GOLDEN MAJD Co.

20 - 22S

Rating @ 0.8 PF		Prime rating	Stand-by rating
Voltage *1	Freq. *2	PT20 *3	PT22S *4
400 V	50 Hz	20.0 KVA	22.0 KVA
480 V	60 Hz	23.0 KVA	26.1 KVA

The above ratings represent the generating set capability guarantied within ±3% at the references conditions equivalent to those specified in ISO 8528/1, ISO 3046/1 and BS 5514/1

NOTES

1 - The applicable voltage range is 380V to 415V for 50Hz applications and 380V to 480V for 60Hz applications.
2 - This generating set is of switchable speed of 1500rpm/1800rpm.
3 - **PT20** is the prime power rating of the generating set, where a variable load and unlimited hours usage are applied on the generating set with an average load factor of 80% of the prime rating over each 24 hour period. Noting that a 10% overload is available for 1 hour in every 12 hours operation.
4 - **PT22S** is the standby power rating of the generating set, where a variable load limited to an annual usage up to 500 hours is applied, with 300 hours of which may be continuous running. Noting that no overload is permitted.

Engine Technical Data		
Model	Perkins 404C-22G	
Cylinders	4; vertical in-line	
Aspiration	Naturally aspirated	
Combustion	Indirect injection	
Cooling System	Water cooled	
Displacement	2.216 L	
Oil consumption	0.1 % of fuel consumption	
Lube oil capacity	10.6 L	
Coolant capacity	6.98 L	
Governor	Mechanical	
Emissions regulations	EU stage2 & EPA tier2	
Speed	1500 rpm	1800 rpm
Fuel Consumption PT20	5.4 L/H	6.4 L/H
Fuel Consumption PT22S	6.2 L/H	7.3 L/H
Radiator Cooling Air Flow	40.2 m^3/min	47.4 m^3/min
Max Exhaust Gas Flow	3.64 m^3/min	4.34 m^3/min

The above performance data are valid as per the following specs:
- Diesel Fuel is according to BS2869 Class A2 or equivalent.
- Lubricating oil is according to API CH4 (15W/40).
- The coolant should be 50% antifreeze and 50% fresh water.

Alternator Technical Data		
Model	Leroy Somer LSA 42.2 S5	
Regulation	± 0.5 %	
International protection	IP23	
Insulation class	H	
Terminals	12	
Frequency	50 Hz	60 Hz
Coolant Air Flow	0.15 m^3/s	0.18 m^3/s

Shipping Data			
Length	Width	Height	Weight
1650 mm	690 mm	990 mm	485 kg

All information given in this leaflet is correct at the time of printing but it may be changed subsequently by the Company

ISO 9001 : 2000
Certificate Number: CC1680-009512,009912

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The Perkins 400 Series provides compact power from a robust family of 2, 3 and 4 cylinder diesel engines, designed to meet today's uncompromising demands within the power generation industry.

The 404C-22G is a compact 4-cylinder naturally aspirated diesel engine. It's premium features provide economic and durable operation for standby duty, low gaseous emissions, overall performance and reliability.

400 Series

404C-22G

Diesel Engine – ElectropaK

20.3 kWm 1500 rev/min
23.9 kWm 1800 rev/min
33.4 kWm 3000 rev/min

Compact, efficient power

A class-leading engine package coupled with an innovative, newly designed cooling pack provides optimum power density, making installation and transportation easier and cheaper. This package has been specially designed to hit the key power nodes required by the power generation industry.

Quiet, clean power

The 404C-22G has an exceptionally low noise signature making it the ideal choice for power generation in any environment. A high compression ratio also ensures clean rapid starting in all conditions. Design features ensure maximum cleanliness in terms of emissions throughout the engines operating life.

Reliable power

Developed and tested using the latest engineering techniques this engine reliably provides power when you need it.
Operating and maintenance costs are reduced through excellent fuel and oil economy whilst whole-life costs are enhanced by a 500 hour service interval and a 2 year warranty.
Excellent service access further improves maintenance and support is provided by a worldwide network of 4000 distributors and dealers.

Engine Speed (rev/min)	Type of Operation	Typical Generator Output (Net)		Engine Power			
				Gross		Net	
		kVA	kWe	kWm	bhp	kWm	bhp
1500	Prime Power	20.3	16.3	18.7	25.1	18.4	24.6
	Standby (maximum)	22.7	18.2	20.6	27.6	20.3	27.2
1800	Prime Power	23.4	18.7	22.0	29.5	21.6	28.9
	Standby (maximum)	25.3	20.2	24.3	32.6	23.9	32.1
3000	Prime Power	33.8	27.0	31.2	41.8	30.2	40.5
	Standby (maximum)	36.7	29.3	34.4	46.1	33.4	44.8

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 typical alternator efficiencies and a power factor (cos θ) of 0.8.

Fuel specification: BS 2869: Part 2 1998 Class A2 or ASTM D975 D2.
Lubricating oil: To API CH4/ACEA E5.

Rating Definitions
Prime Power: Power available at variable load in lieu of a main power network. Overload of 10% is permitted for 1 hour in every 12 hours operation.
Standby (maximum): Power available at variable load in the event of a main power network failure. No overload is permitted.

400 Series

404C-22G

Standard ElectropaK Specification

Air inlet
- Mounted air filters

Fuel system
- Mechanically governed cassette type fuel injection pump
- Split element fuel filter

Lubrication system
- Wet steel sump with filler and dipstick
- Spin-on-full-flow lub oil filter

Cooling system
- Thermostatically-controlled system with belt driven circulating pump and pusher fan
- Mounted radiator and piping

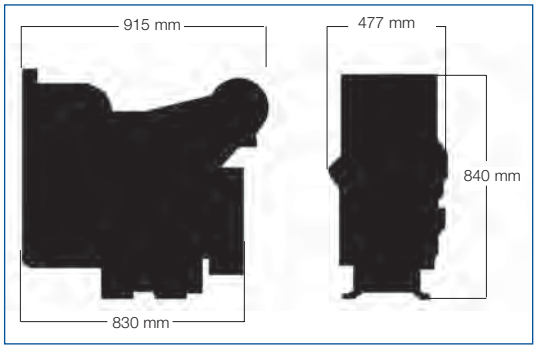
Electrical equipment
- 12 volt starter motor and 12 volt 55 amp alternator with DC output
- Oil pressure and coolant temperature switches
- 12 volt shut off solenoid energised to run
- Glow plug cold start aid and heater/starter switch

Flywheel and housing
1500/1800 rev/min
- High inertia flywheel to SAE J620 Size 7½ Heavy
- Flywheel housing SAE 4 Long

3000/3600 rev/min
- High inertia flywheel to SAE J620 Size 7½ Light
- Flywheel housing SAE 4 Short

Mountings
- Front and rear mounting bracket

Literature
- User's Handbook



General Data

Number of cylinders	4
Cylinder arrangement	Vertical in-line
Cycle	4 stroke
Induction system	Natural aspiration
Combustion system	Indirect injection
Cooling system	Water-cooled
Bore and stroke	84 x 100 mm
Displacement	2216cc
Compression ratio	23.3:1
Direction of rotation	Anti-clockwise viewed on flywheel
Total lubrication system capacity	10.6 litres
Total coolant capacity	6.98 litres
Length	915 mm
Width	477 mm
Height	840 mm
Dry weight (engine)	242 kg (1500/1800 rev/min) 218 kg (3000 rev/min)

Final weight and dimensions will depend on completed specification.

Optional Equipment
- Exhaust silencer
- Workshop manual
- Parts book

Fuel Consumption						
Engine Speed	1500 rev/min		1800 rev/min		3000 rev/min	
	g/kWh	l/hr	g/kWh	l/hr	g/kWh	l/hr
At Standby Rating	254	6.2	252	7.3	254	10.4
At Prime Power	243	5.4	245	6.4	256	9.5
At 75% Prime Power	243	4.0	247	4.8	269	7.5
At 50% Prime Power	265	2.9	269	3.5	313	5.8

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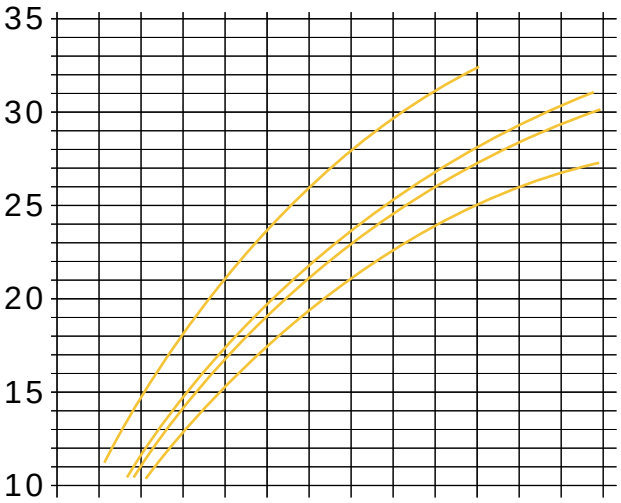
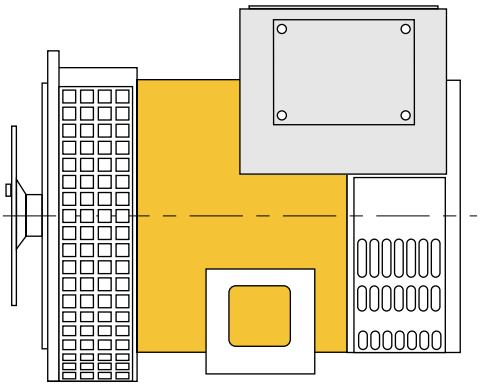




ALTERNATORS

LSA 42.2 - 4 Pole - Three phase

Electrical and mechanical data

PARTNER®

ALTERNATORS

LSA 42.2 - 4P

50 Hz - 1500 r.p.m.

TYPICAL DATA

Insulation class	**H**	Excitation system	**Shunt**	**A R E P**
Winding pitch - Code	**2/3 - (N° 6)**	A.V.R. model	**R 250**	**R 438**
Wires	**12**	Voltage regulation (steady state)	**± 0,5 %**	**± 0,5 %**
Drip proof	**IP 23**	Sustained short-circuit current	**-**	**300% (3 IN) : 10s**
Altitude	**≤ 1000 m**	Total harmonic (*) TGH / THC	**< 4 %**	**< 4 %**
Overspeed	**2250 min $^{-1}$**	Wave form : NEMA = TIF - (*)	**< 50**	**< 50**
Air flow	**0,15 m^3/s**	Wave form : I.E.C. = THF - (*)	**< 2 %**	**< 2 %**

(*) Total harmonic content line to line, at no load or full rated linear and balanced load

RATINGS : kVA / *kW* - **Power factor = 0,8**

Duty/Ambiant T°		Continuous / 40°C								Stand-by / 40°C				Stand-by / 27°C			
Class/T° rise		H / 125° K				F / 105° K				H / 150° K				H / 163° K			
Phase		**3 ph.**			1 ph.	**3 ph.**			1 ph.	**3 ph.**			1 ph.	**3 ph.**			1 ph.
Y		380V	400V	415V	Δ Δ	380V	400V	415V	Δ Δ	380V	400V	415V	Δ Δ	380V	400V	415V	Δ Δ
Δ		220V	230V	240V	230V	220V	230V	240V	230V	220V	230V	240V	230V	220V	230V	240V	230V
42.2 S4	kVA	**17,5**			**11**	17			10	20			12	**21**			12,5
	kW	*14*			*8,8*	*13,6*			*8*	*16*			*9,6*	*16,8*			*10*
42.2 S5	kVA	**20**			**12,5**	19,5			11,6	24			13,5	**25**			14,1
	kW	*16*			*10*	*15,6*			*9,3*	*19*			*10,8*	*19,8*			*11,3*
42.2 M6	kVA	**23**			**14**	21			13	27			15	**28**			15,5
	kW	*18,4*			*11,2*	*16,8*			*10,4*	*21,4*			*12*	*22,4*			*12,4*
42.2 M7	kVA	**27**			**16**	25			15	30			17,4	**31**			18,2
	kW	*21,6*			*12,8*	*20*			*11,9*	*23,8*			*13,9*	*24,8*			*14,6*
42.2 L9	kVA	**31,5**			**18,5**	28,5			17,1	33,4			20	**35**			20,6
	kW	*25,2*			*14,8*	*23*			*13,7*	*26,7*			*15,9*	*27,8*			*16,5*

EFFICIENCIES (%) : Class H . 40° C

	Three phase : 400 V										**Single phase : 230 V**									
	P.F. = 0,8					P.F. = 1					P.F. = 0,8					P.F. = 1				
	1/4	2/4	3/4	4/4	St.by	1/4	2/4	3/4	4/4	St.by	1/4	2/4	3/4	4/4	St.by	1/4	2/4	3/4	4/4	St.by
42.2 S4	82,9	87,4	88	87,6	87,2	84,9	90,2	91,5	91,6	91,5	75,7	81,6	82,2	81,3	80,6	78	85,2	86,9	87,1	86,9
42.2 S5	84,2	87,8	87,9	87	86,6	86,2	90,8	91,6	91,5	91,2	77,2	82	81,9	80,4	79,6	79,8	86	87,1	86,8	86,5
42.2 M6	85	89,2	89,8	89,4	89,1	86,6	91,5	92,6	92,8	92,7	78	83,9	84,7	84,1	83,7	79,9	86,8	88,5	88,7	88,6
42.2 M7	86,4	89,6	89,7	88,9	88,5	88,1	92,1	92,8	92,6	92,4	79,6	84,3	84,5	83,5	82,9	81,6	87,5	88,7	88,5	88,3
42.2 L9	87,9	90,3	90	89	88,6	89,6	92,8	93,1	92,7	92,5	81,7	85,4	85,1	83,7	83,1	83,7	88,6	89,2	88,7	88,4

REACTANCES (%) - TIME CONSTANTS (ms) : CLASS : H / 400 V

		42.2 S4	**42.2 S5**	**42.2 M6**	**42.2 M7**	**42.2 L9**
Kcc	Short-circuit ratio	0,76	0,66	0,71	0,6	0,51
Xd	Direct axis synchronous reactance unsaturated	160	190	170	200	220
Xq	Quadrature axis synchronous reactance unsaturated	80	90	80	100	110
T'do	Open circuit time constant	410	410	450	450	470
X'd	Direct axis transient reactance saturated	10,1	11,5	9,3	10,9	11,8
T'd	Short circuit transient time constant	30	30	30	30	30
X"d	Direct axis subtransient reactance saturated	5,0	5,8	4,6	5,5	5,9
T"d	Subtransient time constant	3	3	3	3	3
X"q	Quadrature axis subtransient reactance saturated	7,1	8,1	6,5	7,7	8,4
Xo	Zero sequence reactance unsaturated	0,8	0,1	0,6	0,2	0,3
X2	Negative sequence reactance saturated	6,0	6,9	5,6	6,6	7,1
Ta	Armature time constant	4	4	4	4	4
OTHER DATA - CLASS : H / 400 V -						
io	No load excitation current (A) (SHUNT/AREP)	0,6/0,9	0,6/0,9	0,5/0,8	0,5/0,8	0,5/0,7
ic	Full load excitation current (A) (SHUNT/AREP)	1,4/2,1	1,6/2,3	1,3/2	1,5/2,3	1,5/2,3
uc	Full load excitation voltage (V) (SHUNT/AREP)	36/13	40/14	34/12	39/14	39/14
ms	Recovery time(ΔU =20 % trans.)	500	500	500	500	500
kVA (Shunt)	Motor start. (ΔU = 20% sust.) or (ΔU = 50% Transient)	44	50	54	64	69
kVA (AREP)	Motor start. (ΔU = 20% sust.) or (ΔU = 50% Transient)	51	59	64	75	80
%	Transient dip (rated step load) - PF : 0,8 LAG	13,6	14,7	13,1	14,5	15,6
W	No load losses	590	590	690	690	680
W	Heat rejection	2000	2400	2200	2700	3100

According to : I.E.C. 34.1/34.2 - U.T.E. : NF C 51.111 - V.D.E. 0530 - B.S. 4999 & 5000 - NEMA : MG 1.22 - ISO 8528 . 3 - CSA (upon request) ....

COMPACT

This type is specially designed for the most tight spaces where other types fail to be installed. With its modern design that uses the latest technologies in fabrication and paint, this enclosure is considered to be GHADDAR MACHINERY Co.'s best selling type ever.

Charasteristics:

> Body and components made of steel with heat-treated highly corrosive powder coating.
> Stainless steel locks and black zinc die-cast hinges.
> One large door on each side to allow easy access for maintenance purposes.
> Lube oil pipe can be reached externally to allow easy drainage.
> Radiator fill access through a special rubber cap on the top of the enclosure.
> Special viewing window for the control panel in a lockable door.
> Lifting points on the base frame.
> Exhaust silencing system in the interior of the enclosure.
> Fuel fill and battery are secured through lockable doors.
> Emergency stop push button mounted on the exterior of the enclosure (optional).

GHADDAR
MACHINERY Co. S.A.L.

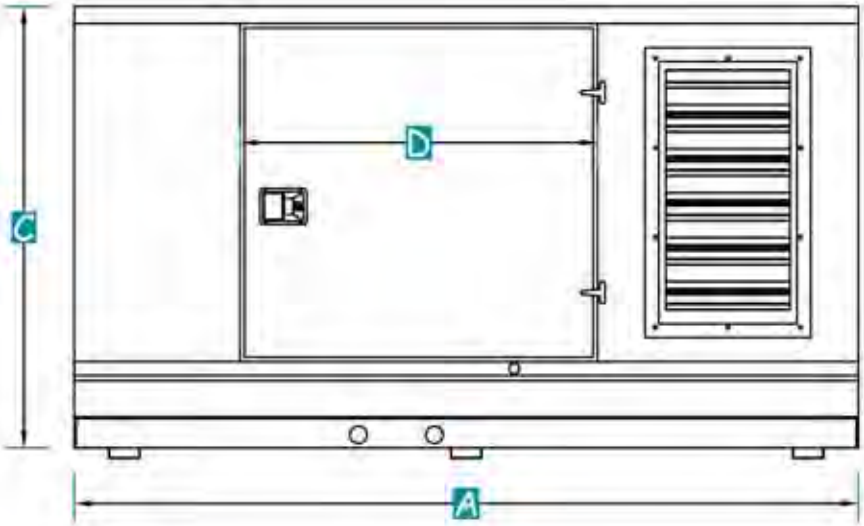
YOUR POWER PARTNER

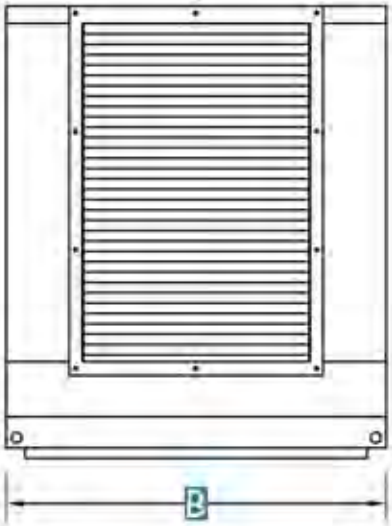
Range
9 - 60 KVA

ISO 9001 :2000
QMI REGISTERED
IQNet CERTIFIED MANAGEMENT SYSTEM
Certificate Numbers: CC1680-009512, 009912

Sound Pressure Levels (dBA)

		50 Hz						60 Hz					
		1 m		3 m		7 m		1 m		3 m		7 m	
Generating Set	Powertech	0%	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%	100%
Engine model	KVA	Load	Load	Load	Load	Load	Load	Load	Load	Load	Load	Load	Load
403C-11G	9	72.5	73.8	69.5	70.8	64.5	65.8	74.2	75.5	71.2	72.5	66.2	67.5
403C-15G	13	72.5	73.8	69.5	70.8	64.5	65.8	74.2	75.5	71.2	72.5	66.2	67.5
404C-22G	20	72.5	73.8	69.5	70.8	64.5	65.8	74.2	75.5	71.2	72.5	66.2	67.5
1103A-33G	30	74.7	76.2	71.2	72.7	66.2	67.7	76.6	78.1	73.1	74.6	68.1	69.6
1103A-33TG1	45	73.3	74.8	69.8	71.3	64.8	66.3	75.2	76.7	71.7	73.2	66.7	68.2
1103A-33TG2	60	73.3	74.8	69.8	71.3	64.8	66.3	75.2	76.7	71.7	73.2	66.7	68.2





Dimensions

Generating Set	Powertech	A: mm	B: mm	C: mm	D: mm
Engine model	KVA				
403C-11G	9	2000	900	1260	876
403C-15G	13	2000	900	1260	876
404C-22G	20	2000	900	1260	876
1103A-33G	30	2270	1100	1310	1020
1103A-33TG1	45	2270	1100	1310	1020
1103A-33TG2	60	2270	1100	1310	1020