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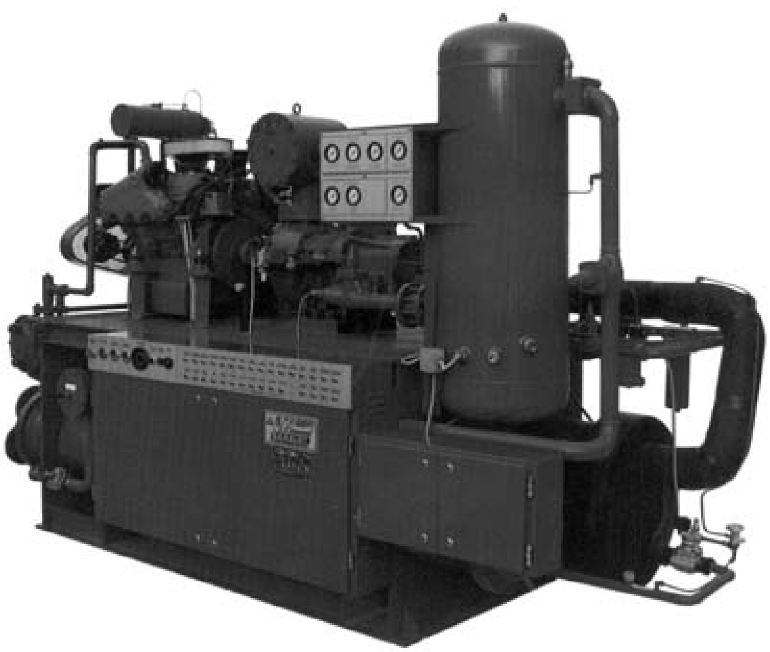


SARAVEL GASCHIL®
GAS ENGINE DRIVEN CHILLERS
60 TO 350 NOMINAL TONS

TABLE OF CONTENTS

GASCHILL® :
SARAVEL GAS ENGINE DRIVEN CHILLERS utilize the latest technology to provide the most efficient and cost effective cooling out of all the current electric and natural gas cooling technologies. With a COP of 1.9 gas engine driven chillers rank first in terms of efficiency as compared to absorption and electrically driven chillers * . *SARAVEL* offers 60, 150, 300 and 350 Ton units to cover the entire range of capacities for commercial and industrial applications. The following features are incorporated into the design of the *SARAVEL* GASCHIL®:

NATURAL GAS ENGINES
At the heart of the GASCHILL® is an industrial duty natural gas engine selected to meet the horsepower requirements of the compressor. The engine combustion heat is removed by the jacket water circulated through a heat exchanger which in turn is cooled by the cooling tower loop. An optional system can recover engine exhaust heat for domestic hot water use, thereby further increasing the efficiency of the gas engine driven chillers system. This unique feature of the GASCHIL® makes this system ideal for hospitals and hotels where domestic hot water is in demand during the summer months. Details on the engine heat recovery system adapted for domestic hot water use shall be supplied upon request.

COMPRESSORS
The 150 and 300 ton models utilize an industrial grade, oil injected screw compressor, the most durable compressor available via an oil actuated slide valve built into the compressor which can unload the compressor down to 10% of the maximum load. Oil cooling is accomplished through a liquid refrigerant injection system which maintains the oil at the proper operating temperature. The 60 and 350 ton models utilize open shaft reciprocating compressors.

EVAPORATOR
The direct expansion cooler designed for highest efficiency features, the refrigerant flows in the tubes and a series of baffles direct water over the refrigerant tubes. The evaporator and low temperature lines are completely protected with closed-cell fire retardant insulation for thermal insulating, condensation prevention, and vapor seal. Evaporators are built to ASME section VIII, Division 1 standard.

CONDENSER
The condenser is a shell and tube heat exchanger with integrally finned tubes. The evaporator, condenser and the oil separator are designed according to the ASME Section VIII, Division 1.

CONTROLS
SARAVEL GASCHLI ® incorporates all the standard refrigeration controls, namely: high and low pressure cut-outs, oil pressure safety cut-out, flow switch, low oil separator level, and anti-freeze control. In addition, to protect the gas engine the following control schemes are employed: 1) low water level 2) high/low oil level 3) high/low carburetor vacuum 4) high engine water temperature.

In summary the advantages of *SARAVEL* GASCHIL® are:

- **Reduced investment for electrical supply/ demand and standby emergency electrical generator.**
- **Direct generation of chilled water by gas, without steam boilers firing full capacity in summertime to supply steam for cooling, as in the case with absorption units.**
- **Extensive application engineering and service**
- **Payback period of 1 to 2 years.**

* American Gas Association, “A Guide Natural Gas Cooling”, by Richard L. Itteilag, Fairmont Press, Lilburn, GA, 1994, Pg 9.

GASCHIL® SUMMARY

TABLE 1. GASCHIL® PHYSICAL DATA

MODEL SGCH		-60-1W *	-150-1W	-300-2W	-350-2W
Compressor(s) (Open Type)	Type	Reciprocating	Screw	Screw	Reciprocating
	No.	1	1	2	1
	Capacity Unloading %	33-100	10 Thru 100 (1)	5 Thru 100 (1)	25-50-75
	Full Load RPM	1800	2600		1140
	Oil Type	Suniso-4GS	Shell Clavus 68		Suniso 4GS
	Oil separator Type	None	External 2-Stage Vertical Tank		None
	Oil Charge Liters	20	65	130	53
	Oil Cooling Method	None	Liquid Refrigerant Injection		None
Engine(s)	Rated RPM	1800	2600		1140
	BHP at Rated RPM	68	158	2 x 158	320
	Configuration	V-6(90°)	V-8 (90°)	2 x V-8 (90°)	V-12 (90°)
	Displacement	262 CU.IN (4.3L)	454 CU.IN (7.4 L)	2 X 454 CU.IN (7.4 L)	1338 CU.IN (21.9 L)
	Air Fuel Mixture	2% Excess Air			Lambda Controller
	Engine Heat Recovery (MBH) (2)	261	500	1000	750
	Fuel Consumption Data (SCFH) (3)	560 (16 m^3/hr)	1470 (42 m^3/hr)	2940 (83 m^3/hr)	2080 (60 m^3/hr)
	Fuel Supply Pressure (Inch W.G.) (4)	7-28 (0.25-1.0 PSIG)			15-37 (0.5-1.3 PSIG)
	Oil Type	SAE 30			
	Oil Capacity	38 L		2 x 38 L	34 L
	HX Conn.	1½"	1½"	2 x 1½"	1½"
	HX Total Rated Flow (GPM)	25	40	2 x 40	80
	HX P.D. @ Rated Flow (Ft. H_2O)	3.6	9.7	2 x 9.7	23
Evaporator	Shell O.D.	14”	526 mm	610 mm	620 mm
	Connection	4”	5”	6”	8”
Condenser	Shell O.D.	10”	14”	2 x 14”	2 x 14”
	Connection	3”	4”	2 x 4”	2 x 6”
Total Cooling Tower Load (MBH)		1027	2474	4948	5510
Electrical Requirements	Voltage (V)	220	220	220	220
	Frequency (Hz)	50	50	50	50
	Power Requirements (Watts)	200	200	200	200
Sound Power Levels dbA @ 1 meter (5)		86	96	99	99
Refrigerant Charge (Kg)		120	170	340	390
Operating Weight (Kg)		3100	4600	9700	9300

* This model is only recommended for industrial duty application.

Note:

1) Ratings for SGCH-150-1W and SGCH-300-2W include 25 and 50 Tons of peaking capacity, respectively, available for 100 hours per year only. This translates to 2 hours of peak capacity under which the chiller can operate at full load condition.
2) Values pertain to engine heat recovery only. With exhaust heat recovery, heat rejection is larger and tower return temperature will be higher. Consult SARAVEL CORP. For exhaust heat recovery options.
3) Fuel consumption data are based on natural gas (NG), and based on HHV of 1146 BTU/FT^3. For LNG and propane applications please consult *SARAVEL CORP*.
4) Fuel supply pressure is based on natural gas (NG), and it is the pressure that must be maintained to the regulator during full power operation. For LNG and propane applications please consult *SARAVEL CORP*.
5) Sound power levels will decrease rapidly with distance from the source. In general, sound strength will halve when the distance is doubled.
6) The continuous presence of a trained chiller operator is mandatory during the working period of the chiller to monitor the performance. Start up and operation of the chiller without the presence of trained personnel will void the guarantee. For operator training please consult *SARAVEL CORP*. A complete installation, startup and service manual is available upon request from *SARAVEL CORP. SALES OFFICE*.
7) Specification subject to change without notice.
8) All specifications are ± 5%.

SELECTION EXAMPLES

SELECTION PROCEDURE

The rating presented in Tables 2 thru 4 indicate the capacity of the chiller at ARI-550-92 conditions as listed below:

- 44 °F leaving chilled water temperature
- 54 °F entering chilled water temperature
- 2.4 gpm/ton chilled water temperature
- 85 °F entering condenser water temperature
- 95 °F leaving condenser water temperature
- 3.0 gpm/ton condenser water flow

The general performance tables may be used to determine the capacity, gas flow required, and heat recovery available. These data are based upon a 10 °F range across the condenser. For range other than 10 °F across the evaporator, use the correction factors presented in Figure 1. At a given range, if the correction is a negative number, subtract it from the design leaving chilled water temperature. Likewise, if the correction is a positive number, add it to the design leaving chilled water temperature. This adjusted chilled water temperature can then be used in the tables.

Knowing the required tonnage, leaving chilled water temperature, and entering condenser water temperature, use the appropriate table to determine which model yields sufficient capacity. Data may be interpolated but not extrapolated.

SELECTION EXAMPLE

Capacity Required: 130 Tons
Leaving chilled water temperature: 44 °F
Chilled water temperature range: 9 °F
Entering condenser water temperature: 85 °F
Leaving condenser water temperature: 95 °F

First a correction must be made to the chilled water temperature for a range of 9 °F. Referring to Figure 1 the correction factor is –0.1 °F. Therefore, the corrected leaving chilled water temperature is 43.9 °F. referring to SGCH-150-1W rating table, the capacity and gas flow rate can be determined by interpolation:

Capacity = 131 Tons
Gas flow rate = 41.6 m^3/hr = 1469 ft^3/hr
Engine Heat Recovery (EHR) = 500 MBH

The COP can be calculated according to the following relation:

$$COP = \frac{\text{Tons x 12,000 BTU/hr/Ton}}{\text{Gas flow [SCFH] x 1146 BTU/hr/ft}^3}$$

$$COP = \frac{131 \times 12{,}000}{1469 \times 1146} = 0.93$$

Note: 1146 BTU/ft^3 = HHV (Higher Heating Value) of natural gas used in domestic application

Chilled water flow rate:

$$GPM_{CHW} = \frac{\text{Tons} \times 24}{EWT - LWT}$$

GPM_{CHW}=hilled water flow rate [gpm]
EWT = Entering chilled water temperature [°F]
LWT = Leaving water temperature [°F]

$$GPM_{CHW} = \frac{131 \times 24}{53 - 44} = 349$$

The chilled water pressure drop, PD_{CHW}, at the Calculated flow rate can be determined from Figure 2.

$$PD_{CHW} = 15\text{ft of water}$$

Condenser water flow rate, GPM_{CW}:

$$GPM_{CW} = 3 \text{ gpm/ton} \times \text{Tons} = 3 \times 131 = 393$$

The condenser water pressure drop, PD_{CW} , at the Calculated flow rate can be determined from Figure 3.

$$PD_{CW} = 9\text{ft of water}$$

The condenser load, Q_C, may be determined using The following equation:

$$Q_C = \frac{GPMC \times (LCWT - ECWT)}{24}$$

$$= \frac{393 \times (95°F - 85°F)}{24} = 163 \text{ Tons}$$

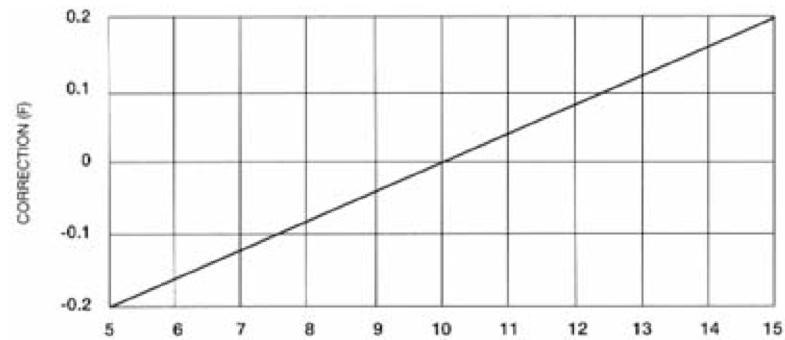
GPM_c = Condenser water flow rate
LCWT = Leaving condenser water temperature
ECWT = Entering condenser water temperature

The cooling tower load, Q_{CT} , includes both the condenser load and the engine heat load if the engine heat recovery option is not used. It can be determined according the following formula:

$$Q_{CT} = (Q_c \times 12 \text{ MBH/Ton}) + EHR$$
$$= (163 \times 12) + 500 = 2456 \text{ MBH}$$

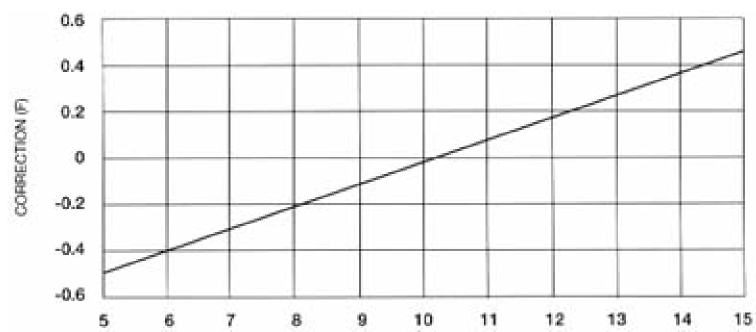
CORRECTION FACTORS

SGCH-60-1W



EVAPORATOR CHILLED WATER RISE (F)

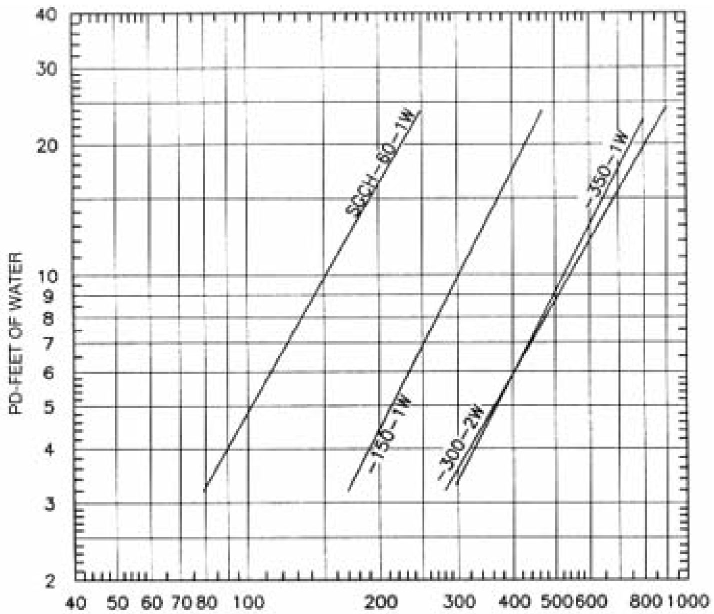
SGCH-150-1W & SGCH-300-2W & SGCH-350-1W



EVAPORATOR CHILLED WATER RISE (F)

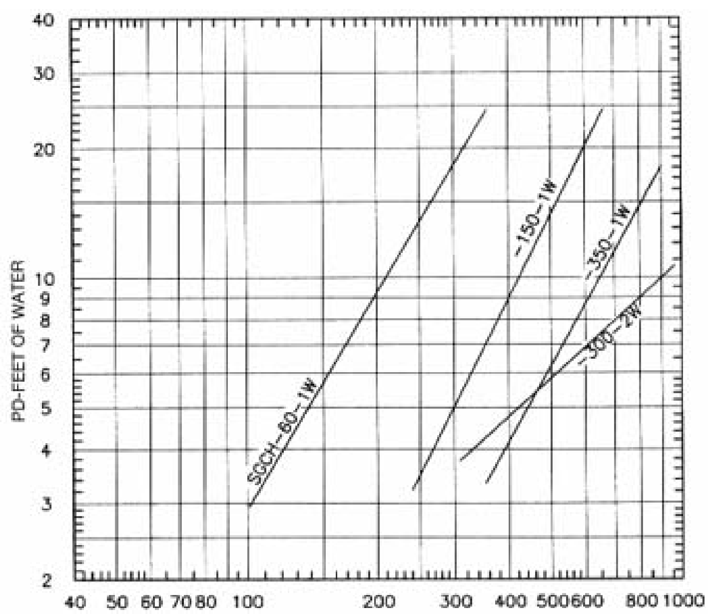
FIGURE 1 CORRECTION FACTORS FOR EVAPORATOR CHILLED WATER RISE
For chilled water ranges other than 10 °F, add correction factor to leaving chilled water temperature before using performance tables.

PRESSURE DROPS



FLOW - GOM

FIGURE 2. COOLING WATER PRESSURE DROP



FLOW – GPM

FIGURE 3. CONDENSER WATER PRESSURE DROP

ECONOMICAL ANALYSIS OF GASCHIL®

In order to calculate the life cycle cost, C, (in $ per ton-hour) of a GASCHIL® system the following equation known as the 'Princeton Equation'** can be used:

$$C = (CRF \times C_{cap} + C_{O\&M})/N_{hr} + (N_{hron} \times P_{kwoft} + N_{month} + P_{kw}) \times Q_{elec}/N_{hr} + Q_{gas} \times P_{gas}$$

where:

CRF: Capital Recovery Factor = $i / [1-(1+i)^{-N}]$
N = equipment lifetime in years
i = discount rate
C_{cap} : installed capital coast of system ($/ton)
$C_{O\&M}$: annual cost of operation and maintenance ($/ton/year)
N_{hr} = number of equivalent full cooling load hr/year = $N_{hron} + N_{hroff}$
N_{hroff} : off-peak hours per year of equivalent full load
N_{hron} : on-peak hours per year of equivalent cooling Load
P_{kwhon} : cost of on-peak electricity ($/$Kwh_e$)
P_{kwoff}: cost of off-peak electricity ($/$Kwh_e$)
N_{month}: number of months per year with demand charge
P_{kw}: demand charge for electricity ($/$Kwh_e$)
$Q_{elec} < 0.1$KW/ton for typical engine chiller systems
Q_{gas}: $0.012/COP_{ec}$
COPec: $nm \times COP_{vap} + nh \times COP_{abs}$
nm: mechanical efficiency of engine = mech. Power out / fuel in (≈25-30%)
nh: heat recovered from engine/fuel in(≈50%)
COP_{vap}: COP of vapor compression system driven by Engine cooling power out/shaft power in
COP_{abs}: COP of absorption system driven by recovered Heat from engine = cooling power out/heat in
P_{gas}: cost of gas ($/MBTU)

Electric Chiller

The levelized lifecycle cost of cooling, C, (in $ per ton-hour) is:

$$C = (CRF \times C_{cap} + C_{O\&M})/N_{hr} + (N_{hron} \times P_{kwhon} + N_{hroff} + P_{kwoff} + N_{month} + P_{kw}) \times Q_{elec}/N_{hr}$$

Where:

CRF : Capital Recovery Factor = $i / [1-(1+i)^{-N}]$
N = equipment lifetime in years
i = discount rate
C_{cap} : installed capital cost of system ($/ton)
$C_{O\&M}$: annual cost of operation and maintenance ($/ton/year)
N_{hr} :number of equivalent fuul cooling load hr/year = $N_{hron} + N_{hroff}$
N_{hroff} : off-peak hours per year of equivalent full load
N_{hron} : on-peak hours per year of equivalent full cooling load

P_{kwhon} : cost of on-peak electricity ($/$KWh_e$)
P_{kwoff} : cost of off-peak electricity ($/$KWh_e$)
Q_{elec} : electricity KW used per ton of cooling= 3.156/cop cooling power out (KW)/electric power in (KW)
N_{month} : number of months per year with demand charge
P_{kw} : demand charge for electricity ($/$KWh_e$)

PAYBACK PERIOD

The payback period method determines the length of time required to recover the initial investment, or first cost of purchasing the GASCHILL ® and is calculated using the following formula:

$$PP = \frac{\text{first cost of the unit}}{\text{uniform net saving per year}}$$

where :

PP = pay back period

** American Gas Association, "An Analysis of the Economics of Gas Engine-Driven chillers", Arlington, VA, EA 1989-5, May 25, 1989.

HEAT RECOVERY PIPING LAYOUT

Heat may be recovered from the engine coolant by Piping it to and from a (secondary) filed installed heat Exchanger. Up to 50 percent of the total gas input May be recovered as high temperature hot water using waste heat from the engine jacket and exhaust.

Water cooled GasChil® models utilize a skid mounted shell-and-tube heat exchanger for engine cooling. One side of the heat exchanger contains engine coolant, the other cooling tower. Field piping for this system is shown schematically in FIGURE 4. As shown, the condenser pump supplies water to both the engine heat exchanger and condenser in a parallel arrangement. In order for this system to work properly, the engine heat exchanger must have the required cooling tower water flow. Insufficient flow will result in high tower water temperatures and fouling of the heat exchanger. A small booster pump is recommended in the engine heat exchanger inlet if filed piping constraints make sufficient flow a concern.

Three way temperature control valves in an engine heat recovery system option would be installed to control engine coolant flow to either the engine heat exchanger or the customer heat recovery system. multiple unit installations should utilize the primary/ secondary loop approach.

Due to the high temperatures involved in recovering engine exhaust heat, a special heat exchanger must be installed in the engine exhaust route.

Consult *SARAVEL CORP*. for engine exhaust heat recovery option and multiple unit-heat recovery details.

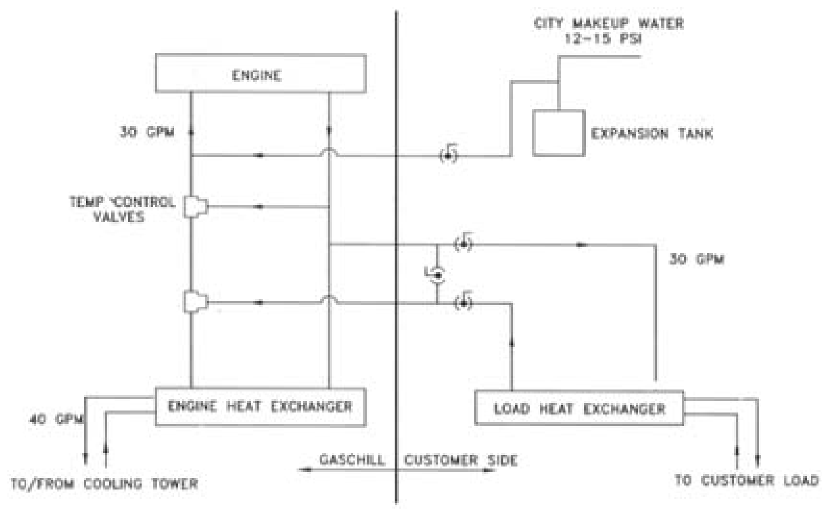


FIGURE 4. TYPICAL HEAT RECOVERY PIPING LAYOUT

Note:

1. All connections to GASCHIL® should follow customary design practices and codes.
2. Isolation valves are recommended for serving the heat recovery system.
3. Primary/secondary piping arrangement is necessary if customer side pressure loss is greater than 5 PSI at 30 GPM.
4. Customer-provided load heat exchanger to be sized according to the ratings on pages 11 thru 12.
5. With exhaust heat recovery, heat rejection is larger. Consult SARAVEL CORP. for exhaust heat recovery options.

RATINGS

TABLE 2. SGCH-60-1W RATINGS

Cond. Leaving Water Temp. °F	Cooler Leaving Water Temp. °F	Capacity Tons	Gas (m³/hr)	EHR (MBH)	Cooler Water		Cond. Water	
					GPM	PD	GPM	PD
75	42	52.2	14.6	223	126.0	7.2	150.7	5.7
	44	54.8	14.7	229	131.5	7.8	156.4	6.1
	45	56.0	14.8	229	134.4	8.1	159.3	6.3
	46	57.2	14.9	231	137.3	8.4	162.4	6.5
90	42	50.8	15.2	239	121.9	6.8	147.5	5.5
	44	53.0	15.4	244	127.2	7.3	153.2	5.9
	45	54.1	15.5	247	129.8	7.6	156.0	6.1
	46	55.3	15.5	249	132.7	7.9	158.9	6.3
95	42	49.0	15.8	256	117.6	6.4	144.3	5.3
	44	51.2	16.0	261	122.9	6.9	149.8	5.7
	45	52.3	16.1	264	125.5	7.2	152.6	5.8
	46	53.4	16.2	267	128.2	7.4	155.5	6.0
100	42	47.2	16.3	270	113.3	6.0	140.7	5.1
	44	49.2	16.6	276	118.1	6.5	146.0	5.4
	45	50.3	16.7	279	120.7	6.7	148.7	5.6
	46	51.3	16.8	282	123.1	6.9	151.5	5.8
105	42	45.2	16.8	284	108.5	5.6	137.0	4.9
	44	47.2	17.1	291	113.3	6.0	142.2	5.2
	45	48.2	17.3	295	115.7	6.2	144.8	5.3
	46	49.3	17.4	298	118.3	6.5	147.5	5.5

Natural Gas Consumption is Based On 1146 (BTU/FT^3) HHV (Higher Heating Valve).
EHR= Engine Heat Recovery (Add EHR To Cooling Tower Load if not using EHR option).

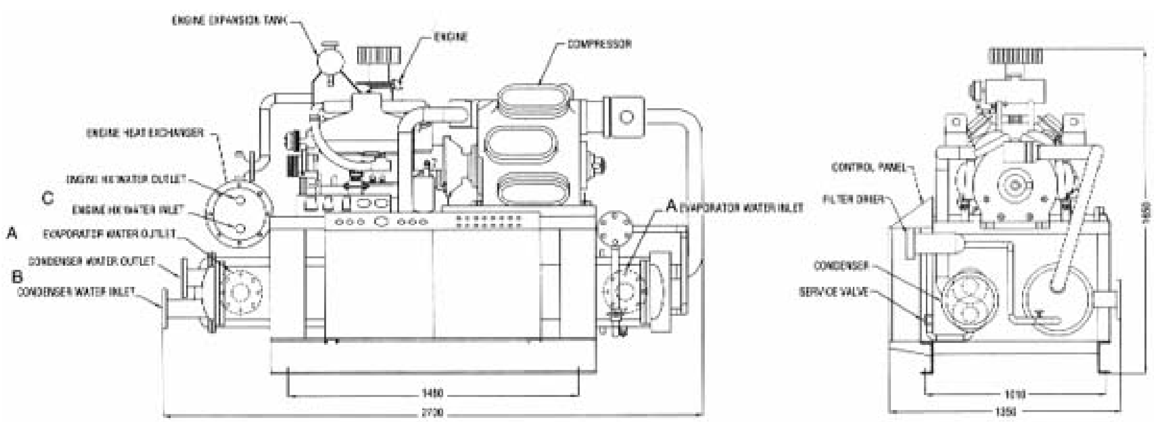


TABLE 3. CONNECTION SIZES FOR SGCH-60-1W

Connection	Description	Size	Type
A	Evaporator Water Inlet/Outlet	4"	150# Flange
B	Condenser Water Inlet/Outlet	3"	150# Flange
C	Engine HX Water Inlet/Outlet	1½"	MPT

TABLE 4. SGCH-150-1W RATINGS

Cond. Leaving Water Temp. °F	Cooler Leaving Water Temp. °F	Capacity Tons	Gas (m³/hr)	EHR (MBH)	Cooler Water		Cond. Water	
					GPM	PD	GPM	PD
85	42	135.9	36.6	440	326.2	11.7	389.8	8.5
	44	141.4	36.8	441	339.4	12.6	403.2	9.1
	45	144.2	36.9	443	346.1	13.1	410.2	9.4
	46	147.1	37.0	444	353.0	13.7	417.1	9.7
90	42	131.2	39.0	468	314.9	10.9	382.6	8.2
	44	136.6	39.8	470	327.8	11.8	395.8	8.8
	45	139.4	39.2	471	334.6	12.3	402.5	9.1
	46	142.2	39.3	472	341.3	12.8	409.4	9.4
95	42	126.3	41.6	498	303.1	10.1	374.9	7.9
	44	131.6	41.6	500	315.8	10.9	387.8	8.4
	45	134.3	41.7	501	322.3	11.4	394.6	8.7
	46	137.0	41.9	502	328.8	11.9	401.3	9.0
100	42	121.1	44.3	531	290.6	9.3	367.2	7.5
	44	126.2	44.4	533	302.9	10.1	379.9	8.1
	45	128.9	44.5	534	309.4	10.5	386.2	8.3
	46	131.5	44.6	535	315.6	10.9	392.9	8.6
105	42	115.7	47.1	565	277.7	8.5	359.0	7.2
	44	120.7	47.3	567	289.7	9.2	371.3	7.7
	45	123.2	47.3	568	295.7	9.6	377.8	8.0
	46	125.8	47.4	569	301.9	10.0	384.0	8.2

Natural Gas Consumption is Based On 1146 (BTU/FT^3) HHV (Higher Heating Valve).
EHR= Engine Heat Recovery (Add EHR To Cooling Tower Load if not using EHR option).

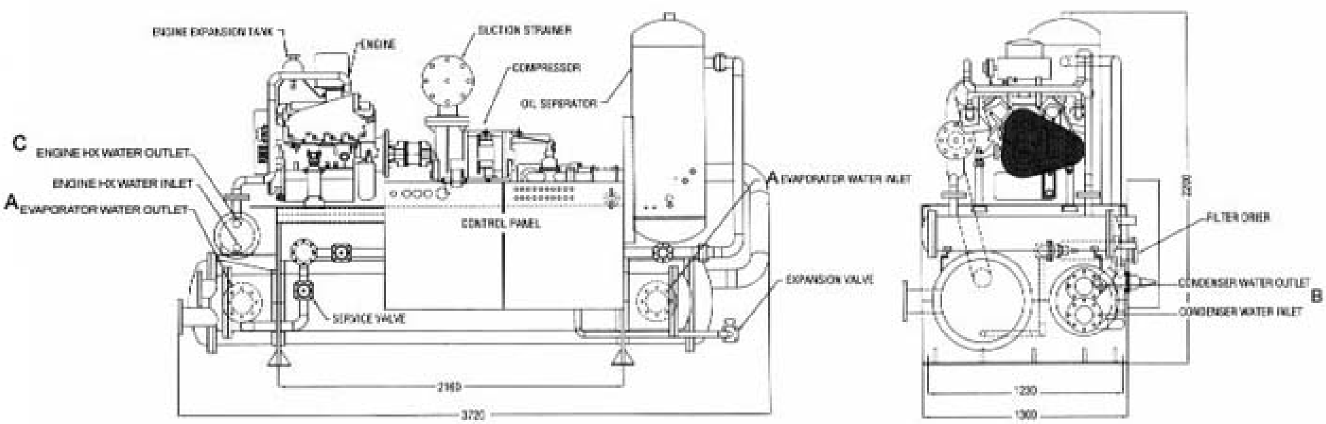


TABLE 5. CONNECTION SIZEZ FOR SGCH-150-1W

Connection	Description	Size	Type
A	Evaporator Water Inlet/Outlet	5"	150# Flange
B	Condenser Water Inlet/Outlet	4"	150# Flange
C	Engine HX Water Inlet/Outlet	1½"	MPT

RATINGS

TABLE 6. SGCH-350-2W RATINGS

Cond. Leaving Water Temp. °F	Cooler Leaving Water Temp. °F	Capacity Tons	Gas (m³/hr)	EHR (MBH)	Cooler Water		Cond. Water	
					GPM	PD	GPM	PD
85	42	271.8	73.2	880	652.4	13.8	779.6	8.5
	44	282.8	73.5	882	678.8	14.8	806.4	9.1
	45	288.4	73.8	886	692.2	15.3	820.4	9.4
	46	294.2	74.0	888	706	15.8	834.2	9.7
90	42	262.4	78.0	936	629.8	13.0	765.2	8.2
	44	273.2	78.2	940	655.6	14.0	791.6	8.8
	45	278.8	78.3	942	669.2	14.5	805	9.1
	46	284.4	78.6	944	682.6	14.9	818.8	9.4
95	42	252.6	83.1	996	606.2	12.2	749.8	7.9
	44	263.2	83.3	1000	631.6	13.1	775.6	8.4
	45	268.6	83.4	1002	644.6	13.6	789.2	8.7
	46	274	83.7	1004	657.6	14.0	802.6	9.0
100	42	242.2	88.5	1062	581.2	11.4	734.4	7.5
	44	252.4	88.8	1066	605.8	12.2	759.8	8.1
	45	257.8	89.0	1068	618.8	12.7	772.4	8.3
	46	263Y	89.1	1070	631.2	13.1	785.8	8.6
105	42	231.4	94.2	1130	555.4	10.5	718	7.2
	44	241.4	94.5	1134	579.4	11.3	742.6	7.7
	45	246.4	94.7	1136	591.4	11.7	755.6	8.0
	46	251.6	94.8	1138	603.8	12.1	768	8.2

Natural Gas Consumption is Based On 1146 (BTU/FT^3) HHV (Higher Heating Valve).
EHR= Engine Heat Recovery (Add EHR To Cooling Tower Load if not using EHR option).

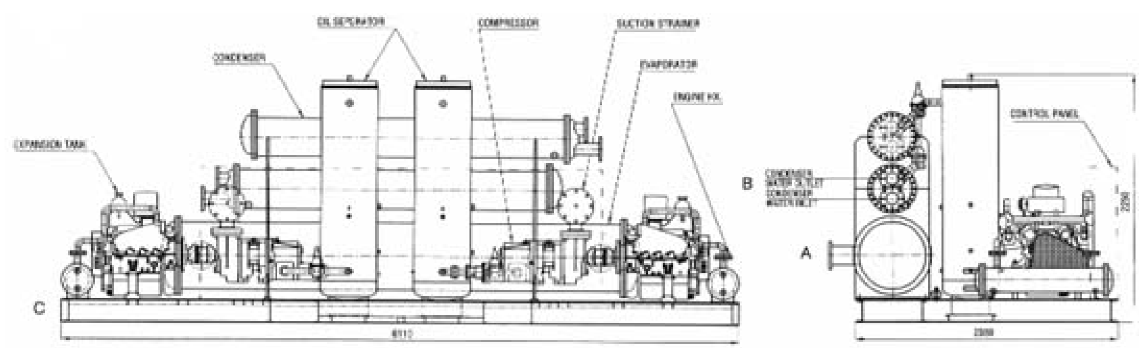


TABLE 5. CONNECTION SIZEZ FOR SGCH-300-2W

Connection	Description	Size	Type
A	Evaporator Water Inlet/Outlet	6"	150# Flange
B	Condenser Water Inlet/Outlet	2 x 4"	150# Flange
C	Engine HX Water Inlet/Outlet	2 x 1½"	MPT

TABLE 8. SGCH-350-2W RATINGS

Cond. Leaving Water Temp. °F	Cooler Leaving Water Temp. °F	Capacity Tons	Gas (m³/hr)	EHR (MBH)	Cooler Water		Cond. Water	
					GPM	PD	GPM	PD
85	42	321.0	54.0	688	770	21.1	482	5.9
	44	334.0	54.2	691	802	23.0	501	6.4
	45	341.0	54.4	693	818	24.0	512	6.7
	46	348.0	54.6	696	835	25.0	522	7.0
90	42	325.0	56.0	713	780	21.7	488	6.1
	44	326.0	56.4	719	783	22.0	489	6.1
	45	327.0	56.7	722	785	22.0	491	6.2
	46	328.0	57.0	726	787	22.1	492	6.2
95	42	398.0	58.2	742	715	18.2	447	5.1
	44	310.0	58.5	745	744	19.7	465	5.5
	45	317.0	58.9	750	761	20.7	476	5.8
	46	323.0	59.0	752	775	21.4	485	6.0
100	42	287.0	60.5	771	689	17.0	431	4.8
	44	299.0	61.0	777	718	18.4	449	5.2
	45	305.0	61.3	781	732	19.1	458	5.4
	46	311.0	61.5	783	746	20.0	467	5.6
105	42	276.0	62.6	798	662	15.6	414	4.4
	44	288.0	63.3	806	691	17.0	432	4.8
	45	294.0	63.6	810	706	17.8	441	5.0
	46	300.0	64.0	815	720	18.5	450	5.2

Natural Gas Consumption is Based On 1146 (BTU/FT³) HHV (Higher Heating Valve).
EHR= Engine Heat Recovery (Add EHR To Cooling Tower Load if not using EHR option).

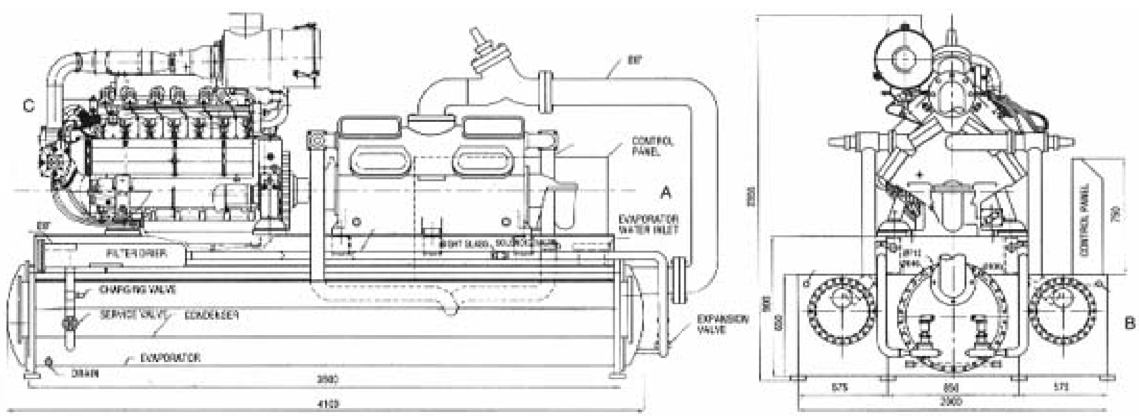


TABLE 9. CONNECTION SIZEZ FOR SGCH-350-2W

Connection	Description	Size	Type
A	Evaporator Water Inlet/Outlet	8"	150# Flange
B	Condenser Water Inlet/Outlet	2 x 6"	150# Flange
C	Engine HX Water Inlet/Outlet	2 x 1½"	MPT

ENGINEERING SPECIFICATIONS

Furnish and install where indicated on the plans *SARAVEL* model SGCH……….packaged gas engine driven liquid chiller(s). The units(s) shall have a capacity of………Tons when cooling……..GPM of water from……. °F to………°F when supplied with……..GPM of………... °F condenser water. The water pressure drop shall not exceed…….. Feet of water through the cooler and…………Feet of water through the condenser.

GENERAL
The packaged gas engine driven liquid chiller(s) shall be completely factory assembled including all interconnecting refrigerant piping and internal wiring of controls and engine starting equipment. Exposed surfaces shall be painted with primer-finisher prior to shipment. The unit shall be shipped with oil charge and operating refrigerant charge. The unit shall include the following:

COMPRESSOR
Reciprocating (SGCH-60-1W & SGCH-350-2W)
The compressor shall be open type, multi-cylinder, reciprocating unit. The compressor shall have a forced fed lubrication system and shall include suction strainer, crankcase oil level sight glass, oil strainer, crankcase oil heater, back seating seal cap type suction and discharge valves.

Screw(SGCH-150-1W & SGCH-300-1W)
The compressor shall be single stage, positive displacement, twin screw compressor of the oil injected type.

Casings
The unit casing shall be of high grade cast iron dowelled together to give the correct alignment between rotors and bearing housings.

Rotors
The male driving rotor shall have 4 lobes and the female rotor shall have 6 lobes. The rotors shall be machined to exacting tolerances and then matched to ‘ideal’ pairs.

Bearings
The bearing shall be high quality cylindrical roller bearing used to carry radial loads paired with angular contact bearing to carry the axial loads. The bearing housings shall incorporate static oil baths, designed to retain a quantity of lubricant at shut-down. A balance piston shall be furnished to equalize the thrust load of the rotors and to minimize the loading on the thrust bearings to ensure long bearing life.

Seals
The mechanical shaft seal shall consist of a carbon face in rotating contact with a cast ring. The seal remains flooded with oil during operation and shut down of the compressor.

Capacity Control
Capacity regulation shall be in the range of 100% to 10% of the full load. Capacity control shall be achieved using an integral capacity control cylinder and piston-actuated by oil pressure and released by spring force.

ENGINE
The gas engine shall be naturally aspirated and spark-ignited with 6, 8 or 16 cylinder V style block. The stating system shall include a 12 0r 24 volt dc power supply, a straight drive started motor, and related wiring.

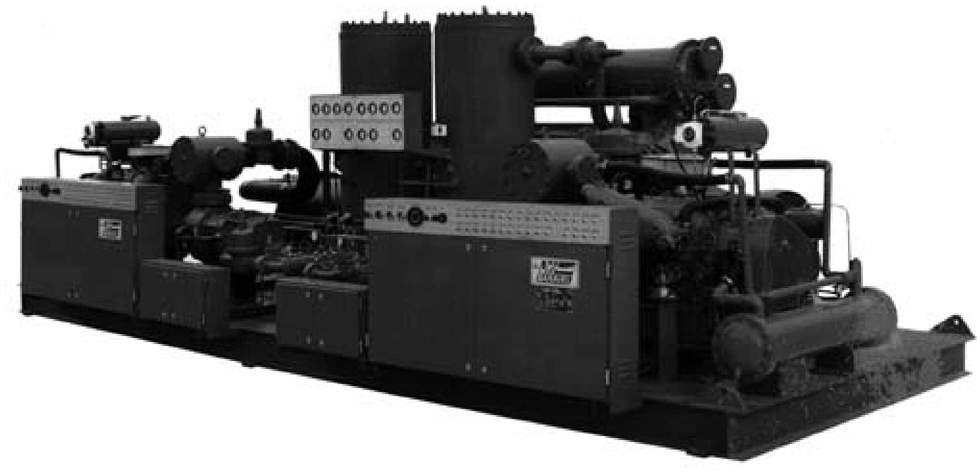
Lubrication System
An internal engine driven oil pump, ", an oil pressure regulator, an oil filter, and an oil level controller shall provide engine lubrication.

Cooling System
The coolant system shall be pressurized, closed loop, direct jacket cooling circuit requiring a city-water make-up line and an expansion tank. It shall include a shell-and tube heat exchanger for rejecting the heat to the cooling tower. It shall provide cooling for the engine jacket, exhaust manifolds, and oil cooler.

FUEL SYSTEM
The fuel system shall be suitable for a low pressure natural gas supply (7" w.g. minimum). It shall include a carburetor and a throttle body assembly.

EVAPORATOR
The evaporator shall be direct expansion type with refrigerant in the tubes and liquid to be chilled in the shell. The evaporator shall be insulated with 19mm thick, flexible, closed cell fire retardant rubber foam sheets to prevent condensation and provide vapor seal. The evaporator shall have a design working pressure of 350 psig(water side) and 300 psig (refrigerant side) and be constructed and tested in accordance with ASME-Section VIII, Division 1 Code requirements.

CONDENSER
The condenser shall be cleanable, shell and tube type with integrally finned copper tubes and removable steel heads. The condenser shall have a design working pressure of 300 psig (water side) and 350 psig (refrigerant side), and be constructed and tested in accordance with ASME-Section VIII, Division 1 code requirements. The condenser shall be equipped with refrigerant relief valve.



SARAVEL GASCHIL ® MODEL SGCH-300-2W

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