4000 Series 4006-23TRS1 Spark Ignited Gas Engine

322 kWm @ 1500 rpm

Developed from a proven engine range that offers superior performance and reliability, the 4006-23TRS is designed to meet the future demands of the power generation industry for clean, efficient gas fuelled engines.

The 4006-23TRS 6-cylinder spark ignition gas engine offers high performance, dependability and reliability whilst meeting the market's increasingly stringent emission requirements.

The 4006-23TRS is a turbocharged, air to water charge cooled, 6 cylinder inline engine, designed for operation on a wide range of methane based gases. Its premium features and design provide economic and durable operation as well as exceptional mechanical efficiency and power-to-weight ratio, whilst offering improved emissions. The overall performance and reliability characteristics make this the prime choice for today's power generation industry.

Specification		
Number of cylinders	6 vertical in-line	
Bore and stroke	160 x 190 mm	6.3 x 7.5 in
Displacement	22.92 litres	1399 in^3
Aspiration	Turbocharged and air-to-water charge cooled	
Cycle	4 stroke	
Combustion system	Spark ignited	
Compression ratio	12.0:1	
Rotation	Anti-clockwise, viewed on flywheel	
Total lubricating capacity	122.7 litres	32.4 US gal
Cooling system	Water cooled	
Total coolant capacity	36 litres	9.5 US gal

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تهران، کیلومتر۲۱ بزرگراه لشگری (جاده مخصوص کرج)
روبروی پالایشگاه نفت پارس، پلاک ۱۲

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4006-23TRS1 Spark Ignited Gas Engine

322 kWm @ 1500 rpm

Features and benefits

Economic power

- Utilises advanced combustion technology to deliver durable and reliable power
- High commonality of components with other engines in the 4000 Series family for reduced stocking levels
- Individual large valve cylinder heads with matched deep bowl pistons for greater swirl, achieve high mechanical efficiency

Reliable power

- Developed and tested using the latest engineering techniques
- Piston temperatures controlled by an advanced gallery jet cooling system
- Extended durability and reduced servicing with extended component life add benefit of the reduced whole life cost
- Robust to varying gas quality

  Specs for both natural gas and biogas are available*

Compact, clean and efficient power

- Exceptional power-to-weight ratio and compact size give optimum power density for ease of transportation and installation
- In excess of 40% mechanical efficiency
- Designed to provide excellent service access for ease of maintenance
- Engines to comply with major international standards
- All engines in the 4000 Series family are capable of meeting the NOx requirements of TA Luft

Product support

- With highly trained Perkins distributors in thousands of communities in over 180 countries, you are never far away from expert product knowledge, genuine parts and a range of advanced diagnostic technology for keeping your engine in peak condition
- Warranties and Service Contracts

  We provide one-year warranties for our gas engines, as standard. These are supported by multilevel Extended Service Contracts that can be bought additionally
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- To find your local distributor: www.perkins.com/distributor

*Engine specification suitable for running on landfill gas, digester gas, biogas and coal bed mine gas. (Please contact your account manager or nearest distributor for more information)

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4000 Series 4006-23TRS1 Spark Ignited Gas Engine

322 kWm @ 1500 rpm

Technical information

Air inlet and exhaust

- Mounted air filter – replaceable cartridge type
- Dry exhaust manifolds
- Exhaust manifold shielding
- High efficiency turbocharger

Governing, gas and ignition system

- Air/Fuel mixer with zero pressure regulator and mixture adjustment screw
- Metal braided flexible gas connection
- Altronic 800 'C' Series ignition system with individual cylinder ignition coils, spark plugs
- Digital governing system, governing to ISO8528-5 class G2

Lubrication system

- Gear driven, externally mounted lubricating oil pump
- Wet sump with filler and dipstick
- Full-flow replaceable canister type oil filters
- Jacket water cooled shell and tube oil cooler/stabiliser
- Closed circuit crankcase ventilation system – natural gases only

Cooling system

- Pressurised jacket water cooling system, gear-driven jacket water, circulating pump – supply on Electro unit only
- Air to water charge cooler, pipe work – supply on Electro unit only
- Jacket water thermostatic control – supply on Electro unit only

Electrical equipment

- 24 volt starter motor
- 24 volt 70 amp battery charging alternator with integral voltage, regulator and activating switch – supply on Electro unit only
- High coolant temperature
- Low oil pressure switch
- High manifold pressure switch
- Digital knock detection

Flywheel and housing

- High inertia flywheel to SAE J620 Size 14
- SAE '0' flywheel housing

Mountings

- Front and rear engine mounting support

Literature

- User's Handbook

Optional equipment

- 220 / 240 volt thermostatically controlled immersion heater
- Three way thermostatic valve for charge cooler cooling circuit
- Mechanically driven water pump for charge cooler circuit
- Exhaust temperature monitoring
- Tool kit
- Additional manuals

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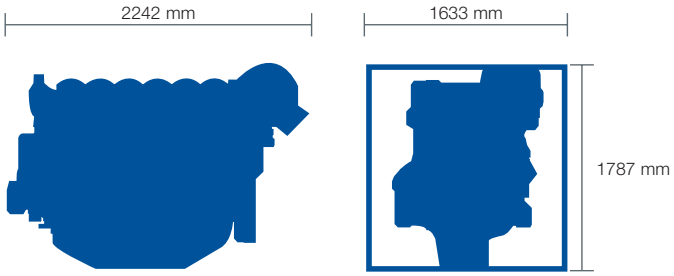
4000 Series 4006-23TRS1 Spark Ignited Gas Engine

322 kWm @ 1500 rpm



Engine package weights and dimensions				
	Electro unit		Cogeneration unit	
Length	2242 mm	88.3 in	2242 mm	88.3 in
Width	1633 mm	64.3 in	1418 mm	55.8 in
Height	1787 mm	70.3 in	1787 mm	70.3 in
Weight (dry)	2420 kg	5335 lb	2420 kg	5335 lb

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4000 Series 4006-23TRS1 Spark Ignited Gas Engine

322 kWm @ 1500 rpm

Speed rpm	Type of operation	Typical generator output (Gross)	Engine power (Gross)
		kWe	kWm
4006-23TRS1	Continuous operating power	307	322

The above ratings represent the engine performance capabilities to conditions specified in ISO 8528/1, ISO 3046/1:1986, BS 5514/1.
Derating may be required for conditions outside these; consult Perkins Engines Company Limited.

Generator powers are typical and are based on an average alternator efficiency and a power factor (cos. θ) of 1.
Fuel specification: Natural gas having a Lower Calorific Value of 34.71 MJ/m^3.

Rating definitions
Continuous operating power: Power available for true Base load, rating as defined in ISO 8528/1, BS 5514/1 – No overload permitted.

Designation	Cogeneration unit	Electro unit
Fuel consumption gross at 1500 rpm	kJ/kW	kJ/kW
Continuous baseload rating	2.55	2.58
75% of prime power rating	2.63	2.66
50% of prime power rating	2.84	2.87
25% of prime power rating	3.88	3.91

Fuel consumption figures are for TA Luft compliant engines at ISO 8528/1 in “Cogen” engine specification, running on British natural gas with LCV 34.71 MJ/Sm^3

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4006-23TRS2 Spark Ignited Gas Engine

393 kWm @ 1500 rpm

Developed from a proven engine range that offers superior performance and reliability, the 4006-23TRS is designed to meet the future demands of the power generation industry for clean, efficient gas fuelled engines.

The 4006-23TRS 6-cylinder spark ignition gas engine offers high performance, dependability and reliability whilst meeting the market's increasingly stringent emission requirements.

The 4006-23TRS is a turbocharged, air to water charge cooled, 6 cylinder inline engine, designed for operation on a wide range of methane based gases. Its premium features and design provide economic and durable operation as well as exceptional mechanical efficiency and power-to-weight ratio, whilst offering improved emissions. The overall performance and reliability characteristics make this the prime choice for today's power generation industry.

Specification		
Number of cylinders	6 vertical in-line	
Bore and stroke	160 x 190 mm	6.3 x 7.5 in
Displacement	22.92 litres	1399 in^3
Aspiration	Turbocharged and air-to-water charge cooled	
Cycle	4 stroke	
Combustion system	Spark ignited	
Compression ratio	12.0:1	
Rotation	Anti-clockwise, viewed on flywheel	
Total lubricating capacity	122.7 litres	32.4 US gal
Cooling system	Water cooled	
Total coolant capacity	36 litres	9.5 US gal

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4006-23TRS2 Spark Ignited Gas Engine

393 kWm @ 1500 rpm

Features and benefits

Economic power

- Utilises advanced combustion technology to deliver durable and reliable power
- High commonality of components with other engines in the 4000 Series family for reduced stocking levels
- Individual large valve cylinder heads with matched deep bowl pistons for greater swirl, achieve high mechanical efficiency

Reliable power

- Developed and tested using the latest engineering techniques
- Piston temperatures controlled by an advanced gallery jet cooling system
- Extended durability and reduced servicing with extended component life add benefit of the reduced whole life cost
- Robust to varying gas quality

  Specs for both natural gas and biogas are available*

Compact, clean and efficient power

- Exceptional power-to-weight ratio and compact size give optimum power density for ease of transportation and installation
- In excess of 40% mechanical efficiency
- Designed to provide excellent service access for ease of maintenance
- Engines to comply with major international standards
- All engines in the 4000 Series family are capable of meeting the NOx requirements of TA Luft

Product support

- With highly trained Perkins distributors in thousands of communities in over 180 countries, you are never far away from expert product knowledge, genuine parts and a range of advanced diagnostic technology for keeping your engine in peak condition
- Warranties and Service Contracts

  We provide one-year warranties for our gas engines, as standard. These are supported by multilevel Extended Service Contracts that can be bought additionally
  Discover more: www.perkins.esc
- To find your local distributor: www.perkins.com/distributor

*Engine specification suitable for running on landfill gas, digester gas, biogas and coal bed mine gas. (Please contact your account manager or nearest distributor for more information)

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4006-23TRS2 Spark Ignited Gas Engine

393 kWm @ 1500 rpm

Technical information

Air inlet and exhaust

- Mounted air filter – replaceable cartridge type
- Dry exhaust manifolds
- Exhaust manifold shielding
- High efficiency turbocharger

Governing, gas and ignition system

- Air/Fuel mixer with zero pressure regulator and mixture adjustment screw
- Metal braided flexible gas connection
- Altronic 800 'C' Series ignition system with individual cylinder ignition coils, spark plugs
- Digital governing system, governing to ISO8528-5 class G2

Lubrication system

- Gear driven, externally mounted lubricating oil pump
- Wet sump with filler and dipstick
- Full-flow replaceable canister type oil filters
- Jacket water cooled shell and tube oil cooler/stabiliser
- Closed circuit crankcase ventilation system – natural gases only

Cooling system

- Pressurised jacket water cooling system, gear-driven jacket water, circulating pump – supply on Electro unit only
- Air to water charge cooler, pipe work – supply on Electro unit only
- Jacket water thermostatic control – supply on Electro unit only

Electrical equipment

- 24 volt starter motor
- 24 volt 70 amp battery charging alternator with integral voltage, regulator and activating switch – supply on Electro unit only
- High coolant temperature
- Low oil pressure switch
- High manifold pressure switch
- Digital knock detection

Flywheel and housing

- High inertia flywheel to SAE J620 Size 14
- SAE '0' flywheel housing

Mountings

- Front and rear engine mounting support

Literature

- User's Handbook

Optional equipment

- 220 / 240 volt thermostatically controlled immersion heater
- Three way thermostatic valve for charge cooler cooling circuit
- Mechanically driven water pump for charge cooler circuit
- Exhaust temperature monitoring
- Tool kit
- Additional manuals

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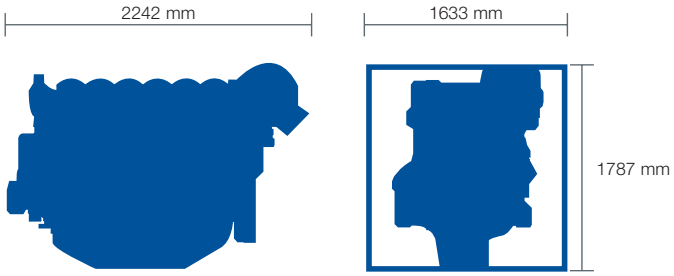
4000 Series 4006-23TRS2 Spark Ignited Gas Engine

393 kWm @ 1500 rpm



Engine package weights and dimensions				
	Electro unit		Cogeneration unit	
Length	2242 mm	88.3 in	2242 mm	88.3 in
Width	1633 mm	64.3 in	1418 mm	55.8 in
Height	1787 mm	70.3 in	1787 mm	70.3 in
Weight (dry)	2420 kg	5335 lb	2420 kg	5335 lb

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تهران، کیلومتر۲۱ بزرگراه لشگری (جاده مخصوص کرج)
روبروی پالایشگاه نفت پارس، پلاک ۱۲

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4006-23TRS2 Spark Ignited Gas Engine

393 kWm @ 1500 rpm

Speed rpm	Type of operation	Typical generator output (Gross)	Engine power (Gross)
		kWe	kWm
4006-23TRS2	Continuous operating power	375	393

The above ratings represent the engine performance capabilities to conditions specified in ISO 8528/1, ISO 3046/1:1986, BS 5514/1.
Derating may be required for conditions outside these; consult Perkins Engines Company Limited.

Generator powers are typical and are based on an average alternator efficiency and a power factor (cos. θ) of 1.
Fuel specification: Natural gas having a Lower Calorific Value of 34.71 MJ/m^3.

Rating definitions
Continuous operating power: Power available for true Base load, rating as defined in ISO 8528/1, BS 5514/1 – No overload permitted.

Designation	Cogeneration unit	Electro unit
Fuel consumption gross at 1500 rpm	kJ/kW	kJ/kW
Continuous baseload rating	2.49	2.52
75% of prime power rating	2.57	2.60
50% of prime power rating	2.73	2.76
25% of prime power rating	3.35	3.38

Fuel consumption figures are for TA Luft compliant engines at ISO 8528/1 in “Cogen” engine specification, running on British natural gas with LCV 34.71 MJ/Sm^3

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4008-30TRS1 Spark Ignited Gas Engine

447 kWm @ 1500 rpm

Developed from a proven engine range that offers superior performance and reliability, the 4008-30TRS is designed to meet the future demands of the power generation industry for clean, efficient gas fuelled engines.

The 4008-30TRS 8-cylinder spark ignition gas engine offers high performance, dependability and reliability while meeting the market's increasingly stringent emission requirements.

The 4008-30TRS is a turbocharged, air to water charge cooled, 8 cylinder inline gas engine, designed for operation on a wide range of methane based gases. Its premium features and design provide economic and durable operation as well as exceptional mechanical efficiency and power to weight ratio, whilst offering improved emissions. The overall performance and reliability characteristics make this the prime choice for today's power generation industry.

Specification		
Number of cylinders	8 vertical in-line	
Bore and stroke	160 x 190 mm	6.3 x 7.5 in
Displacement	30.56 litres	1865 in^3
Aspiration	Turbocharged and air-to-water charge cooled	
Cycle	4 stroke	
Combustion system	Spark ignited	
Compression ratio	12.0:1	
Rotation	Anti-clockwise, viewed on flywheel	
Total lubricating capacity	165.6 litres	43.7 US gal
Cooling system	Water cooled	
Total coolant capacity	48 litres	12.7 US gal

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4008-30TRS1 Spark Ignited Gas Engine

447 kWm @ 1500 rpm

Features and benefits

Economic power

- Utilises advanced combustion technology to deliver durable and reliable power
- High commonality of components with other engines in the 4000 Series family for reduced stocking levels
- Individual large valve cylinder heads with matched deep bowl pistons for greater swirl, achieve high mechanical efficiency

Reliable power

- Developed and tested using the latest engineering techniques
- Piston temperatures controlled by an advanced gallery jet cooling system
- Extended durability and attention to reducing servicing with extended component life add benefit of the reduced whole life cost
- Robust to varying gas quality

  Specs for both natural gas and biogas are available*

Compact, clean and efficient power

- Exceptional power-to-weight ratio and compact size give optimum power density for ease of transportation and installation
- In excess of 40% mechanical efficiency
- Designed to provide excellent service access for ease of maintenance
- Engines to comply with major international standards
- All engines in the 4000 Series family are capable of meeting the NOx requirements of TA Luft

Product support

- With highly trained Perkins distributors in thousands of communities in over 180 countries, you are never far away from expert product knowledge, genuine parts and a range of advanced diagnostic technology for keeping your engine in peak condition
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- We provide one-year warranties for our gas engines, as standard. These are supported by multilevel Extended Service Contracts that can be bought additionally
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*Engine specification suitable for running on landfill gas, digester gas, biogas and coal bed mine gas. (Please contact your account manager or nearest distributor for more information)

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4008-30TRS1 Spark Ignited Gas Engine

447 kWm @ 1500 rpm

Technical information

Air inlet and exhaust

- Mounted air filter – replaceable cartridge type
- Dry exhaust manifolds
- Exhaust manifold shielding
- High efficiency turbocharger

Governing, gas and ignition system

- Air/Fuel mixer with zero pressure regulator and mixture adjustment screw
- Metal braided flexible gas connection
- Altronic 800 'C' Series ignition system with individual cylinder ignition coils, spark plugs
- Digital governing system, governing to ISO8528-5 class G2

Lubrication system

- Gear driven, externally mounted lubricating oil pump
- Wet sump with filler and dipstick
- Full-flow replaceable canister type oil filters
- Jacket water cooled shell and tube oil cooler/stabiliser
- Closed circuit crankcase ventilation system – natural gases only

Cooling system

- Pressurised jacket water cooling system, gear-driven jacket water, circulating pump – supply on Electro unit only
- Air to water charge cooler, pipe work – supply on Electro unit only
- Jacket water thermostatic control – supply on Electro unit only

Electrical equipment

- 24 volt starter motor
- 24 volt 70 amp battery charging alternator with integral voltage, regulator and activating switch – supply on Electro unit only
- High coolant temperature
- Low oil pressure switch
- High manifold pressure switch
- Digital knock detection

Flywheel and housing

- High inertia flywheel to SAE J620 Size 14
- SAE '0' flywheel housing

Mountings

- Front and rear engine mounting support

Literature

- User's Handbook and Parts Manual

Optional equipment

- 220 / 240 volt thermostatically controlled immersion heater
- Three way thermostatic valve for charge cooler cooling circuit
- Mechanically driven water pump for charge cooler circuit
- Exhaust temperature monitoring
- Tool kit
- Additional manuals

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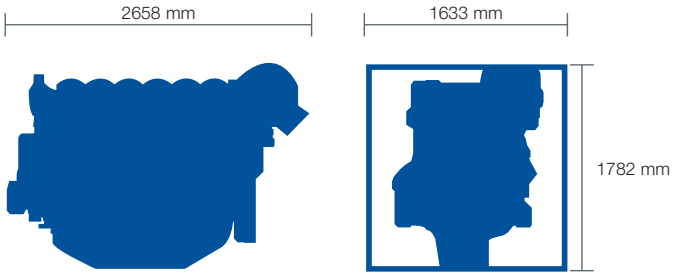
4000 Series 4008-30TRS1 Spark Ignited Gas Engine

447 kWm @ 1500 rpm



Engine package weights and dimensions				
	Electro unit		Cogeneration unit	
Length	2658 mm	105 in	2559 mm	101 in
Width	1633 mm	64 in	1418 mm	56 in
Height	1782 mm	70 in	1782 mm	70 in
Weight (dry)	3350 kg	7385 lb	3350 kg	7385 lb

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THE HEART OF EVERY GREAT MACHINE

4000 Series 4008-30TRS1 Spark Ignited Gas Engine

447 kWm @ 1500 rpm

Speed rpm	Type of operation	Typical generator output (Gross)	Engine power (Gross)
		kWe	kWm
4008-30TRS1	Continuous operating power	425	447

The above ratings represent the engine performance capabilities to conditions specified in ISO 8528/1, ISO 3046/1:1986, BS 5514/1.
Derating may be required for conditions outside these; consult Perkins Engines Company Limited.

Generator powers are typical and are based on an average alternator efficiency and a power factor (cos. θ) of 1.
Fuel specification: Natural gas having a Lower Calorific Value of 34.71 MJ/m^3.

Rating definitions
Continuous operating power: Power available for true Base load, rating as defined in ISO 8528/1, BS 5514/1 – No overload permitted.

Designation	Cogeneration unit	Electro unit
Fuel consumption gross at 1500 rpm	kJ/kW	kJ/kW
Continuous baseload rating	2.51	2.54
75% of prime power rating	2.58	2.61
50% of prime power rating	2.81	2.84
25% of prime power rating	3.63	3.66

Fuel consumption figures are for TA Luft compliant engines at ISO 8528/1 in “Cogen” engine specification, running on British natural gas with LCV 34.71 MJ/Sm^3

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تهران، کیلومتر۲۱ بزرگراه لشگری (جاده مخصوص کرج)
روبروی پالایشگاه نفت پارس، پلاک ۱۲

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Technical Data

4000 Series

4016-61TRS1
4016-61TRS2

Gas Engine

1500 rev/min

Basic technical data

Number of cylinders ... 16
Cylinder arrangement ... 60° Vee
Cycle ... 4 stroke
Induction system ... turbocharged, air to water charge cooled
Combustion system ... spark ignition
Compression ratio ... 12:1
Bore ... 160 mm
Stroke ... 190 mm
Cubic capacity ... 61.123 litres
Direction of rotation ... anti-clockwise viewed on flywheel
Firing order ... 1A, 1B, 3A, 3B, 7A, 7B, 5A, 5B, 8A, 8B, 6A, 6B, 2A, 2B, 4A, 4B
Cylinder 1 ... furthest from flywheel

Overall weight (all engines) and dimensions

Model	Height mm	Length mm	Width mm	Weight (dry) kg	Weight (wet) kg
Cogeneration unit					
Bio gas	1979	2949	1660	5820	6158
Natural gas	1969	2949	1737	5820	6158
Electro unit					
Natural gas	1969	3192	1737	5820	6158

Centre of Gravity (all engines)

Forward of rear face of cylinder block ... tba
Above crankshaft centre line ... tba

Moment of inertia (mk²)

-engine ... 8,65 kgm²
-flywheel ... 9,57 kgm²
Cyclic irregularity for engine/flywheel ... 1:312

Ratings

This is defined in ISO3046/1, BS5514 and DIN 6271
Electrical ratings are based on stated alternator efficiency and are for guidance only. For Load Acceptance figures, please refer to Stafford Applications Engineering Department.

Operating point

Engine speed ... 1500 rev/min
Ignition timing ... 26° BTDC
Inlet manifold mixture temperature ... 45 °C
Cooling water exit temperature ... < 96°C
Exhaust emission ... according to TA-Luft (NOx)

Fuel data

Lower calorific value ... 34710 kJ/Sm³
Density ... 0,76 kg/Sm³
Stoich air requirement ... 16 kg/kg
Minimum methane number before derate ... 75

Performance

Steady state speed stability at constant load ... ± 0,75%
Note: All data based on operation to ISO 3046/1, BS 5514 and DIN 6271 standard reference conditions.

Governing type ... Digital speed governor

Test conditions

-air temperature ... 25 °C
-barometric pressure ... 100 kPa
-relative humidity ... 30%

General installation

Designation	Units	Continuous baseload rating			
		Cogeneration unit		Electrounit	
		TRS1	TRS2	TRS1	TRS2
Gross engine power	kW	912	1042	912	1042
Brake mean effective pressure	kPa	1193	1364	1193	1364
Combustion air flow	m³/min	68,3	78,8	69,1	79,7
Exhaust gas temperature (max) before turbo	°C	594	600	594	600
Exhaust gas temperature (max) after turbo	°C	482	468	482	468
Exl					207
Exl					1,6
Bo					2,8
Overall electrical efficiency	%	38,4	38,6	37,6	37,8
Charge coolant flow	l/sec	350			
Nominal excess air factor (Lambda)	λ	1,7			
Typical gross Genset 25 °C (100 kPa) Electrical output (unity 1.0pf)	kWe	875	1000	875	1000
Assumed alternator efficiency	%	96			

Baseload rating: Unlimited hours usage with an average load factor of 100% of the published baseload power rating.

Energy balance

4016-61TRS1&2- Cogeneration unit

Designation	Units	Continuous Baseload rating			
		TRS1		TRS2	
		Value	%	Value	%
Energy in fuel	kWt	2288	100	2584	100
Energy in power output (Net)	kWb	912	39,8	1042	40,3
Energy in exhaust (25°C)	kWt	661	28,9	803	31,1
Energy to exhaust (120°C)	kWt	539	23,6	646	25,0
Energy to coolant and oil	kWt	487	21,3	445	17,2
Energy to charge cooler	kWt	134	5,9	180	7,0
Energy to radiation (exhaust temp. 25°C)	kWt	95	4,1	114	4,4

4016-61TRS1&2 - ElectroUnit

Designation	Units	Continuous Baseload rating			
		TRS1		TRS2	
		Value	%	Value	%
Energy in fuel	kWt	2334	100	2630	100
Energy in power output (Net)	kWb	912	39,1	1042	39,6
Energy in exhaust (25°C)	kWt	661	28,3	803	30,5
Energy to exhaust (120°C)	kWt	539	23,1	646	24,6
Energy to coolant and oil	kWt	501	21,5	459	17,5
Energy to charge cooler	kWt	148	6,4	194	7,4
Energy to radiation (exhaust temp. 25°C)	kWt	113	4,8	132	5,0

Not to be used for CHP design purposes (indicative figures only).
Consult Perkins Engines Company Limited.
Assumes complete combustion.

Cooling system

Recommended coolant: 50% inhibited ethylene glycol or 50% inhibited propylene glycol and 50% clean fresh water. For combined heat and power systems and where there is no likelihood of ambient temperature below 10 °C, then clean 'soft' water may be used, treated with 1% by volume of Perkins inhibitor in the cooling system. The inhibitor is available in 1 litre bottles from Perkins.
Total coolant capacity (engine only) .. .. 95 litres
Maximum jacket water pressure in crankcase ... ... 100 kPa (plus static pressure head)

Jacket cooling water data

Total coolant flow ... ...950 l/min
Coolant exit temperature (max) . ... 96 °C
Coolant entry temperature (max) ... ... 81 °C

Charge cooling water data

Coolant flow ... ...600 l/min
Coolant entry temperature . ... 36 °C
Coolant exit temperature ... ... 40 °C
Charge cooler ... ... fin and tube on engine x2
Shutdown switch setting ... ... .193 kPa falling
Coolant immersion heater capacity ... ... 4 kW 1 off

Lubrication system

Recommended lubricating oil: Lubricating oil requirements vary with fuel used. Full specifications including oil sampling and recommendations and condemnation limits appear on the Fuel, Coolant and Lubricating Oil Recommendation Sheet for the 4000 Series Gas Engines.

Lubricating oil capacity

Total system capacity .. .. 286 litres
Sump maximum .. .. 257 litres
Sump minimum ... ... 147 litres

Lubricating oil temperature

Oil temperature in rail (continuous operation) . ... 88 °C
Lubricating oil pressure at rated speed ... ...470 kPa
Lubricating oil flow at 1500 rev/min . ... 402 l/min
Sump drain plug tapping size GA1
Oil pump .. .. gear driven
Shutdown switch setting .. .. 193 kPa falling
Oil filter screen spacing ... ... 20 microns
Oil consumption after running in .. .. 0,25 g/kWhr
Normal operating angles:
-front and rear .. .. 5°
-side tilt ... ... 10°

Ignition system

Type ... ...electronic ignition system
Primary voltage ... ... .24V
Polarity ... ... Negative earth
Spark plug type ... ... Pre-chamber

Fuel system

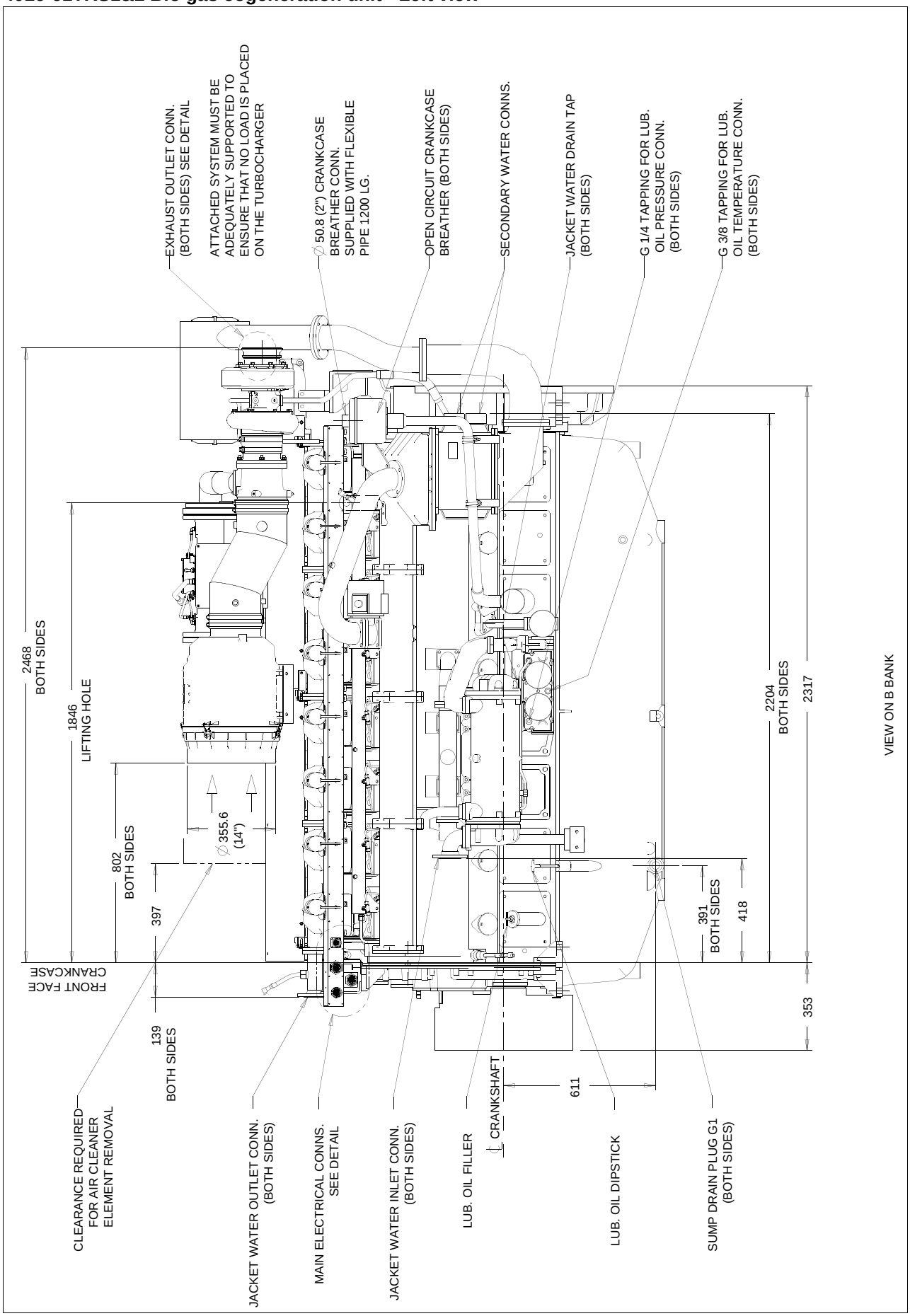
Recommended fuel: Natural Gas LHV at 34 MJ/m³ (930 Btu/cu.ft). Other fuels may be used, for example landfill or digester gas. Ratings will vary from those shown.
Where fuels other then Natural Gas are being considered you must obtain a full gas analysis including details of any solid or liquid components. Refer results to Perkins Engines Company Limited to determine suitability. Gas supplies must be filtered to the same standard as the engine intake air (i.e. Maximum particle size not to exceed 50 microns).
Minimum gas supply pressure. ... ... 5 kPa
Maximum gas supply pressure ... ... 25 kPa
Fuel system type . ...Electronic AFR control system
Installation of gas supply and shut off valves to be in accordance with local regulations.

Designation	Cogeneration unit		ElectroUnit	
	TRS1	TRS2	TRS1	TRS2
Fuel consumption gross	**kJ / kWs**	**kJ / kWs**	**kJ / kWs**	**kJ / kWs**
100% Continuous baseload rating	2,51	2,48	2,56	2,53
75% of Continuous base load rating	2,60	2,58	2,63	2,60
50% of Continuous baseload rating	2,68	2,66	2,70	2,68
25% of Continuous base rating	2,75	2,74	2,77	2,76

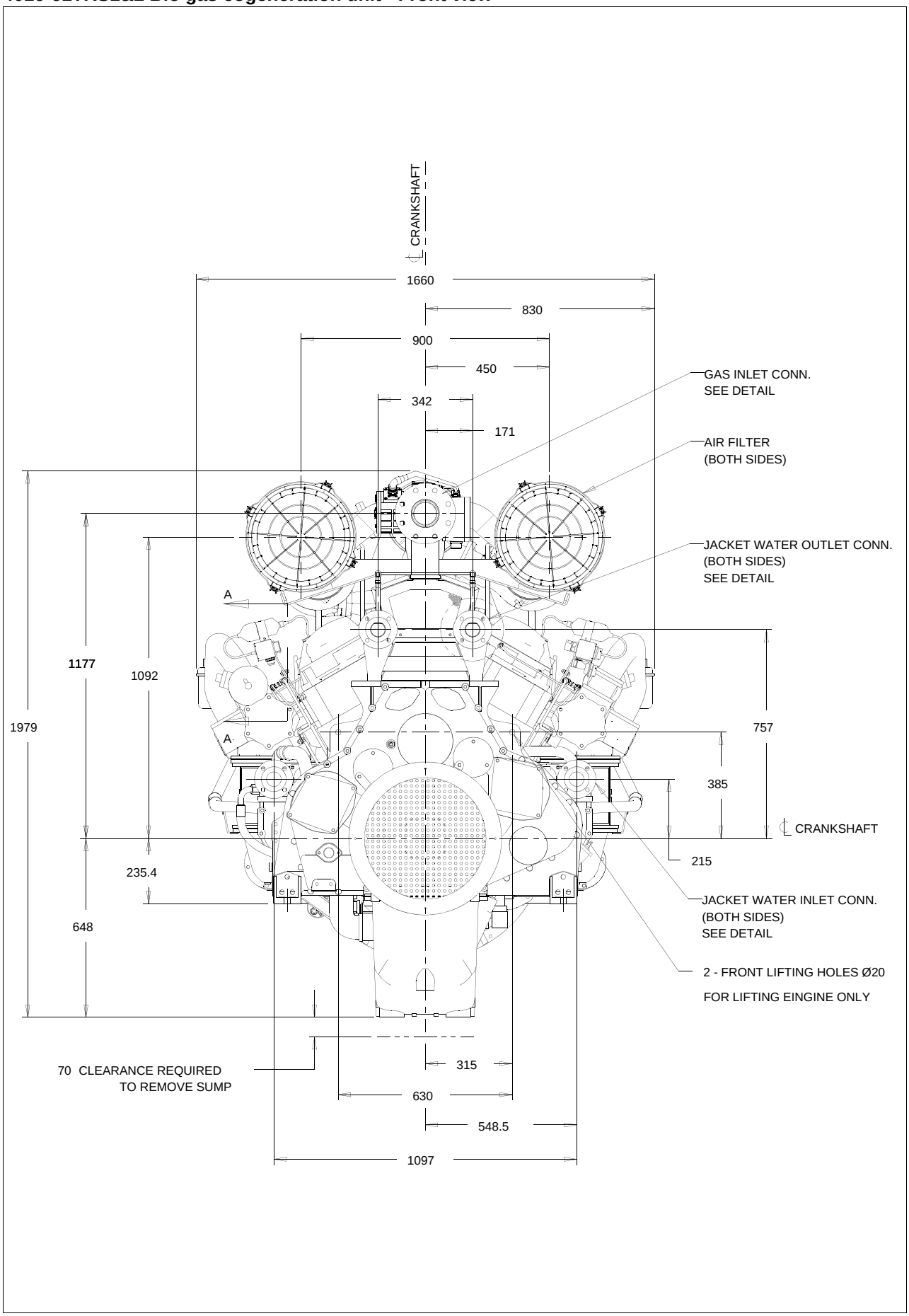
Fuel: Natural Gas - LHV = 34,71 MJ/m³
Tolerance on Fuel consumption

Designation		Cogeneration unit		ElectroUnit	
Mass flow data	**Units**	**TRS1**	**TRS2**	**TRS1**	**TRS2**
Fuel	Kg/h	180	203	183	207
Volume flow data					
Fuel (15 °C)	m³/hr	237	268	241	273

4016-61TRS1&2 Bio gas cogeneration unit - Left view



4016-61TRS1&2 Bio gas cogeneration unit - Front view



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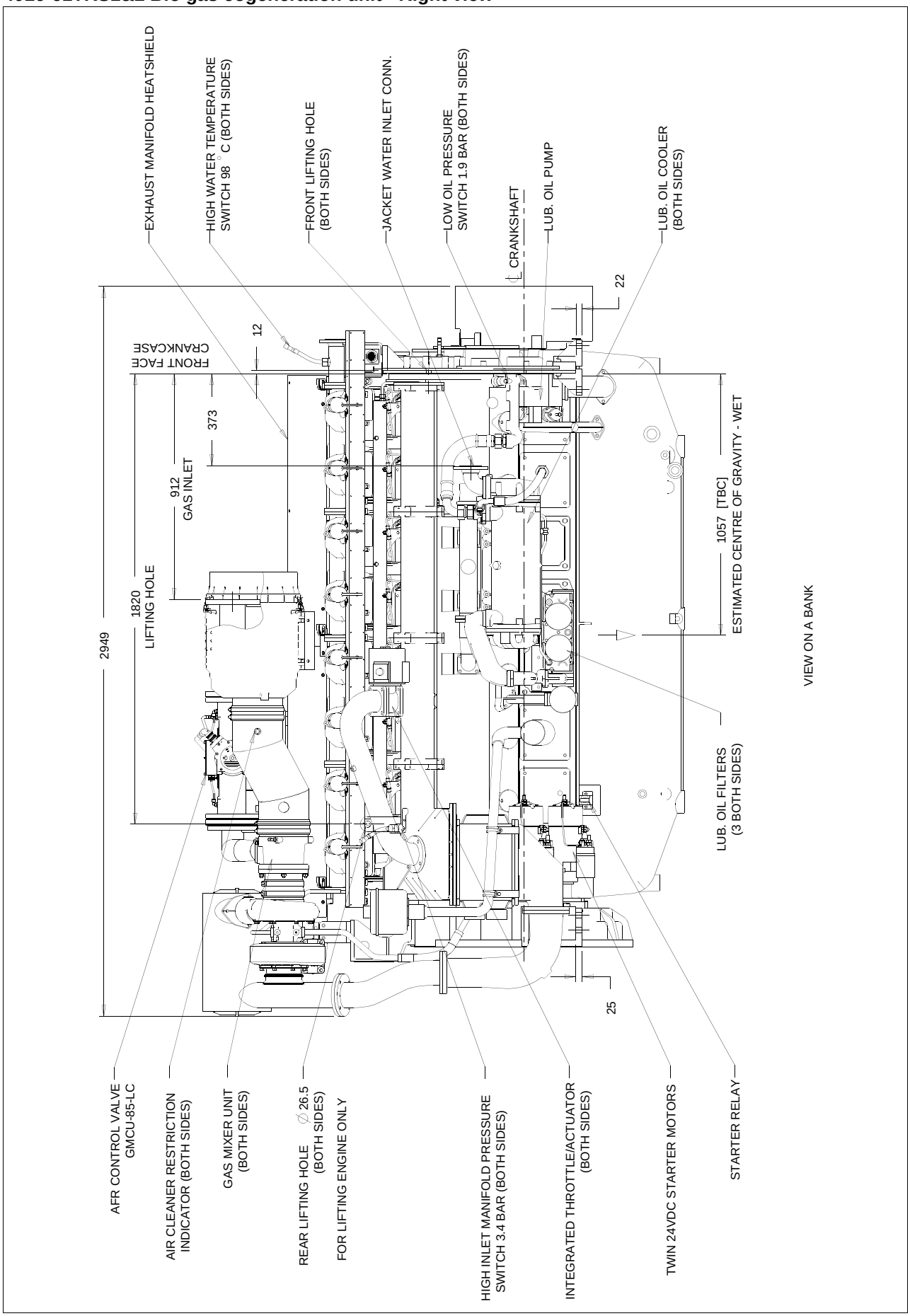
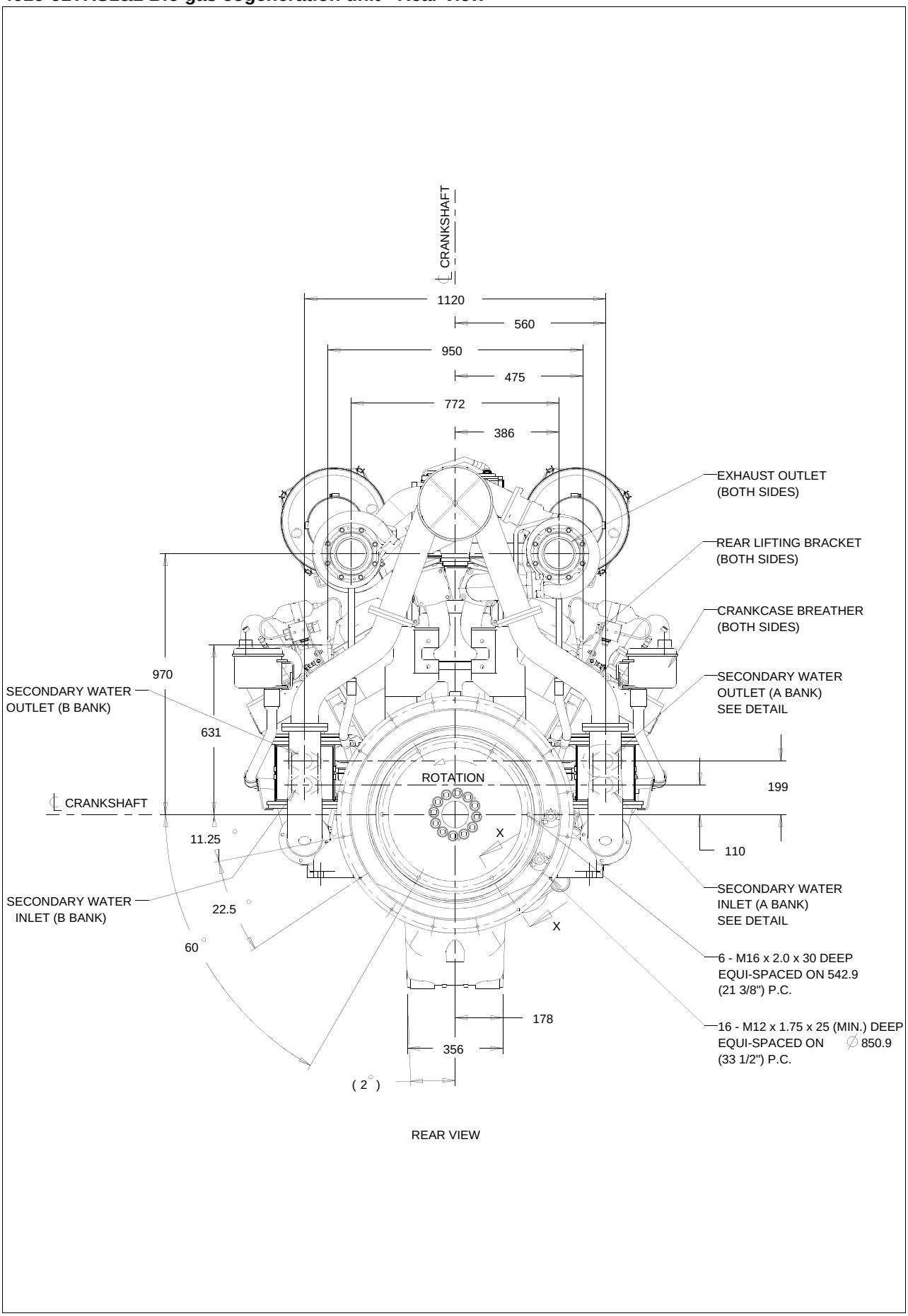
4016-61TRS1&2 Bio gas cogeneration unit - Right view



4016-61TRS1&2 Bio gas cogeneration unit - Rear view



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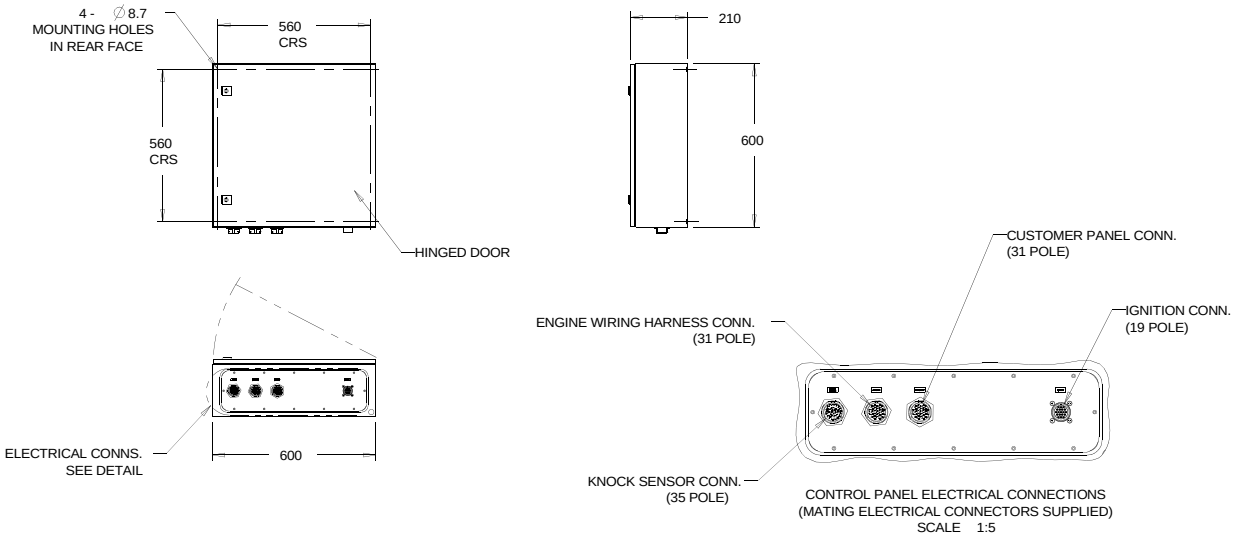
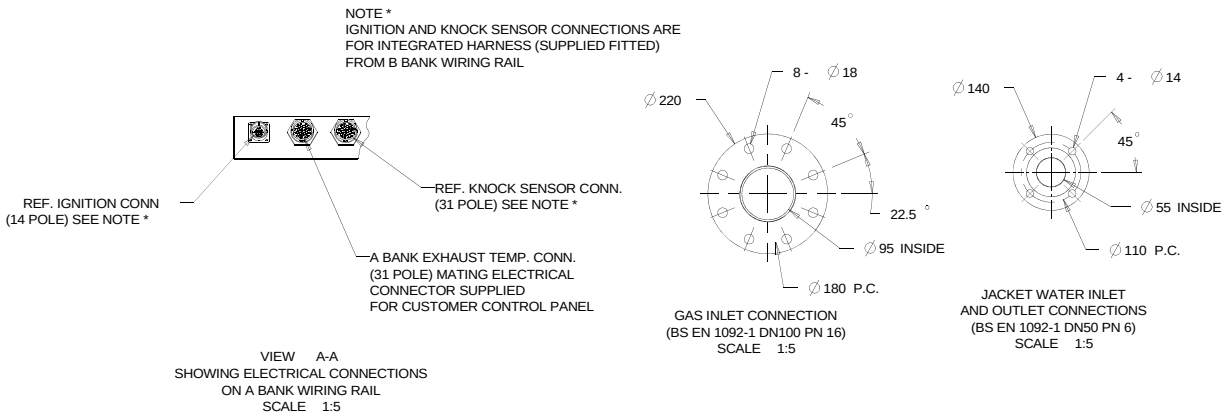
4016-61TRS1&2 Bio gas cogeneration unit - Electrical connections, Exhaust Outlet an



CONTROL PANEL ELECTRICAL CONNECTIONS
(MATING ELECTRICAL CONNECTORS SUPPLIED)
SCALE 1:5

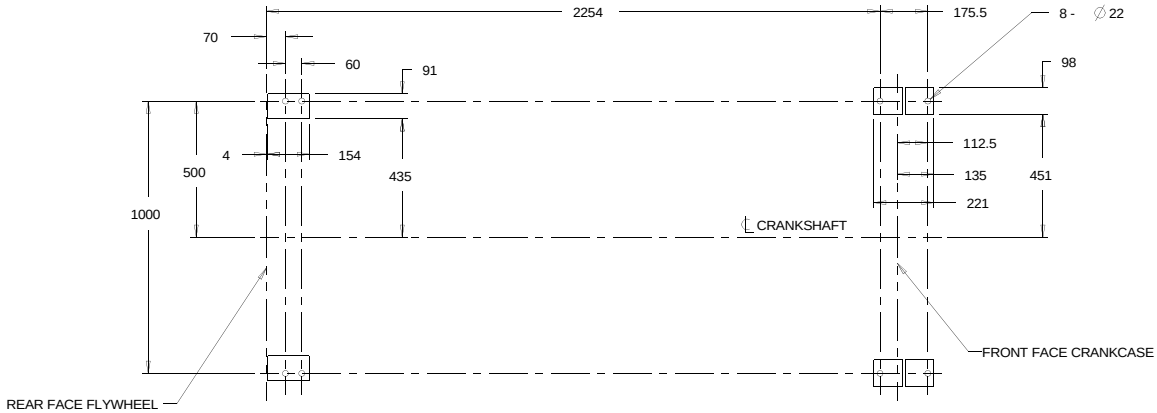
ENGINE CONTROL PANEL (SUPPLIED LOOSE)



VIEW A-A
SHOWING ELECTRICAL CONNECTIONS
ON A BANK WIRING RAIL
SCALE 1:5

GAS INLET CONNECTION
(BS EN 1092-1 DN100 PN 16)
SCALE 1:5

JACKET WATER INLET
AND OUTLET CONNECTIONS
(BS EN 1092-1 DN50 PN 6)
SCALE 1:5



PLAN VIEW OF ENGINE MOUNTINGS

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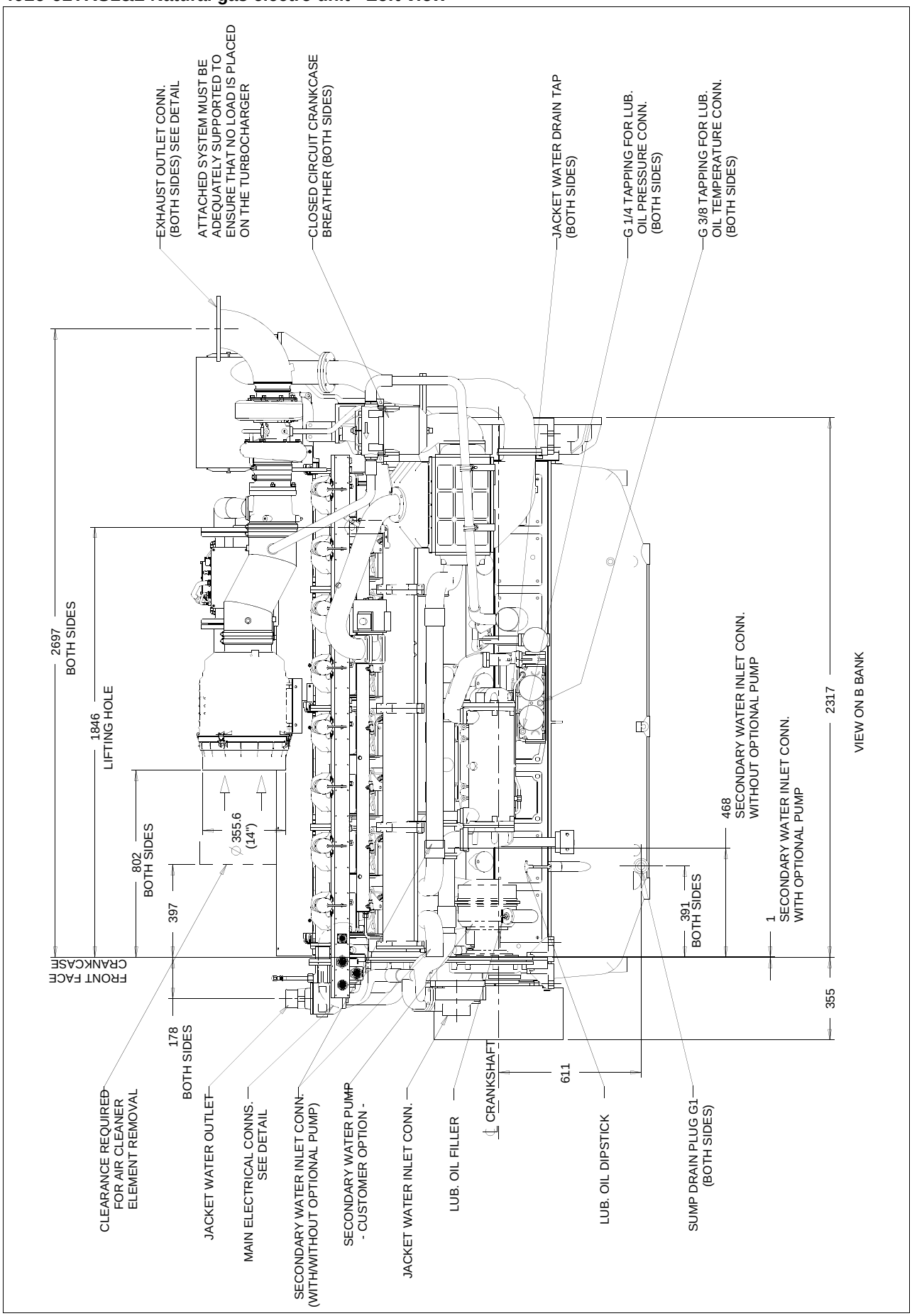
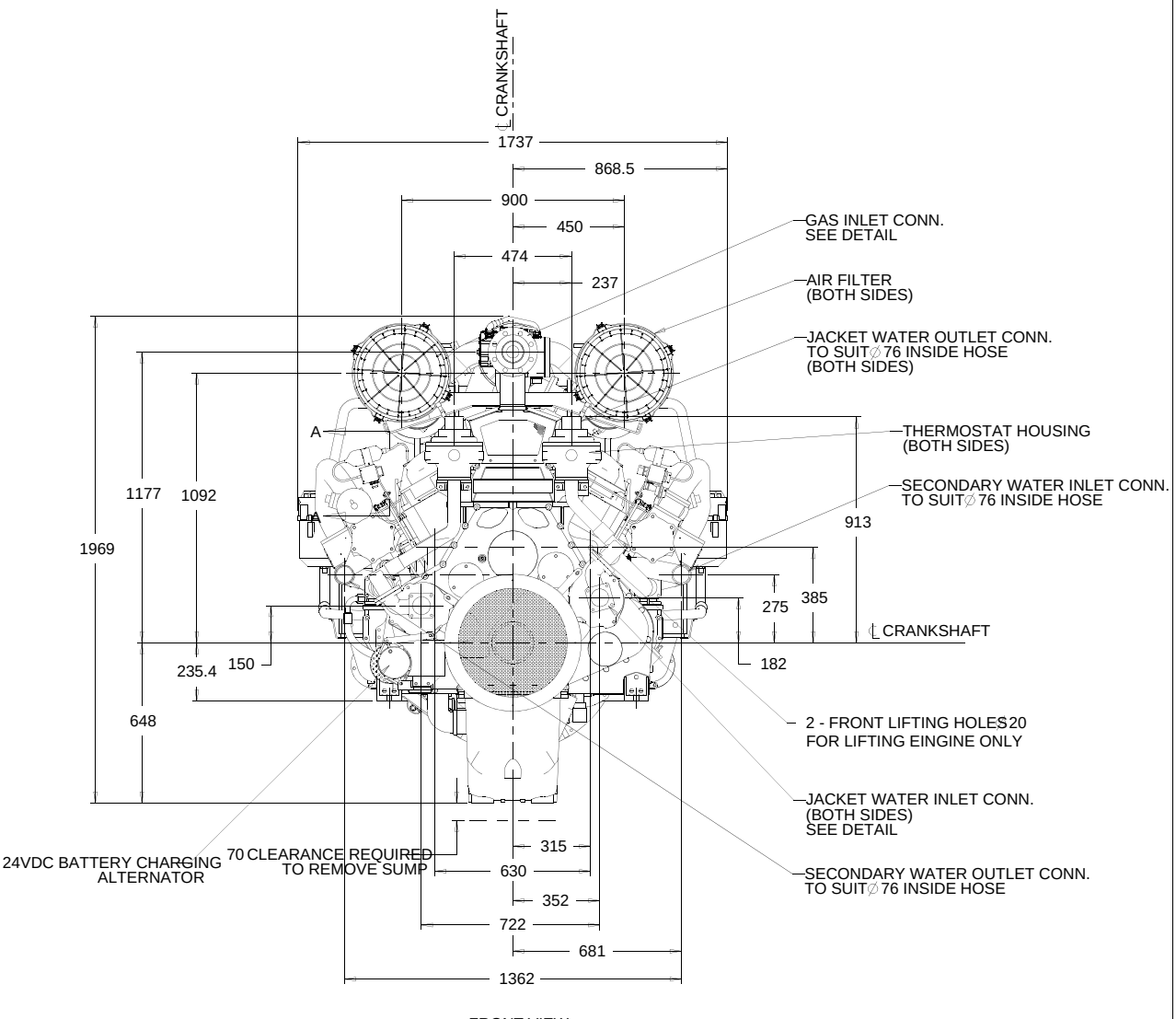
4016-61TRS1&2 Natural gas electro unit - Left view



4016-61TRS1&2 Natural gas electro unit - Front view



FRONT VIEW

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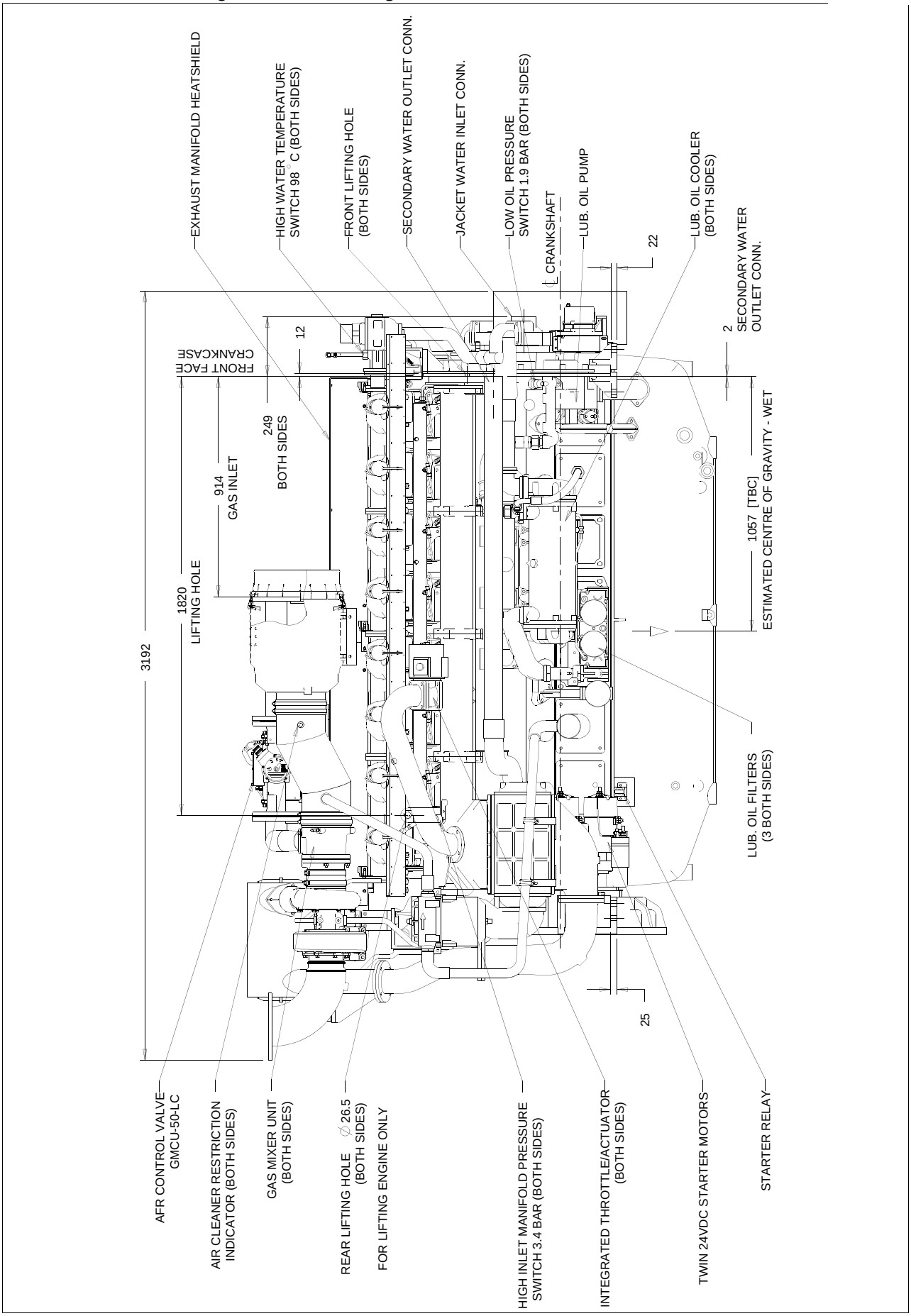
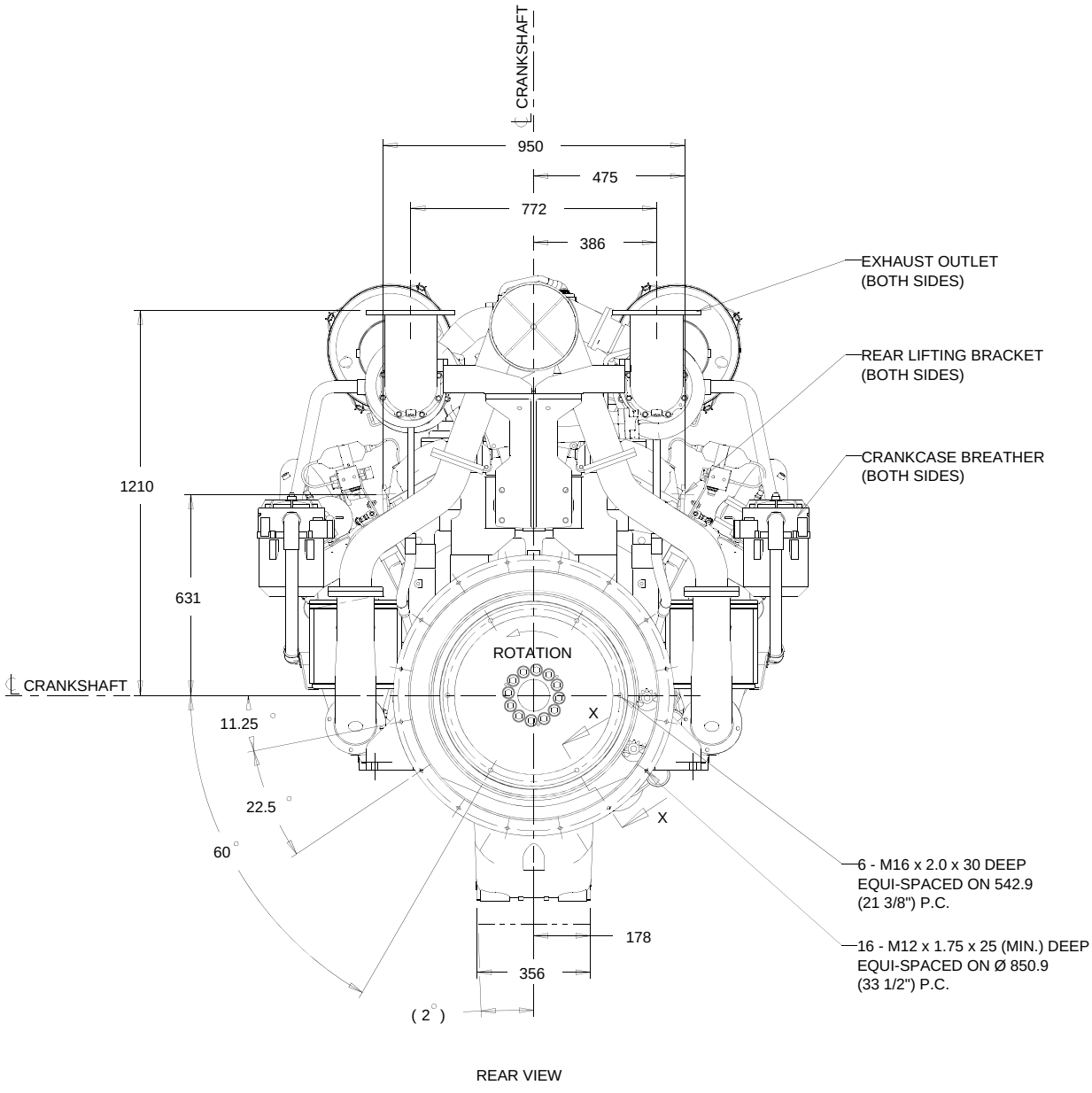
4016-61TRS1&2 Natural gas electro unit - Right view



4016-61TRS1&2 Natural gas electro unit - Rear view



REAR VIEW

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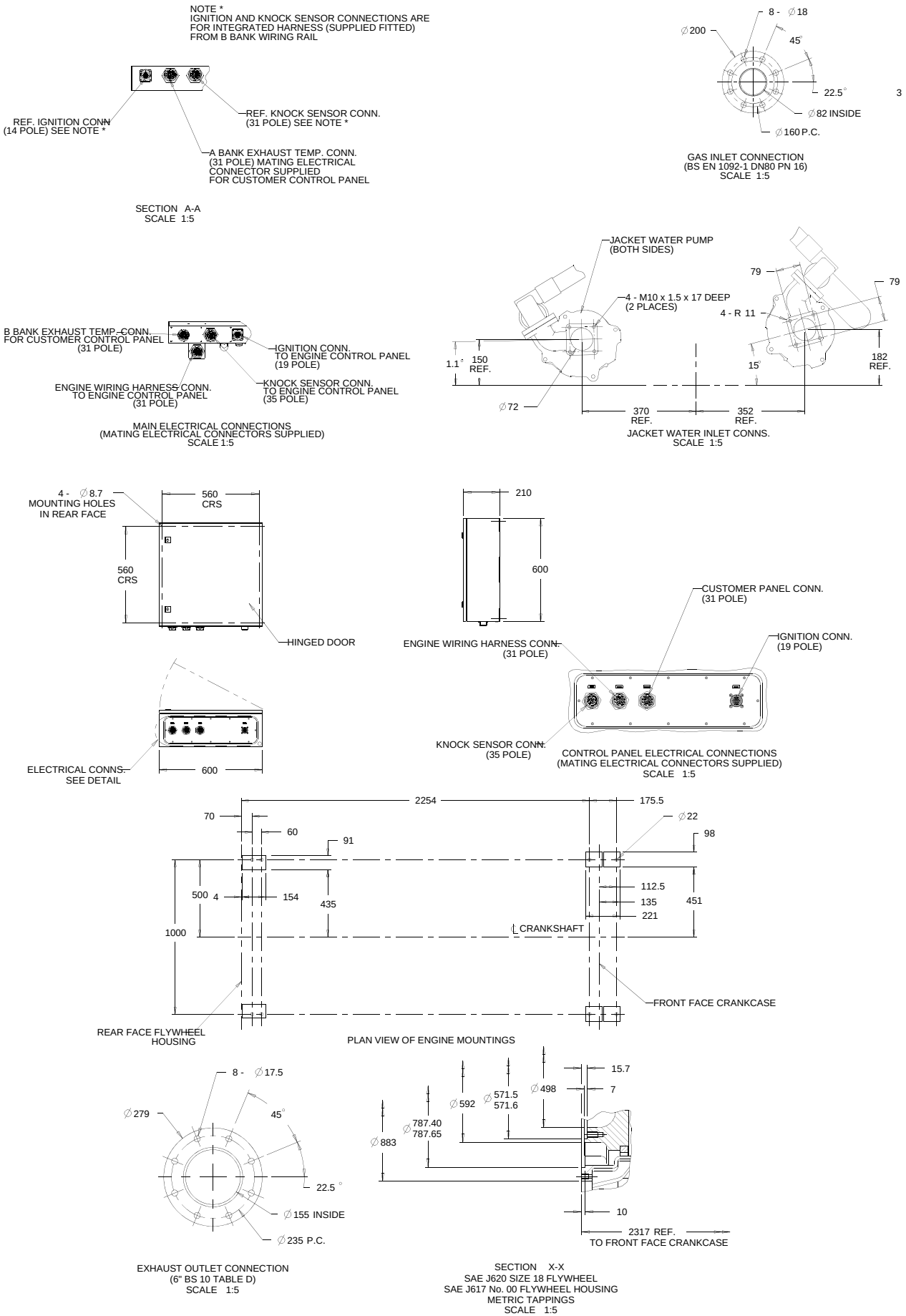
4016-61TRS1&2 Natural gas electro unit - SAE Flywheel, Exhaust Outlet and Support Pads



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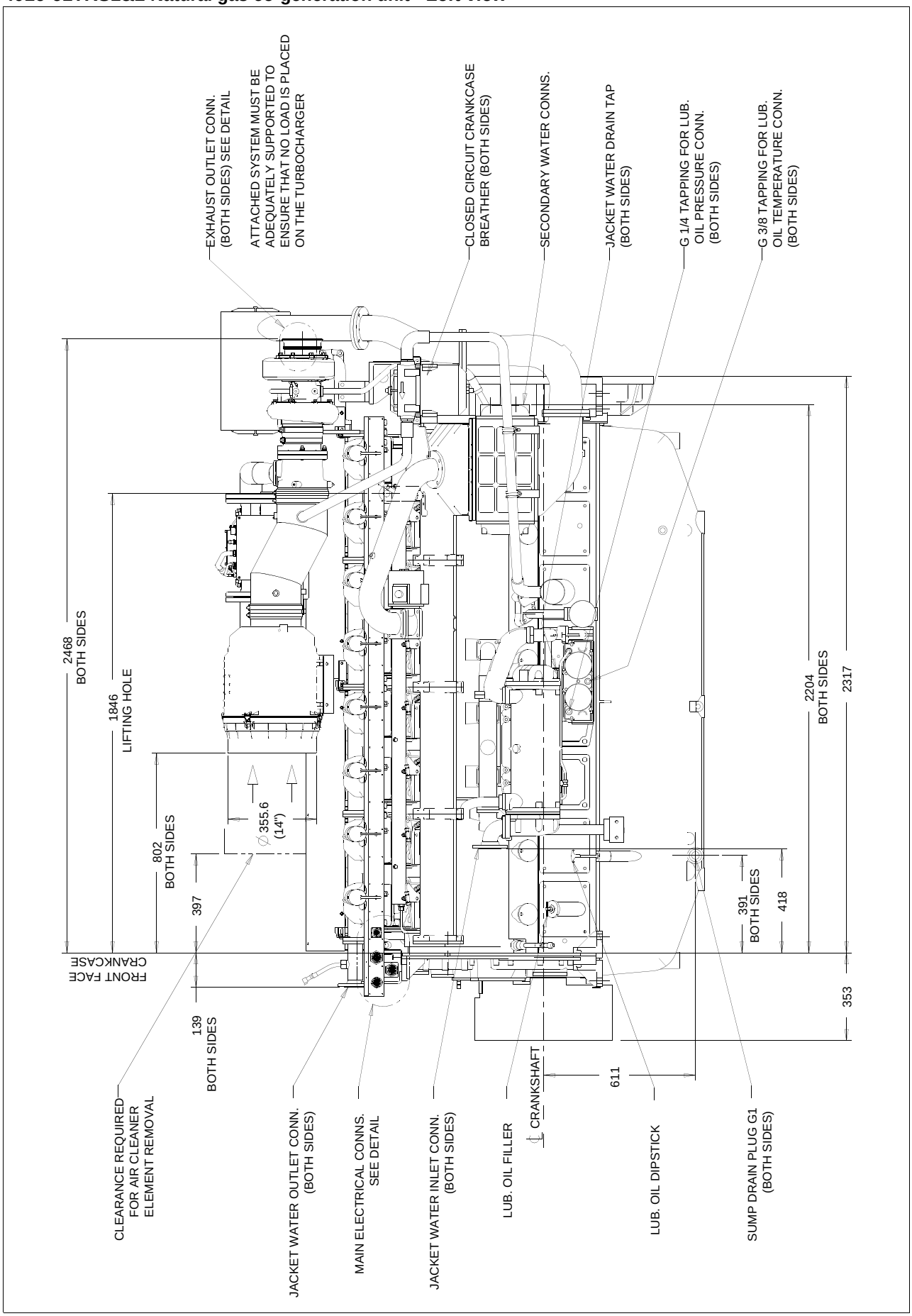
4016-61TRS1&2 Natural gas co-generation unit - Left view



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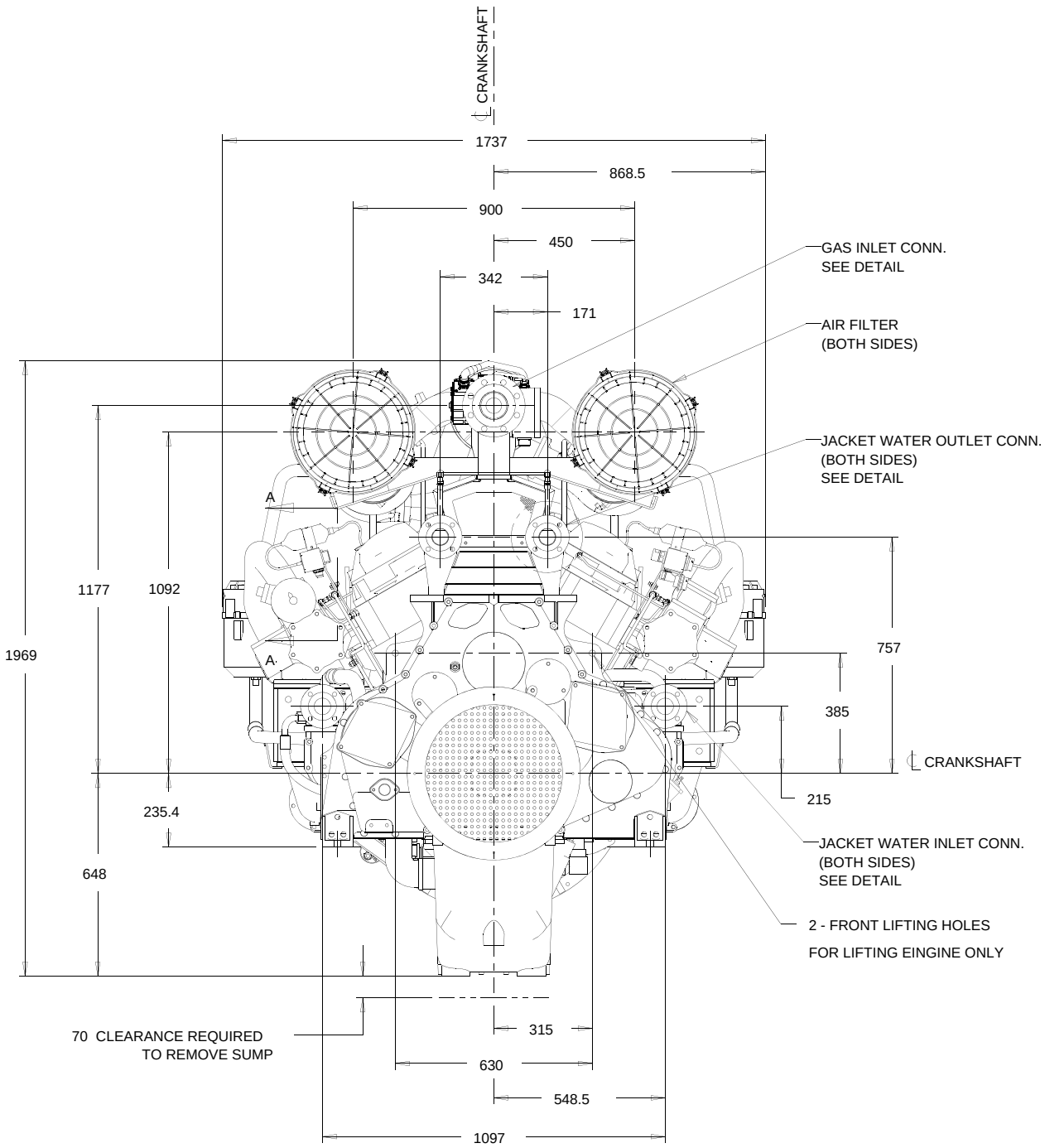
4016-61TRS1&2 4016-61TRS1&2 Natural gas co-generation - Front view



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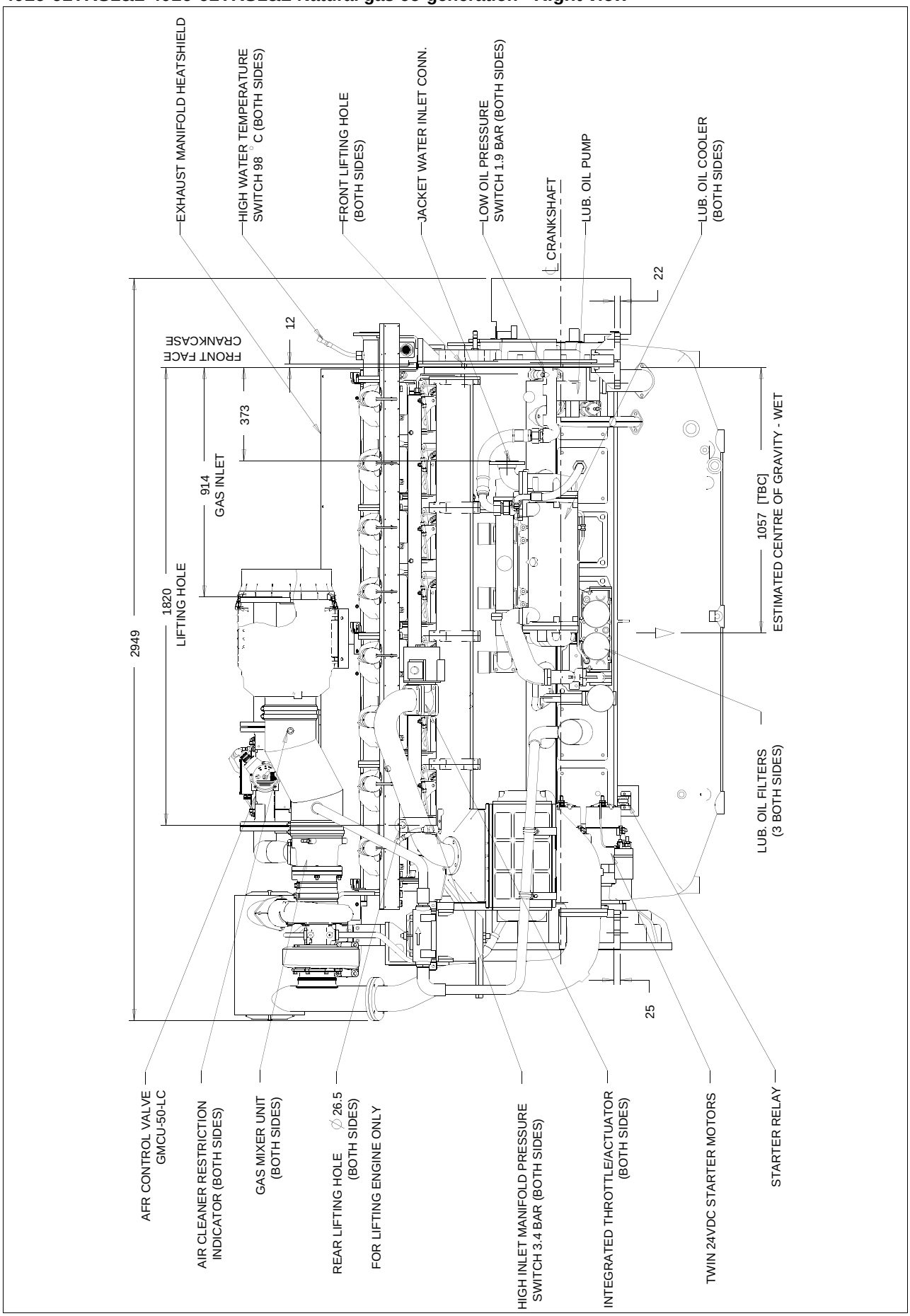
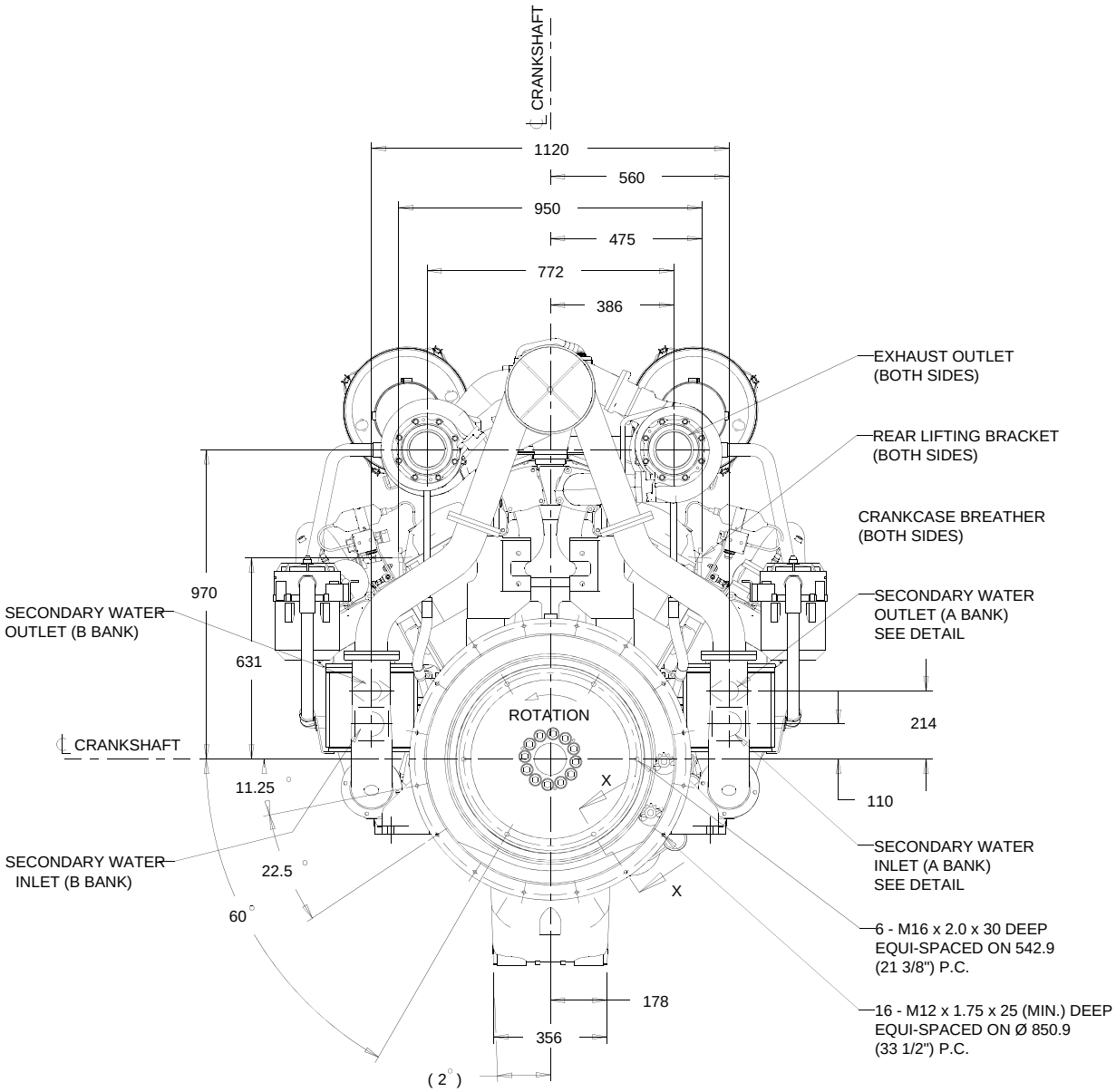
4016-61TRS1&2 4016-61TRS1&2 Natural gas co-generation - Right view



4016-61TRS1&2 Natural gas co-generation - Rear view



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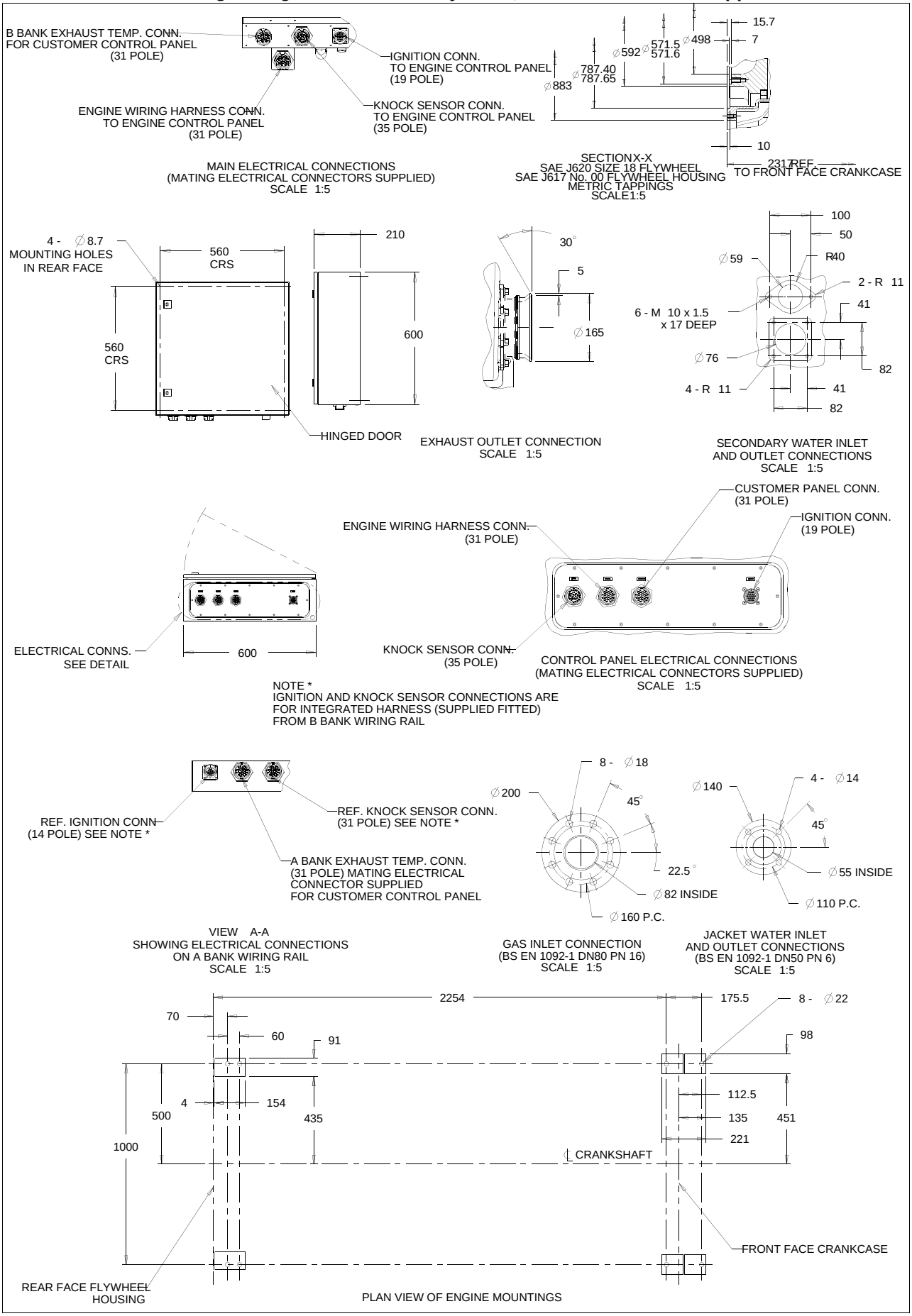
4016-61TRS1&2Natural gas co-generation - SAE Flywheel, Exhaust Outlet and Support Pads



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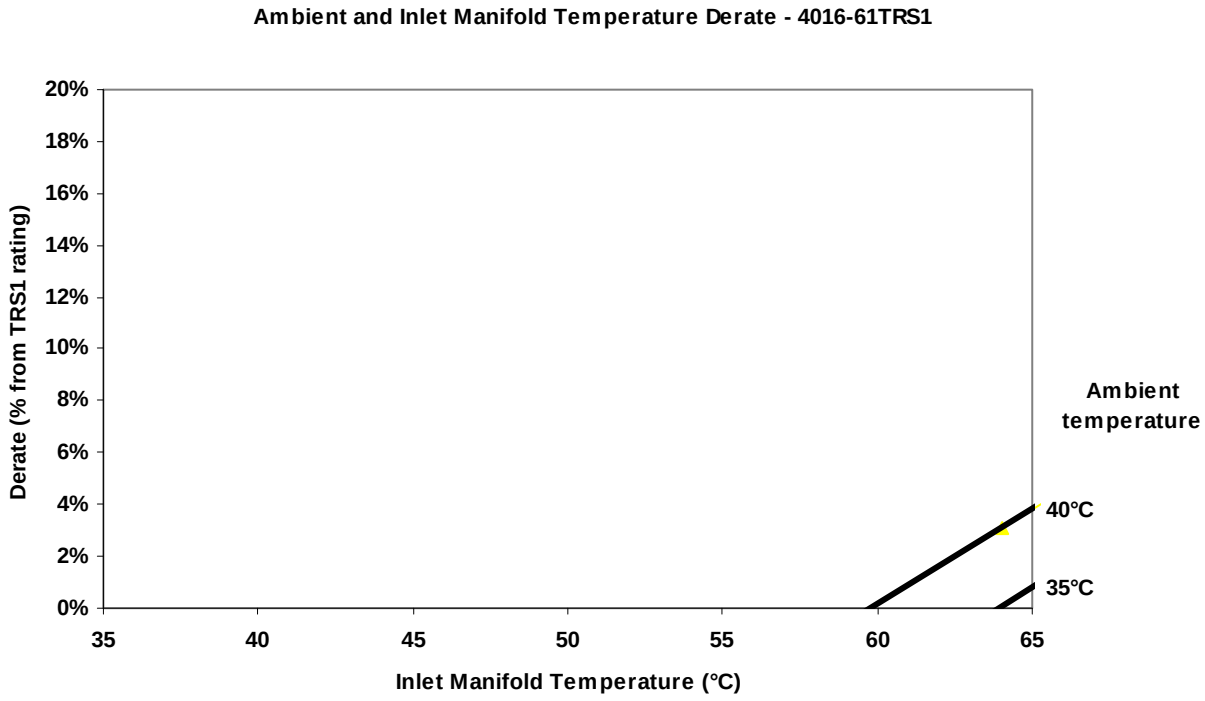
Derate tables

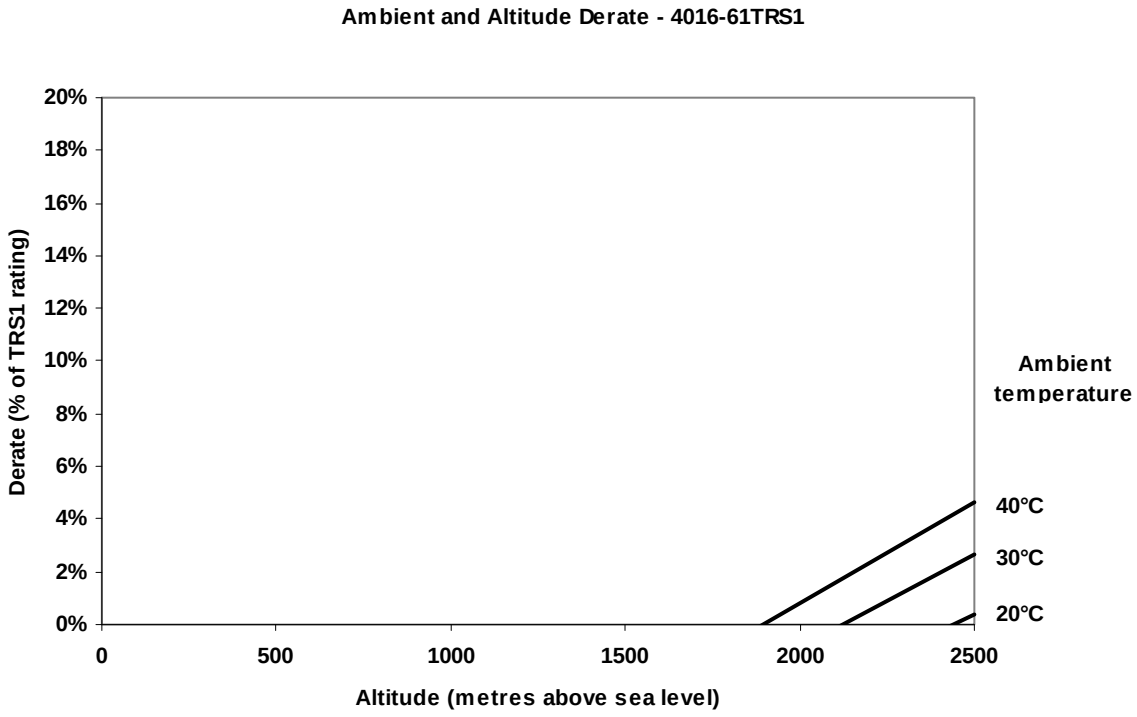
Note: Standard conditions for the following derate charts are:

50 °C inlet manifold temperature; 120 m altitude; TA Luft NOx emissions (500 Nm³)

Ambient/inlet manifold temperature, TRS1



Ambient / Altitude, TRS1



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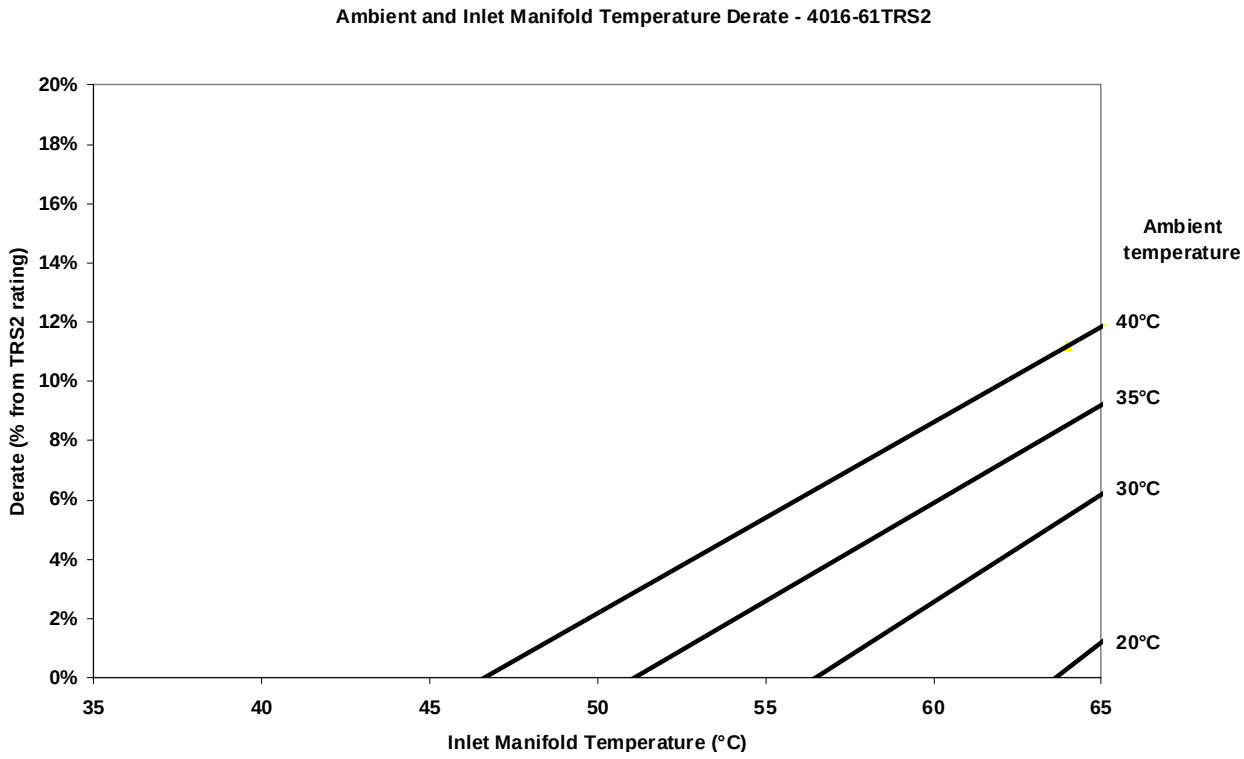
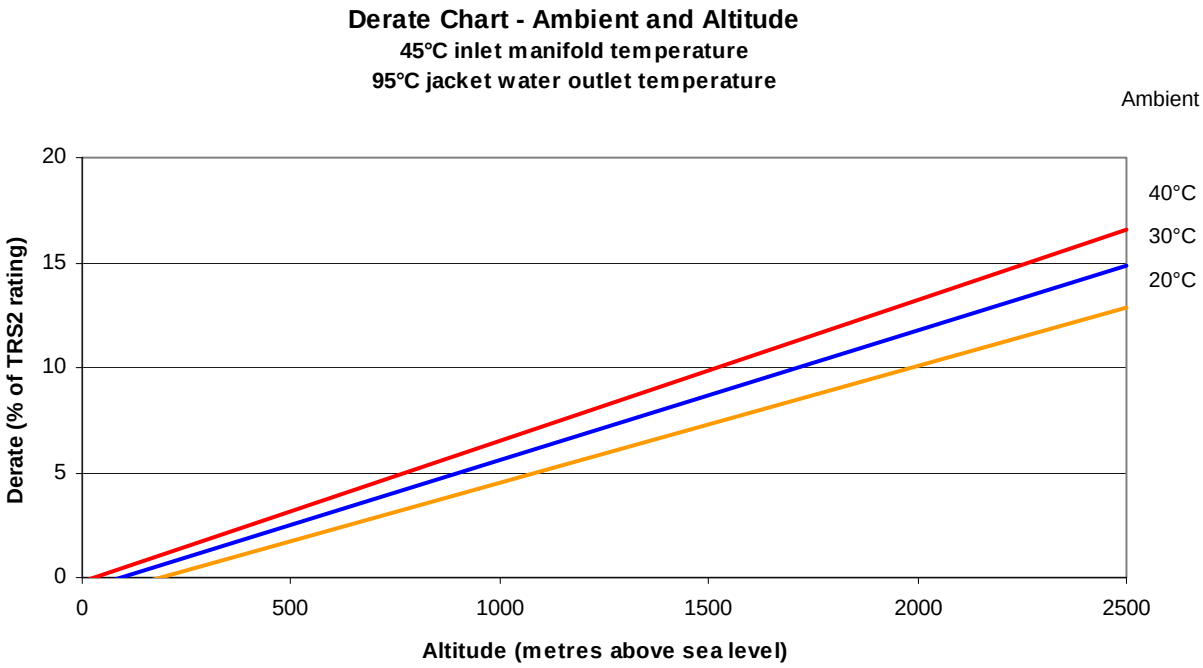
Ambient / Inlet manifold temperature, TRS2



Ambient/altitude, TRS2



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Induction system

Maximum air intake restriction of engine:
-clean filter . ... 127 mm H_2O
-dirty filter ... ... 380 mm H_2O
-air filter type .. .. 2 of dry type

Exhaust emissions data

Ambient temperature of 25 °C
Emissions at continuous baseload rating.

If the engine is to operate in ambient conditions other then test conditions then suitable adjustments may be necessary for any change in inlet air temperature or barometric pressure.

Designation		TRS1	TRS2
Oxygen (O^2)	%	9,2	9,4
Oxides of Nitrogen (NOx)	mg/Nm³	460	480
Hydrocarbons (THC)	mg/Nm³	1502	1410
Carbon Monoxide (C0)	mg/Nm³	860	870
Lambda		1,7	1,7

Designation		Cogeneration unit		Gas unit	
		TRS1	TRS2	TRS1	TRS2
Mass flow data					
Combustion air (25 °C)	kg/h	4852	5598	4909	5662
Volume flow data					
Combustion air (25 °C)	m³/h	4098	4728	4146	4782

Exhaust system

Designation	Units	TRS1	TRS2
Maximum back pressure for total system	mm H_2O	600	400

Exhaust outlet flange size ... ... 2 x 152 mm

For recommended pipe sizes see the Installation Manual.

Designation		Cogeneration unit		Electro unit	
Exhaust gas volume flow (100 kPa)	**Units**	**TRS1**	**TRS2**	**TRS1**	**TRS2**
Exhaust gas flow (at turbo exit temperature)	m³/h	10816	12395	11053	12632
Exhaust gas mass flow	kg/h	4932	5652	5040	5760

Electrical system

Type .. .. insulated return
Alternator voltage .. .. 24V with integral regulator
Alternator output ... ...32A at stabilised output 28 A at 20°C ambient
Starter motor voltage. 24V
Starter motor power 16,4kW
Number of teeth on flywheel 156
Number of teeth on starter motor 12
Minimum cranking speed .. .. 120 rev/min
Starter motor solenoid pull-in current ... ... 26,8A at 24V
Starter motor solenoid hold-in current... ... ... 9A at 24V

Engine mountings

Maximum static bending moment at rear face of block. ... 1356 kg
Maximum permissible overhung load on flywheel. ... ... 850 kg

Starting requirements temperature down to 0°C

Oil: . ... See page 2, Lubrication system
Starter: ... ... 2 x 24 Volts
Battery: .. .. 4 x 12V total Ah 143
In-rush current to starter: ... ...1000 amps
Cranking current: ... ... 600 amps
Starter cable size: .. ..120 mm²
Maximum length: ... ...6 m

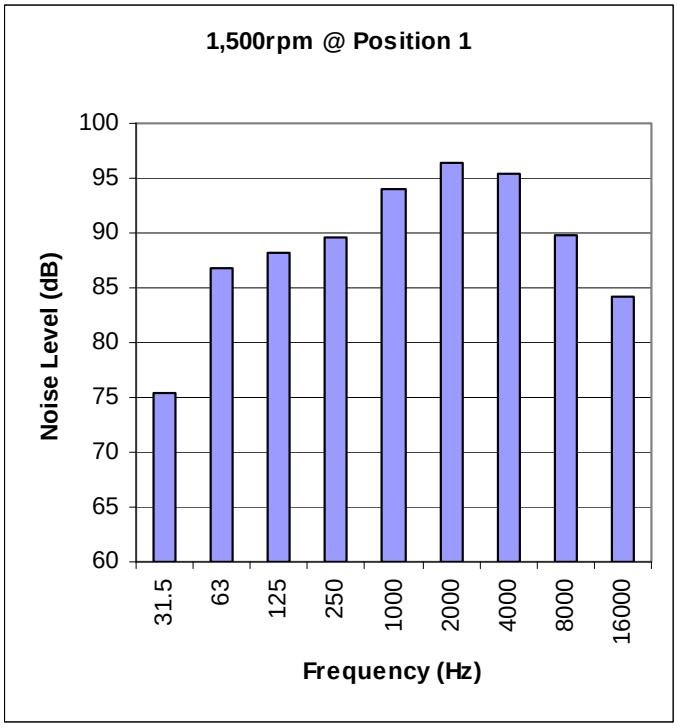
- The battery capacity is defined by the 20 hour rate
- The starting ability of an engine with an immersion heater will be improved by appox. 10°C and the start aid specification can be modified accordingly the oil specification should be for the minimum ambient temperature as the oil will not be warmed by the immersion heater
- Breakaway current is dependant on battery capacity available. Cables should be capable of handling the transient current which may be up to double the steady cranking current.

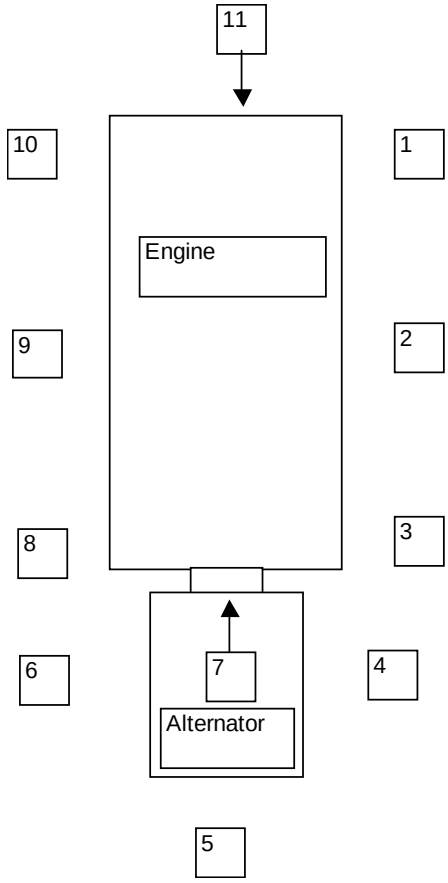
Noise Data

Noise levels

The figures for total noise levels are typical for an engine running at the continuous baseload power rating in a semi-reverberant environment and measured at a distance of one metre from the periphery of the engine (sound pressure level re: -20 x 10^{-6} pa).
Ambient noise level ... ... 78 dBA

Position	Noise Level (dBA)
1	106.4
2	105.4
3	103.4
4	102.1
5	99.8
6	102.8
7	105.6
8	104.3
9	104.6
10	105.0
11	103.5





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