

Quote

PETROBANK ENERGY RESOURCES LTD.
c/o DRH CONSULTING LTD.
S-WK-1478GL

EFX COMPRESSION
QUOTE #CP050081
Customer Copy

Compressor Performance Map

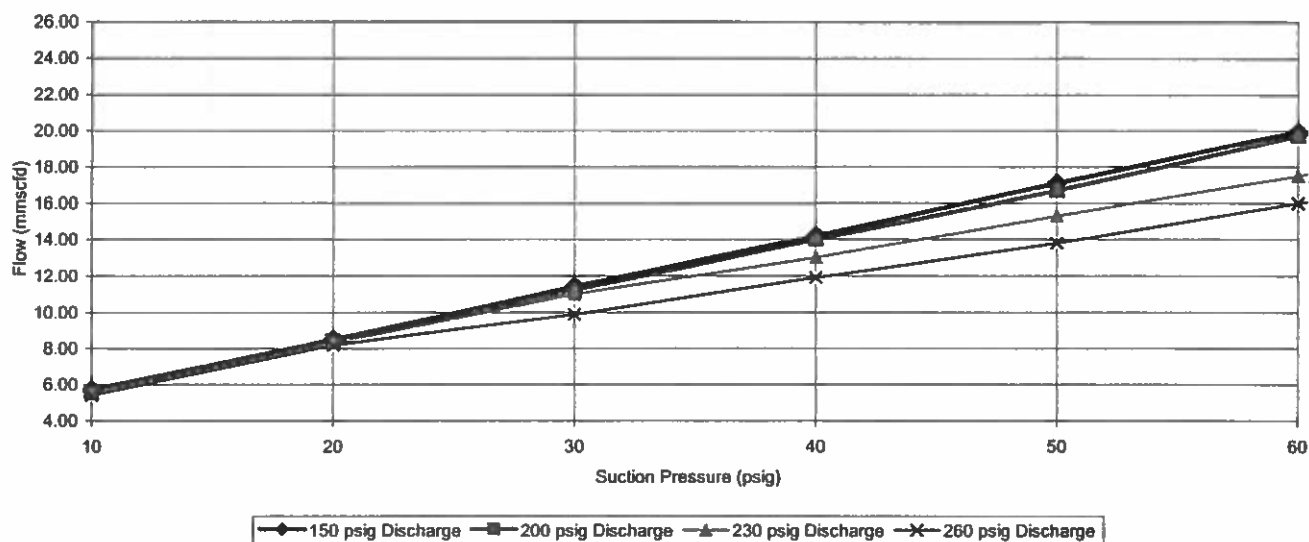
Enerflex Screw Compressor Package

Waukesha 7042GL Driver

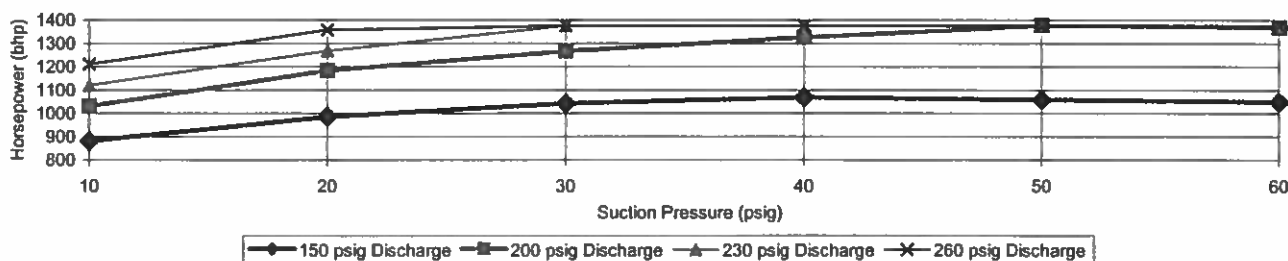
Kobelco KS32LNB

Major Equipment		Process Design	
Driver:	Waukesha 7042GL	Suction Temperature:	60 F
Driver Speed:	1200 RPM	Ambient Temperature:	95 F
Available HP:	1375	Altitude:	2500 FT
Compressor:	Kobelco KS32LNB	Gas Specific Gravity:	0.65
Gear Ratio:	2.19	Cp/Cv	1.266
Compressor Speed:	2628 RPM		
Compressor V.I.	VARIABLE		
Oil Pump:	YES		
Package Pressure:	350 Psig		

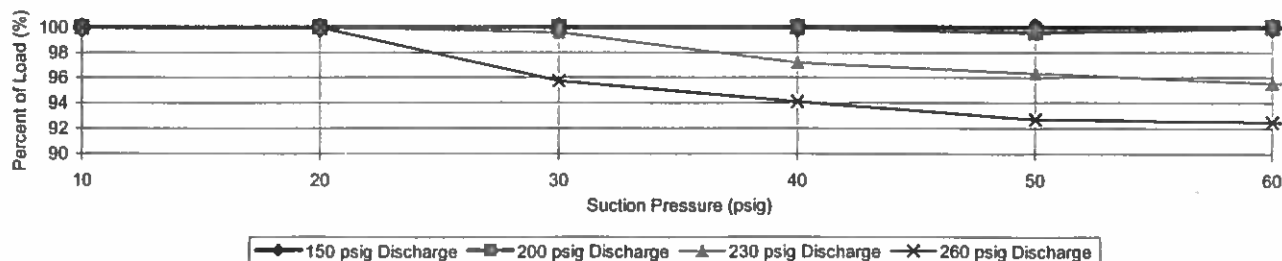
FLOW CURVE



POWER CURVE



PERCENT LOAD CURVE



OIL-FLOODED SCREW COMPRESSOR DATA SHEET

MULTI-CALCULATION RESULTS (1 / 1)

Registered to : KOCOA
Customer :

User :
Project :

Ref. :

		KS32LNB			
		0	1		
GAS TYPE					
MOLECULAR WEIGHT		18.824	18.824		
SPECIFIC HEAT RATIO(Cp/Cv)		1.266	1.266		
COMPRESSIBILITY		0.9900	0.9900		
RELATIVE HUMIDITY %		100.00	100.00		
ATM PRESSURE PSI		13.30	13.30		
SLIDE VALVE POSITION %		100.0	92.8		
INLET VOLUME ACFM		2692	2231		
GAS FLOW lbm/h WET		40381	33463		
(at 14.7PSIA & 60 Deg.F) MMSCFD WET		19.54	16.19		
(at 14.7PSIA & 60 Deg.F) MMSCFD DRY		19.47	16.14		
SUCTION CONDITIONS					
PRESSURE(SUC.dP INCL.) PSIG		60.00	60.00		
TEMPERATURE Deg.F		60.0	60.0		
DISCHARGE CONDITIONS					
PRESSURE(DIS.dP INCL.) PSIG		260.0	260.0		
TEMPERATURE Deg.F		200.0	200.0		
PRESSURE RATIO		3.729	3.729		
VI		2.90	2.90		
SPEED RPM		2628	2628		
BHP AT COMP.INLET SHAFT HP		1683	1375		
SEPARATE GEAR LOSS HP		0	0		
TOTAL BHP(GEAR LOSS INCL.) HP		1683	1375		
DRIVER RATED POWER HP		1448	1448		
DRIVER SPEED RPM		1200	1200		
LUBE OIL COOLER HEAT DUTY kBTU/h		1439	1143		
SUPPLY TEMPERATURE Deg.F		150.0	150.0		
QUANTITY/BEARING & MECH.SEAL GPM US		94	94		
QUANTITY/ROTOR CHAMBER GPM US		42	14		
QUANTITY/TOTAL GPM US		136	108		
SPECIFIC GRAVITY lbm/ft3		53.8	53.8		
SPECIFIC HEAT Btu/lbm/F		0.4900	0.4900		

The shaft power calculated has a tolerance within +4% and the flow rate has a tolerance within -2%. All results are based on accuracy of input conditions. And the results at unload are for reference only.

KOBELCO reserves the right to final verification of all rating results.

EPX Compression

UNIT DESCRIPTION

Qty

COMPRESSOR

- 1 Screw compressor, KOBELCO model KS-32LNB (as per attached data sheet), complete with:
- 350 psig MAWP
 - flanges: suction - 12" 300#
 - discharge - 10" 300#

Compressor Equipment

Compressor Drive

- 1 Speed increaser, 2.19 ratio, 1478HP at 1200 RPM, output speed 2628 RPM, PACIFIC RIM, EMPB 0800B-DDI
- 1 Output coupling, type 125 steel flex coupling complete with 250mm dropout spacer, stainless steel plate packs, 2-ARS 255-6 NHK hubs, both hubs bored, keyed and balanced, clamping style hub on the compressor
- 1 Sheave, jackshaft, 5-groove used with R1 bushing, BROWNING, 5C200R
- 4 V-belt, C-section, gripnotch, shop to specify length
- 1 Assembly guard, steel, hinged
- 1 Coupling guard, steel
- 4 Sheave, tightener, 1-groove used with Q1 bushing, BROWNING, TC120Q
- 2 Bushing, 1 1/8", BROWNING, Q1
- 2 Bushing, tightener, 1", BROWNING, IDQ1 1
- 1 V-belt, C-section, gripnotch, shop to specify length
- 2 Drive tightener, BROWNING, ATQ-1
- 1 Sheave, 6-groove, special, 12" for VHP engine
- 1 V-belt, C-section, gripnotch, shop to specify length

Compressor Oil Systems

- 1 Thermostat valve, 3" 300# RF, set at 150 Deg.F, cast steel, 3-way, FPE, S3010X-150, mixing configuration, 350 psig MAWP at 200 Deg.F
- 1 Strainer, "Y", 3" 300# RF, CS, 1/8" perforated screen, Alta YF300
- 2 Filter assembly, 16" element, PALL, HZ8914D32MSUWBNN
- 2 Filter element, 16", PALL, HC8914FMS16Z, element collapse pressure rating 150 psid
- 7 Ball valve, 3/4" NPT x SW, 1500# WOG, RP, CS, A105 body, 316SS ball and stem, NACE, WORCESTER, 4446RG-SWXSE, complete with locking handle
- 6 Needle valve, 3/4" MNPT x 1/2" FNPT, 316SS, PGI, GS-V-528-SCJ
- 2 Differential pressure gauge, 1/4" FNPT, 2-1/2" dial, 0-30 psid, aluminum body, MIDWEST, 120AA0000030
- 2 Ball valve, 3" 300# RF, RP, CS, NUTRON, T3-R30R03B
- 4 Ball valve, 2" SW, 1500# WOG, RP, CS, A105 body, 316SS ball and stem, NACE, WORCESTER, 4446RG-SW, complete with locking handle
- 6 Ball Valve, 1/2" NPT, 3000# WOG, FP, CS, NUTRON, T3-F05S30B
- 2 Thermowell, 1/2" x 1/2" MNPT x 4" long, 316SS, U=2.5", 0.260" bore, stepped
- 2 Thermocouple, 1/4" OD, K type, 316SS, THERMOKINETICS, K250-316-S-010.0-B-82X-YM4-72
- 1 Sight glass window indicator, 3/4" NPT, CS, HENRY, SG-1006
- 6 Check valve, 1/2" tube, 1/3 psi, 316SS, NUFRO. SS-CHS6-1/3
- 1 Lubricator, PARKER 07L32BE
- 1 Gear pump, 1-1/2" NPT, VIKING, SC40570-GOV, complete with relief valve, Buna mechanical seal
- 1 Control valve, 1" NPT, WCB, 5-35 psi, FISHER, 119-N12
- 1 Ball valve, 1" NPT, 3000# WOG, RP, CS, NUTRON, T3-R10S30B, complete with locking handle
- 1 Ball valve, 3/4" NPT, 3000# WOG, RP, CS, NUTRON, T3-R07S30S, complete with locking handle
- 1 Pressure gauge, bottom mount, 1/2" NPT, 4" liquid filled, 0-400 psi, dual, 316SS BT, WIKA, 233.54
- 4 SAE flange, 2" SW, 3000 psi, 4-bolt, ANCHOR FLANGE W4-32-32U, complete with Buna gasket and bolting
- 1 Dual 3-way solenoid valve, 24VDC, air assist, 316SS, XP, CSA, VERSA, TXX3503GHHTSXX155167D024, complete with SS spring return

EPX Compression

- 1 Mechanical Seal Drain Pot
- 3 Regulator, 1/4" NPT, aluminum, 0-125#, tapped bonnet, FISHER, 67CFR-601/SPEC
- 1 Potentiometer, 4-20 mA, Supplied with compressor
- 1 Temperature gauge, back mount, 1/2" NPT, 3" dial, 4" stem, 0-250 Deg.F, dual, TREND, 33040
- 1 Globe valve, 2" SW, 800# WOG, CS, NEWCO, 28S-FS2
- 1 Globe valve, 1-1/2" NPT, 800# WOG, CS, NEWCO, 28T-FS2
- 2 Pressure transmitter, 1/4" NPT, 0-400 psig, WIKA, 892.23.510
- 1 Pressure transmitter, 1/4" NPT, 0-160 psig, WIKA, 892.13.500
- 1 Gear Pump, 2" 250# Flanged, GLOBAL, GG1201-X0429
- 1 Differential Bypass Valve, 1 1/2" NPT, Set @ 55 psid, BLACKMER, BLA BV112-55
- 1 Solenoid valve, 3-way, 1/4" NPT, 24VDC, EPNC 115 psi, SS, NC, XP, CSA, ASCO, EF8320G202-24
- 1 Control valve, 1" NPT, LCC, NACE, FC, 6-30 psi, FISHER/FLOPRO, D2-X1

DRIVER

- 1 Waukesha model L7042GL (as per attached data sheet), lean burn, turbocharged, intercooled, 12 cylinder, v-configuration, four cycle, natural gas fueled spark ignition engine includes:
- gas driven pre-lube pump with gas relay valve
 - CSA, CEC, Class I, Division 2, electronic digital ignition system
 - DSM detonation sensing ignition timing control
 - site rated per the proposal performance data
 - front crankshaft pulley (6 "C" Grooves, 9.6" pitch diameter)
 - flywheel for 22.5" HD adapter
 - water inlet header
 - water outlet connections
 - high capacity auxiliary water pump
 - omit oil filter connections
 - speed control air actuator

Driver Equipment**Start Gas**

- 2 Ball valve, 1-1/2" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R15S20A, complete with locking handle
- 1 Strainer, "Y", 1 1/2" NPT, 1480 psig MAWP, CS, 1/32" perforated screen, ALTA, YS600
- 1 Regulator, 1-1/2" NPT, aluminum, high flow, 2-150 psi, FAIRCHILD, Z19859-612EN
- 1 Gas relay valve, 1-1/2" NPT, 450 psi MAWP, TDI, RLVA25683001201
- 1 Braided steel hose, 2" MNPT x male NPT union x 12" long
- 1 Air/Gas starter, turbine, low pressure 90-30 psig, inertia, TDI TURBOSTART, T121-00001-B1R, complete with dual turbine, 12 teeth, 6/8 pinion, maximum torque at 0 RPM
- 1 Braided steel hose, 3" 150# RF x 3" 150# RF x 10" long

Air Intake

- 2 Ball valve, 1/4" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R02S20A, complete with locking handle
- 2 Air filter adapter, dry type, 8" OD, WAUKESHA L-VHP
- 2 Rubber elbow, 90 degrees, 8", DONALDSON, P11-2605
- 2 Rubber elbow, 45 degrees, 8", DONALDSON, P11-2606
- 1 Warm air mixing box, (2) x 8" inlet x 12" outlet

EFX Compression

Exhaust

- 1 Expansion bellow, 12" 150# FF, internal flanges, complete with 2" collar and SS liner x 12" long, 3" axial
- 1 Hospital grade muffler, SILEX, JDDT-12-SO12-LL-CS-A, 12" 150# end in/side out, type SO12, low pressure drop, carbon steel, complete with lifting lugs, aluminum paint
- 1 Exhaust line, 12", 11 gauge, 316LSS, WAUKESHA L-VHP
- 1 Insulation for 12" 150# SS exhaust line, no air space, custom, complete with 2" thick x 6# density ceramic fibre insulation, 18 gauge SS tie wire on 6" centers, 0.032" thick stucco aluminum jacketing, SS fasteners 4" centers, 0.020 x 1/2" SS bands with wing seals at circumference laps, insulated tight to SS exhaust line

Lubrication

- 2 Level indicator, sight glass window, 10" bolt centers, MP FILTRI, LVA 30 TA, complete with thermometer
- 1 Oil filter assembly, 1" FNPT, BALDWIN, BL914, complete with BF915 element and base FB1307, metal housing
- 1 Oil level controller, 1/2" FNPT electrical connections, SPDT, XP, CSA, KENCO, LCE-17, complete with electric switch, door mount
- 1 Ball valve, 2" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R20S20A, complete with locking handle
- 1 Elbow coupling, 2", 90 degree, style 90, DRESSER, 0090-0245-082
- 1 Ball valve, 1/4" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R02S20A, complete with locking handle
- 2 Ball valve, 1" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R10S20A, complete with locking handle
- 1 Ball valve, 1" NPT, 3-way, full SS, APOLLO, 76-605-01
- 1 >>CEC IGNITION SYSTEM, BY WAUKESHA
- 1 >>K-TYPE THERMOCOUPLE HARNESS BY WAUKESHA
- 1 >>LUBE OIL (MAKE-UP) TANK, INTEGRAL WITH CRANE RAILS BY EFX
- 1 >>WASTE OIL TANK, INTEGRAL WITH SKID SIDEMEMBERS BY EFX
- 1 Pyrometer harness, L Series G/GSI, K type, 30' lead, 18 PT, PIC, PVHP12AB30K18
- 18 Thermocouple, type K, 12/16 cylinder Waukesha VHP G/GSI, 90 degree elbow, probe 4" INS, 12" flex connector, PIC, 02-2007-14-1K-12

EPX Compression

Fuel Gas

- 1 Ball valve, 1-1/2" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R15S20A, complete with locking handle
- 1 Strainer, "Y", 1 1/2" NPT, 1480 psig MAWP, CS, 1/32" perforated screen, ALTA, YS600
- 1 Fuel filter, 1-1/2" NPT, HEADLINE, 385A-S453P, complete with elements and SS plug
- 7 Ball valve, 1/4" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R02S20A, complete with locking handle
- 1 Pressure gauge, bottom mount, 1/4" NPT, 2-1/2" liquid filled, 0-300 psi, dual, 316SS BT, 316SS BT, WIKA, 233.53
- 1 Ball valve, 1/2" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R05S20A, complete with locking handle
- 1 Regulator, 1" NPT, DI, 3/8" orifice, 35-80# spring range, set at 50 psig, FISHER, 627-494
- 1 Gas relay valve, 1-1/2" NPT, 450 psi MAWP, TDI, RLVA25683001201
- 2 Braided steel hose, 1-1/2" MNPT x female NPT union x 8" long
- 1 Solenoid valve, 3-way, 1/4" NPT, 24VDC, EPNC 115 psi, SS, NC, XP, CSA, ASCO, EF8320G202-24
- 1 Regulator, 1/4" NPT, aluminum, 0-125#, tapped bonnet, FISHER, 67CFR-601/SPEC
- 1 Pressure gauge, centre back mount, 1/4" NPT, 2" dry, 0-60 psi, dual, WIKA, 111.10
- 1 Plug valve, 1/4" tube, 316SS, NUPRO, SS-4P4T

Cooling

- 1 Surge tank, 2-compartment, 150litre/150litre
- 2 Set gauge valve, 5/8" OD tubular x 1/2" MNPT, CS, 400#, DANIEL, 1TC
- 2 Acrylic sight glass gauge, 5/8" OD x 3/8" ID, 1/4" wall thick
- 2 Level switch, 1-1/2" NPT, SPDT (HI), XP, CSA, MURPHY, L1100, complete with Buoyglas float
- 3 Ball valve, 3/8" NPT, 2000# WOG, FP, SS, NAVCO, C1-R03S20A, complete with locking handle
- 5 Ball valve, 3/4" NPT, 2000# WOG, RP, 316SS, NACE, NAVCO, C1-R07S20A, complete with locking handle
- 4 Straight coupling, 6", style 38, DRESSER, 0038-0057-011
- 1 Pressure gauge, bottom mount, 1/4" NPT, 2-1/2" liquid filled, 0-30 psi, dual, 316SS BT, WIKA, 233.53
- 1 >> Oil cooler, supplied with gearbox

EPX Compression

- 2 Ball valve, 1" NPT, 2000# WOG, RP, A105 body, NACE, NAVCO, H1-R10S20S
- 3 Temperature gauge, back mount, 1/2" NPT, 3" dial, 2-1/2" stem, 0-250 Deg.F, dual, TREND, 33025
- 5 Thermowell, 1/2" x 3/4" MNPT x 4" long, 304SS, U=2.5", 0.260" bore, stepped
- 1 Pump, centrifugal, 6 x 4 x 10, CRANE DEMING, 3131-453-31-106
- 1 >> Auxiliary coolant pump by WAUKESHA
- 1 >> Main jacket cooling TCV by WAUKESHA
- 2 Thermocouple, 1/4" OD, K type, 316SS, THERMOKINETICS, K250-316-S-010.0-B-82X-YM4-72
- 1 Globe valve, 1" NPT, 800# WOG, CS, NEWCO, 28T-FS2
- 1 Wafer butterfly valve, 6" 150#, cast iron body, C&C

STANDARD EQUIPMENT

AIR CLEANER – Two, dry type with rain shield and service indicator.

BARRING DEVICE – Manual.

BEARINGS – Heavy duty, replaceable, precision type.

BREATHER – Closed system.

CONNECTING RODS – Drop forged steel, rifle drilled.

CONTROL SYSTEM – Pneumatic. Includes pilot operated valves for air start and prelube. Engine mounted control panel with two push button valves. Pilot operated air start valves omitted when starter is not furnished by Waukesha. Includes engine On/Off push button. One mounted on either side of the engine.

CRANKCASE – Integral crankcase and cylinder frame. Main bearing caps drilled and tapped for temperature sensors. Does not include sensors.

CRANKSHAFT – Counterweighted, forged steel, seven main bearings, and dynamically balanced.

CYLINDERS – Removable wet type cylinder liners, chrome plated on outer diameter. Induction hardened.

CYLINDER HEADS – Twelve interchangeable, valve-in-head type. Two hard faced intake and two hard faced exhaust valves per cylinder. Hard faced intake and exhaust valve seat inserts. Roller valve lifters and hydraulic push rods. Includes prechamber and related fuel control valves.

ENGINE ROTATION – Counterclockwise when facing flywheel.

ENGINE MONITORING DEVICES – Engine thermocouples, K-type, for jacket water temperature, lube oil temperature, intake manifold temperature, individual cylinder exhaust temperature and a common pre turbine temperatures, one on each bank. Magnetic pickup wired for customer supplied tachometer. Lube oil pressure and intake manifold pressure sensing lines are terminated in a common bulk head.

EXHAUST OUTLET – Single vertical at rear. Flexible stainless steel connection with 8" (203 mm) pipe flange.

FLYWHEEL – Approx. $WR^2 = 155000 \text{ lb-in}^2$; with ring gear (208 teeth), machined to accept two drive adapters: 31.88" (810 mm) pilot bore, 30.25" (768 mm) bolt circle, (12) 0.75"-10 tapped holes; or 28.88" (734 mm) pilot bore, 27.25" (692 mm) bolt circle, (12) 0.625"-11 tapped holes and (12) 0.75"-10 tapped holes.

FLYWHEEL HOUSING – No. 00 SAE.

FUEL SYSTEM – Dual natural gas, 4" (102 mm) duplex updraft carburetors. Two Fisher Model 99, 2" (51 mm) gas regulators, 30 – 50 psi (241 – 345 kPa) gas inlet pressure required. Prechamber fuel system and control logic.

GOVERNOR – Woodward UG-8 LD hydraulic lever type, with friction type speed control. Mounted on right hand side.

IGNITION – Waukesha Custom Engine Control™ Ignition Module. Electronic digital ignition system. 24V DC power required.

INTERCOOLER – Air-to-water.

LEVELING BOLTS

LIFTING EYES

LUBRICATION – Full pressure. Gear type pump. Full flow filter, 36 gallon (136 litres) capacity, not mounted. Includes flexible connections. Includes lube oil strainer, mounted on engine. Air/gas motor driven prelube pump. Requires final piping.

MANIFOLDS – Exhaust, (2) water cooled.

OIL COOLER – With thermostatic temperature controller and pressure regulating valve. Not mounted.

OIL PAN – Base type. 90 gallon (340 litres) capacity including filter.

PAINT – Oilfield orange primer.

PISTONS – Aluminum with floating pin. 10.5:1 compression ratio. Oil cooled.

SHIPPING SKID – Steel for domestic truck or rail.

TURBOCHARGERS – Two, dry type. Wastegate controlled.

VIBRATION DAMPER – Two, viscous type. Guard included with remote mounted radiator or no radiator.

WATER CIRCULATING SYSTEM

Auxiliary Circuit – For oil cooler and intercooler. Pump is belt driven from crankshaft pulley. Includes thermostatic valve.

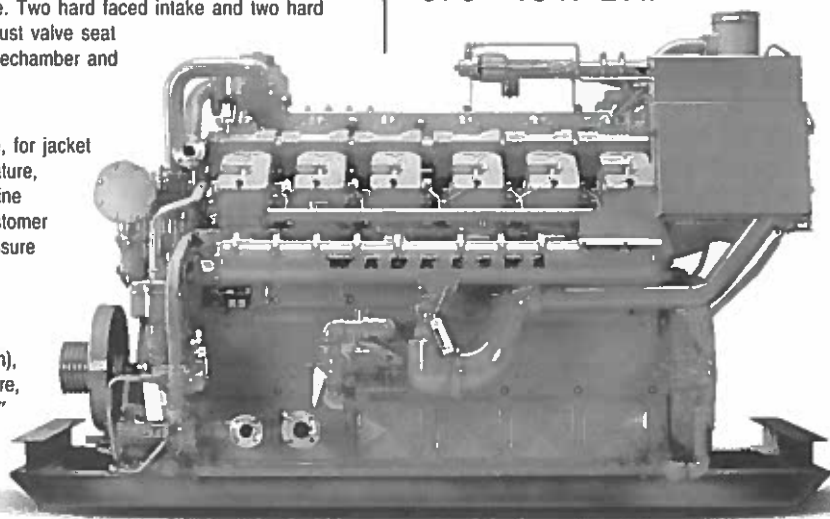
Engine Jacket – Belt driven water circulating pump, cluster type thermostatic temperature regulating valve, full flow bypass type. Flange connections and mating flanges for (2) 4" (102 mm) inlets and (1) 5" (127 mm) outlet.

WAUKESHA CUSTOM ENGINE CONTROL, DETONATION SENSING MODULE (DSM™) – Includes individual cylinder sensors, Detonation Sensing Module, filter and cables. Device is compatible with Waukesha CEC™ Ignition Module only. Sensors are mounted and wired to engine junction box. Detonation Sensing Module and filter are shipped loose. One 11 ft. cable provided for connection between engine junction box and filter. One each 15 ft. cable provided for connection between filter and DSM and Ignition Module and DSM. One 20 ft. cable provided for power and ground for filter. All cables are shipped loose. Packager is responsible for power supply and ground to the DSM. 24V DC power is required. The DSM meets Canadian Standards Association Class 1, Group D, Division 2, hazardous location requirements.

Waukesha
VHP

L7042GL

VHP™ Series Gas Engine
576 - 1547 BHP



Model L7042GL Turbocharged and Intercooled, Twelve Cylinder, Lean Combustion, Four-Cycle Gas Engine

SPECIFICATIONS

Cylinders V 12	Starting System 125 - 150 psi air/gas
Piston Displacement 7040 cu. in. (115 L)	24/32V electric
Bore & Stroke 9.375" x 8.5" (238 x 216 mm)	Dry Weight 21,000 lb. (9525 kg)
Compression Ratio 10.5:1	Full Load Exhaust Emissions Nox - 1.50 g/bhp-hr CO - 2.65 g/bhp-hr HC - 1.00 g/bhp-hr (non-methane)
Jacket Water System Capacity 107 gal. (405 L)	
Lube Oil Capacity 90 gal. (340 L)	

Waukesha Engine
® ISO 9001
CERTIFIED