ motor connects motor coil by Y connection during starting, therefore reducing voltage on coils to $1/\sqrt{3}$ of input voltage and reconnects motor coil by Δ connection after starting. By doing so, we can decrease starting current through voltage drop, i.e., so-called voltage-drop starting.

Y-Δ motor connection method is shown in the following motor wiring diagram:



In Y connection, MCM and MCS are inductive while motor leads Z, X, Y are tied together as a neutral connecting as Y fashion. A few seconds later (1 sec is recommended), MCM and MCS become deductive. Around 40 ms later, MCM and MCD are inductive, it turns out Δ run connection.

Please pay attention:

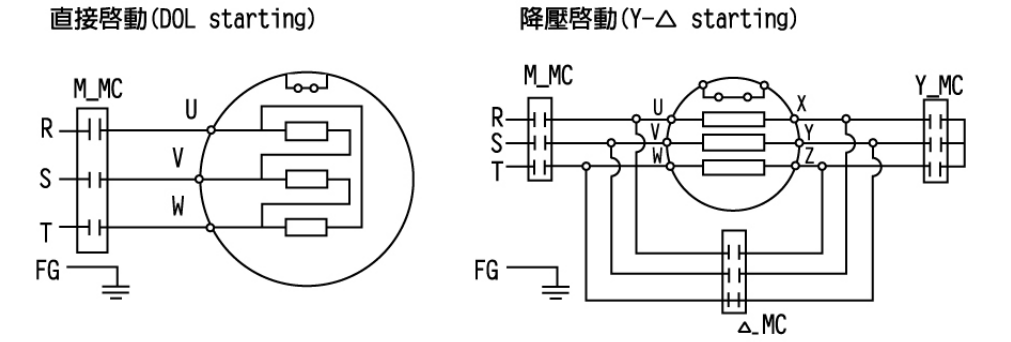
After Y start, MCM and MCS are deductive for 40 ms and then MCM and MCD are inductive for Δ run. Within as transient as 40 ms, pseudo short circuit might occur due to inappropriate action of contactors, causing trip of compressors. When it occurs, we recommend usage of adjustable Y-Δ dedicated Timer or slightly lengthen time span for MCM and MCS deduction – MCM and MCD re-induction from 40 ms to 60 ms max directly in micro controller or PLC program. Because motor is not powered during Y-Δ shift, shorter Y-Δ shift span is suggested to prevent second start due to decreased rotation speed. However, if Y-Δ shift span is too short, aforementioned pseudo short circuit might occur.

Characteristics of Y-Δ starting:

a. Starting current in Y connection is 1/3 of lock rotor ampere.
b. Starting torque in Y connection is 1/3 of lock rotor torque.

4. Electrical Wiring Diagram

Please refer to the motor wiring drawing on the inside cover of terminal box.



1. Every time have the compressor maintenance must turn off the power first.
2. Thermostat will shut the power off when the compressor overloads, before restart the compressor please find out the reason and reject. Never start with short-circuits of thermostat, it may result reduce the compressor life and even leads to the compressor damages.
3. Always using multimeter with short-circuits to checking thermostat in order to prevent high voltages result burn out of thermostat.
4. For prevented the service person face to the accident of electric shock, suggest connected the FG system properly.
5. Please keeping the terminal box exterior and interior clean and dry after maintenance, lock up the terminal box in prevent the short-circuits and injury.

8. System Design & Application Advice

ChynTec scroll compressors have been applied widely for air conditioning and refrigeration. Proper system design and application ensure the lifespan of the compressor and the optimization of the capacity for the system.

A) Oil Heater

When compressor stops operating, the temperature of oil stocked in the lower body should be 10K higher than the low pressure saturate temperature to make sure that liquid refrigerant does not store in the lower body of the compressor. Oil heater is a standard accessory to ChynTec scroll compressors. We recommend oil heater is installed in all application system in order to ensure long term operation. The oil heater specification is 220V, 100W. Please turn on oil heater 12 hours before operation (if the suction or discharge shutoff valve is installed in the system, please open it first.), and turn on the oil heater when compressor stops operating.

Under low ambient temperature, or big temperature difference between day and night, or long period of time between compressors assembled and first time operation at customer site, if discharge check valve and suction/discharge shutoff valve are not installed in the system, excessive liquid (refrigerant and oil mixture) is likely to accumulated in compressors. It will result in liquid start up and cause damage to compressor. Under this condition, we recommend use of 150W oil heater, or extending heating time to more than 24 hours.

B) Thermostat

The motor of ChynTec scroll compressor is a 3 phase type, built in thermal protector. When the motor is over heated caused by overload of the motor, shortage of refrigerant, or motor reverse, the switch will trip. Because the protector will be reset automatically, we recommend to use extra control (manual reset) to reset the system.

C) Pressure Limitation for Each Series

			R22	R407C	R134a	R404A
S Series	High pressure range	kg/cm^2G	9.7~25.4	9.4~24.7		
	Low pressure range	kg/cm^2G	2.1~6.4	1.7~6.1		
	Max high pressure	kg/cm^2G	27	25		
	Min low pressure	kg/cm^2G	1.5	1.0		
W Series	High pressure range	kg/cm^2G	9.7~21.1			
	Low pressure range	kg/cm^2G	2.1~5.9			
	Max high pressure	kg/cm^2G	22			
	Min low pressure	kg/cm^2G	1.5			
L Series	High pressure range	kg/cm^2G	9.7~23.7			11.7~26.6
	Low pressure range	kg/cm^2G	0.7~6.4			0.7~7.9
	Max high pressure	kg/cm^2G	24			27
	Min low pressure	kg/cm^2G	0.3			0.3
H Series	High pressure range	kg/cm^2G	9.7~27.7			
	Low pressure range	kg/cm^2G	1.1~7.0			
	Max high pressure	kg/cm^2G	28			
	Min low pressure	kg/cm^2G	0.5			
C Series (R134a)	High pressure range	kg/cm^2G			5.8~23.2	
	Low pressure range	kg/cm^2G			0.7~3.5	
	Max high pressure	kg/cm^2G			24	
	Min low pressure	kg/cm^2G			0.3	

- High/Low pressure protector
  It is necessary for scroll compressors to install high pressure protector to protect compressors under the conditions of the block of fan, non-operative of cooling water in system. It is necessary to install low pressure protector to protect compressors under the conditions of shortage or leakage of refrigerant in system. How to setup the high/low pressure protector depends on the application and working condition. In general, high pressure protector should be lower than max high pressure listed above; low pressure protector should be higher than min low pressure listed above.

D) Low ambient temperature and minimum pressure difference

The required minimum pressure difference between suction and discharge port of scroll compressor is 4~5 kg/cm^2 to make sure enough back pressure to force orbiting scroll to sit on thrust bearing. If pressure difference below this required range, orbiting scroll will separate from thrust bearing and cause unwanted movement. To create enough pressure difference, it is necessary to maintain discharge pressure at certain level. Therefore, when compressor operates in low ambient temperature condition, the control on discharge pressure is very important. The noise level of compressor might be increased .

E) Electric Voltage Requirement
Stable power supply provides proper voltage to ensure stable and long term operation.

Power supply voltage range: Rated voltage ± 10%

Frequency	Rated voltage	Voltage range
60 Hz	220V-3-60Hz	198V-242V
	380V-3-60Hz	342V-418V
	440V-3-60Hz	396V-484V
50 Hz	380V-3-50Hz	342V-418V

Phase voltage unbalanced value should be smaller than 2%, because the voltage unbalance will cause certain phase current too high, and the motor will be over heated or burned out.

$$V_{Unbalance} = \frac{|V_{AVG} - V_{UV}| + |V_{AVG} - V_{UW}| + |V_{AVG} - V_{VW}|}{2 \times V_{AVG}} \times 100$$

V_{AVG}: the average of 3 phase voltages

V_{UV} V_{VW} V_{UW}: UV, VW, and UW phase voltage

F) Switch On/Off Limitation
The switch on/off limitation of compressor is max 6 times in an hour. Too many times of switch on/off compressor will shorten the lifespan. We recommend install the delay timer to limit the switches. The minimum operating time depends on the system design. It is recommended that the minimum operating time is 8 – 10 minutes. At least, the system engineer must consider for proper motor cooling and oil returning back to safety level in compressor.

G) Compressors Reverse Protection
Scroll compressor can only compress the refrigerant in one direction. The operating direction is decided by the phase sequence of 3 phase motor. Please use phase meter to ensure the power phase is connected correctly before test operating,

The reverse can be found by:
- Scroll abnormal crash noise
- High and Low pressure can not be built up

We recommend install the power relay on system to ensure the normal operation.

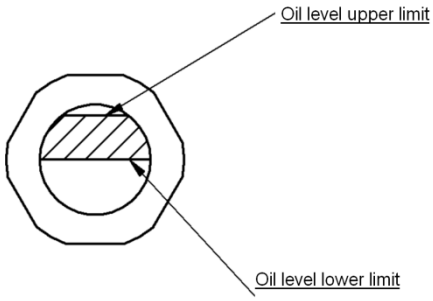
H) Discharge Temperature Limitation
We recommend install temperature protector on the piping around 15 cm off discharge port to limit the max discharge temperature. The cutoff temperature is set at 125℃.

Our optional accessory of discharge temperature protector cutoff temperature is 125℃ and the reset temperature is 105℃.

I) Minimum Superheat at Suction Port
To prevent excessive liquid refrigerant from entering into compression chamber directly, the recommended lowest suction superheat is 5K. The superheat of compressor should be maintained at 5-15K.

J) Minimum Superheat at Discharge Port
To prevent liquid refrigerant from entering into compressor and result in loss of lubrication, recommended minimum superheat at discharge port is 15K. (Discharge temperature is at least 15K higher than condensing temperature.) Normally, the discharge superheat is 25K for R134a, 35K for R22 and R407C.

K) Oil Level Exam
When the compressor operates stably, please make sure there is no liquid refrigerant stocked at the lower body of compressor, and the oil level should be above 1/2 of the sight glass and below upper limit shown in the right figure. You can also check the oil level immediately after the compressor shut down. At this moment, the oil level should be above 1/2 of the sight glass.

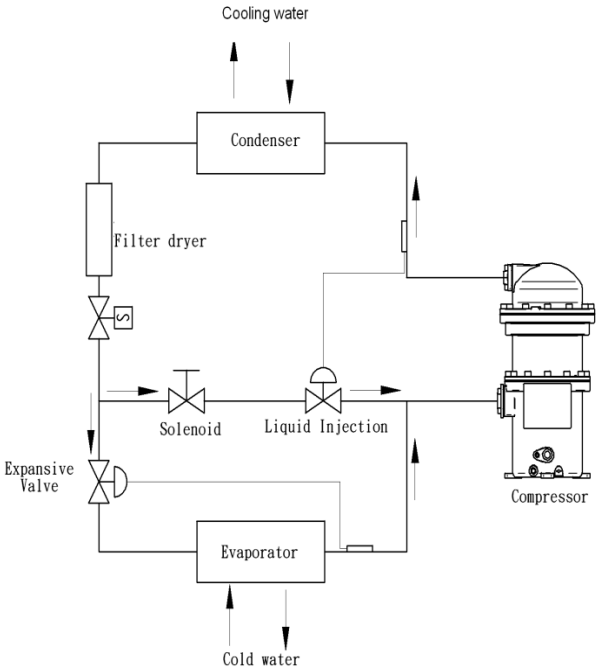


L) Notice of Pump Down
a. The damage caused by incorrect operation of pump down shall render the warranty void.
b. Stop the compressor immediately if any abnormal noise noticed during pump down process.
c. The low pressure limitation is 0.5(Kg/cm^2.G). The time limitation of pump down is 15 seconds. Either condition sets up, stop the compressor immediately.

M) Suction Port Liquid Injection
When operate in air-cooled heat pump application under heavy loading working condition, or low temperature refrigeration application under high compression ratio working condition, the motor is likely over-heated, and the discharge temperature will exceed the max discharge temperature limit. These will shorten the operating lifespan of compressors.

Suction port liquid injection device is to install a solenoid valve and an expansion vale between liquid line and compressor suction port to introduce part of liquid refrigerant into compressor. This is to utilize the latent heat of liquid refrigerant to cool down motor coil temperature, and compression chamber temperature to ensure adequate long term operation and safety of compressors.

It is recommended to install suction port liquid injection device when discharge temperature is higher than 125℃ for certain system application. The device includes high temperature expansion valve and solenoid valve, as shown in the right figure. The setting temperature of solenoid valve is at 115℃. When discharge temperature reaches 115℃, solenoid vale will be opened; and discharge temperature drops to 95℃, solenoid valve will be closed again. If the discharge temperature rises higher than 125℃ even the solenoid valve has been opened, the discharge temperature protector must be tripped to protect compressor. High temperature expansion valve equipped with a temperature sensor to detect discharge temperature and control the flow of refrigerant accordingly to utilize liquid refrigerant to cool down discharge temperature.



9. Optional Accessories

Description		Specification
Oil drain		1/4” shutoff valve
Outlet shutoff valve		1-1/8” shutoff valve
Outlet shutoff valve		1-3/8” shutoff valve
Intake shutoff valve		1-5/8” shutoff valve
External check valve		1-1/8”, 1-3/8” check valve
Oil heater		150W 220V, 100W 110V 200W 220V
External discharge temperature protector (Thermostat)		Cut out temp:115℃ Cut in temp: 85℃
Insert type discharge temperature protector (Thermostat)		Cut out temp:125℃ Cut in temp: 100℃
Insert type discharge temperature protector (PTC)		Trip temp: 125℃
Oil level regulator		Supply voltage: 24VAC 50/60Hz +/-10 % , 0.7A Oil supply fitting: 7/16"-20 UNF male
Oil level watch		Supply voltage: 24VAC, 50/60Hz, +10/-15%, 0.05A

PTC motor protector		Power supply: AC 50/60Hz 24V-15%+10% AC 50/60Hz 115-120/230-240V-15%+10%
PTC motor protector (with phase sequence relay)		Power supply: AC 50/60Hz 115-120/230-240V-15%+10% 3VA Phase sequence relay: 3 AC 50/60Hz, 200…575±10%
Suction filter		Suction filter

Oil recommends

Refrigerant	Product Series	Mineral oil			POE oil	
		4GS	3GS	Icematic-299	CP-2931AW	RL 32H
R22	S	Standard		Optional		
	W	Standard		Optional		
	L		Standard			
	H	Standard		Optional		
R134a	C				Standard	Optional
R407C	S				Standard	Optional
R404A	L				Standard	Optional

Specification of refrigeration oil:

Item	Specification	4GS	3GS	CP-2931AW	Icematic-299	RL32
1	Viscosity @40℃	54.9	29.5	32.3	55.5	32.5
	@100℃ (mm^2/s)	5.97	4.31	5.71	5.94	5.8
2	Specific Gravity @15℃	0.915	0.909	0.982	0.92	0.977
3	Water Content (ppm)	20	20	＜100	45	＜40
4	Pour Point (℃)	-35	-40	-51	-36	-46
5	Flash Point (℃), C.O.C.	188	178	257	183	258
6	Acid Number (Mg KOH/g)	0.01	0.01	＜0.05	0.05	0.02

Remark:

1. POE code: CP-2931AW. This POE oil is for compressor operates with refrigerant R407C, R134a, R404A, R410A, etc.
2. POE oil is very hygroscopic. Less then 1 hour exposure to the air is strongly recommended after the intake and outlet of the compressor is unsealed.
3. When the original refrigeration oil of the compressor and system unit is replaced by POE oil, the remaining mineral oil must not exceed 3% to assure smooth long term operation.

10. Maintenance

1. All parts of compressor are recyclable, and shall be recovered, reused and/or disposed of properly in connection with maintenance, repair and scrapping.
2. Maintenance notices:
   a) Personal safety concern;
   b) Be careful of the damage to environment and facility;
   c) Be sure the system kept in good operating condition;
   d) Consider the maintenance space at the system design and installation stage;
   e) Must exam the leakage of refrigerant or oil after maintenance;
   f) Reduce the operational cost of maintenance.
3. When change the type of refrigerant operates with the system, the following notices shall be taken in account:
   a) Make sure which type of refrigerant the system can operate with;
   b) Examine all materials used in the system to ensure they are compatible with the replaced refrigerant;
   c) Verify the possibility of exceeding the allowable pressure;
   d) Verify the motor capacity;
   e) Pay attention to the refrigerant classification;
   f) Prevent mixture of residual refrigerant and residual oil.

4. Maintenance Period Recommendation

Item \ Hour	100	1000	10000	20000	30000
Out looking	▲	▲	▲	▲	▲
Electric insulation			▲	▲	▲
Refrigeration oil					◎
Oil level	▲	▲	▲	▲	▲
Noise / Vibration	▲	▲	▲	▲	▲
Bearing					◎

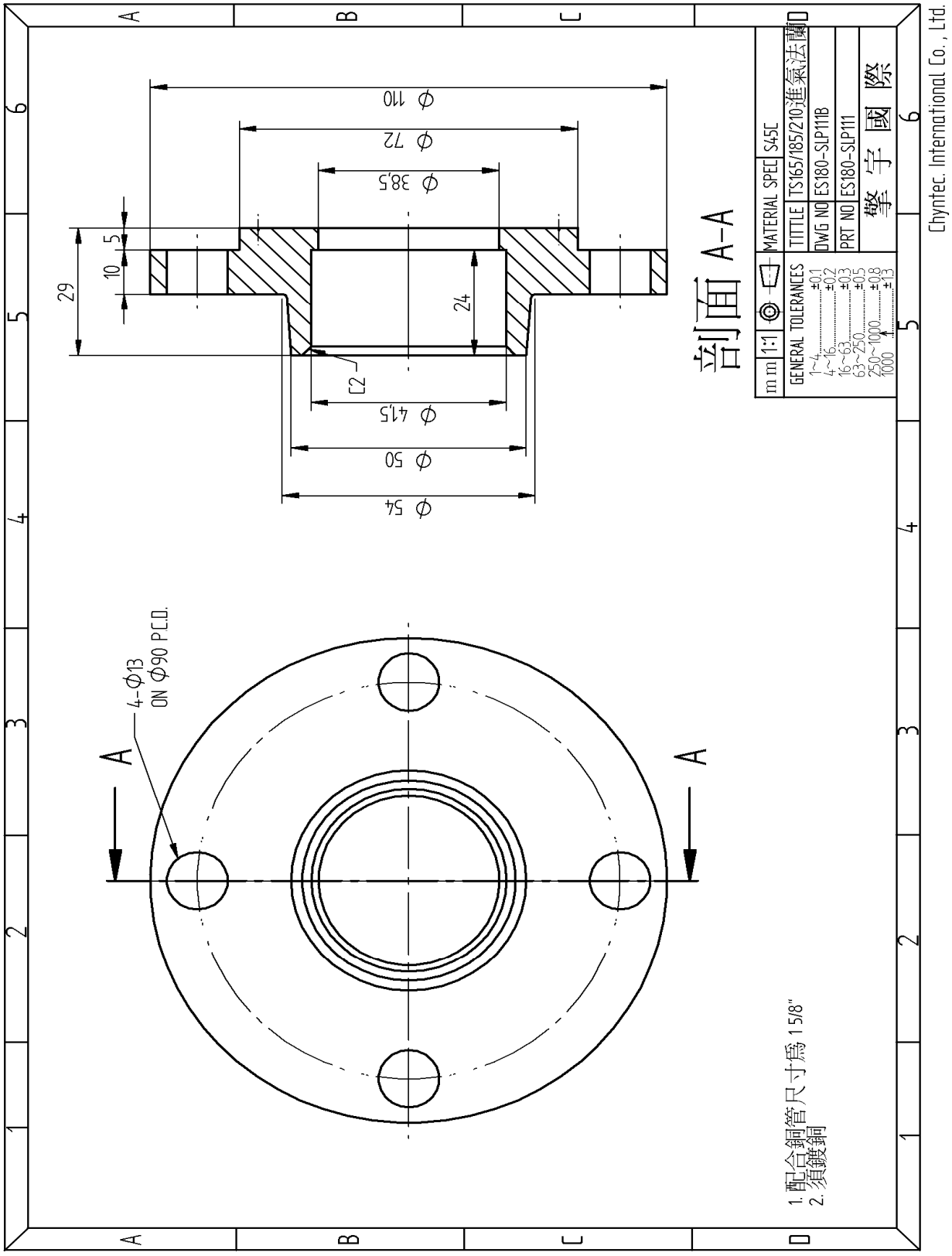
▲Check / ◎ Change

Remark:

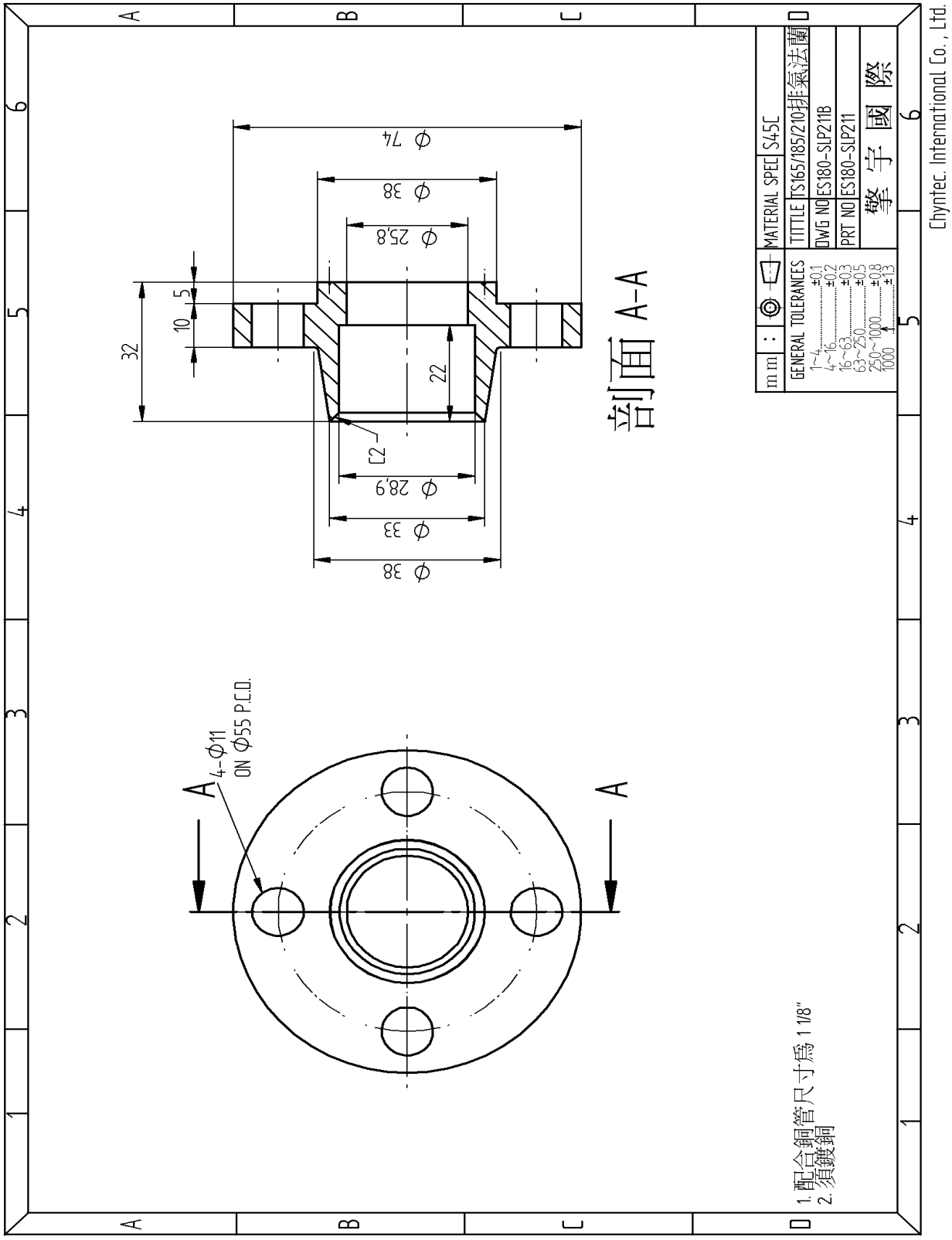
a) Besides the periodical check listed above for electricity insulation, the insulation condition needs to be checked annually before operation after long period of shutting down.
b) If the abnormal noise/vibration is noted, please contact ChynTec immediately for technical support.
c) The pressure test and leakage test are required after compressor repairing.
d) When the change of bearing is necessary, please change the whole bearing set.
e) Unless instructions and procedures are followed, and services conducted by authorized personnel, any damage caused will render the warranty void, and repairs will be on owner's expense.

11. Dimensions of Intake and Outlet Flange

TS Model Intake Flange



TS165/185/210(S/W/L/H)　TS110/125/130(C) Outlet Flange



TS250/280/310(S/W/L/H)　TS160/185/200(C) Outlet Flange