

| Ratings  |                                    |           |                               |           | <h2 style="color: blue;">Gas Engine Data Sheet</h2> <p>Model : 12M33G2N0/5</p> <p>Frequency: 50HZ</p> <p>Fuel Type: Natural gas</p>   |               |  |      |            |
|--|------------------------------------|-----------|-------------------------------|-----------|---|---------------|--|------|------------|
| Engine Speed<br>(RPM)  | Continuous Power (COP)<br>(kWm/PS) |           | Rated Power (PRP)<br>(kWm/PS) |           |   |               |  |      |            |
|  | Gross Power                        | Net Power | Gross Power                   | Net Power |   |               |  |      |            |
| 1500   | 600/816                            | 570/775   | 600/816                       | 570/775   |   |               |  |      |            |
|  |                                    |           |                               |           |   |               |  |      |            |
| Generator Set Output   | Continuous Power (COP)             |           | Rated Power (PRP)             |           |   |               |  |      |            |
|  | kW                                 | kVA       | kW                            | kVA       |   |               |  |      |            |
|  | 500                                | 625       | 500                           | 625       |   |               |  |      |            |
|  |                                    |           |                               |           |   |               |  |      |            |
| <b>Rating definitions</b><br>Continuous Power (COP)<br>1. Power output available with constant load for unlimited time.<br>2. For continuous operation at constant load.<br>3. Without overload capacity.<br>Prime Power (PRP)<br>1. Power output available with varying load for unlimited time.<br>2. Average power output is no more than 70% of the PRP over 24 h of operation.<br>3. 100% load operation cannot exceed 500h every year.<br>4. 10% overload can operate 1h within every 12h, and the accumulative overload operation cannot exceed 25h every year. |                                    |           |                               |           | <b>Conversion table</b><br>1 in = 25.4 mm                      1 ft = 0.3048 m<br>1 cfm = 1.7 m <sup>3</sup> /h = 28.3 L/min    1 lb <sub>m</sub> = 0.45359 kg<br>1 kW = 1.36 PS = 1.34 HP        1 kcal/h = 1.163 W<br>1 Imp gal = 4.546 lit.              1 mm Hg = 133 Pa<br>1 US gal = 3.785 lit.                1 inch Hg = 3386 Pa<br>1 BTU=1.055 kJ                        1 mm water = 9.789 Pa<br>1 psi =6.89 kPa                        1 inch water = 248.64 Pa<br>1 lbm.ft =1.356 J                      1 lb <sub>f</sub> = 4.45 N |               |  |      |            |
| <b>Note:</b><br>1. The power rating is in accordance with ISO 3046.<br>2. Test conditions: 100 kPa, 25°C air inlet temperature, relative humidity of 30%.<br>3. The derating in different altitude and temperature can be confirmed from the engineers of Baudouin.<br>4. Natural gas refers to Standard Pipeline Natural gas, CNG and LNG with a methane number that is greater than 70.<br>Consult Sales Application Engineering and perform gas analysis for fuel types that vary from these conditions.  |                                    |           |                               |           | Update history:<br><br><br><table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Certified by:</td> <td> </td> </tr> <tr> <td>Date</td> <td style="text-align: center;">2019-10-25</td> </tr> </table>  | Certified by: |  | Date | 2019-10-25 |
| Certified by:  |                                    |           |                               |           |   |               |  |      |            |
| Date   | 2019-10-25                         |           |                               |           |   |               |  |      |            |

### Contents of tested gas

The technical data is based on natural gas with the following contents.

| Constituent                               | Abbrev | %Mole                    |
|---|--------|--------------------------|
| Methane                                   | CH4    | 97.05                    |
| Ethane                                    | C2H6   | 0.40                     |
| Ethylene                                  | C2H4   | <0.01                    |
| Propane                                   | C3H8   | 0.10                     |
| Butane                                    | C4H10  | 0.04                     |
| Pentane                                   | C5H12  | <0.02                    |
| Hexane                                    | C6H14  | <0.01                    |
| Nitrogen                                  | N2     | 1.92                     |
| Oxygen                                    | O2     | 0.49                     |
| Hydrogen                                  | H2     | <0.01                    |
| Carbon monoxide                           | CO     | <0.01                    |
| Carbon Dioxide                            | CO2    | <0.01                    |
| Density ( at 100 kPa, 25°C )              |        | 0.6852 kg/m <sup>3</sup> |
| Higher calorific value (at 100 kPa, 25°C) |        | 36.42 MJ/m <sup>3</sup>  |
| Lower calorific value (at 100 kPa, 25°C)  |        | 32.81 MJ/m <sup>3</sup>  |
| Methane number (at 100 kPa, 25°C)         |        | 97.3                     |

### General Data

|   |                                    |
|---|------------------------------------|
| Engine model.....   | 12M33G2N0/5                        |
| No. of Cylinders/Valves.....  | 12/48                              |
| Cylinders arrangement .....   | V-engine                           |
| Bore×Stroke mm (in) .....   | 150×185 (5.9×7.28)                 |
| Displacement L (in <sup>3</sup> ) .....                             | 39.2 (2392)                        |
| Thermodynamic Cycle.....  | 4 stroke                           |
| Fuel type.....  | Natural gas                        |
| Control system.....   | WOODWARD                           |
| Combustion system .....   | Spark-ignited                      |
| Fuel system .....   | Lean Burn                          |
| Aspiration.....   | Turbocharged and Intercooled       |
| Compression ratio.....  | 11:1                               |
| Flywheel housing .....  | SAE0                               |
| Flywheel.....   | 18"                                |
| Inertia of flywheel kg·m <sup>2</sup> (lbm·ft <sup>2</sup> ) .....  | 7.18 (170.4)                       |
| Inertia of crankshaft kg·m <sup>2</sup> (lbm·ft <sup>2</sup> )..... | 4.52 (107.3)                       |
| Emission standard .....   | N/A                                |
| Engine dimensions and weight without radiator                       |                                    |
| - Length mm (in.).....  | 2164 (82.8)                        |
| - Width mm (in.).....   | 1497 (58.9)                        |
| - Height mm (in.) .....   | 1710 (67.3)                        |
| Engine dry weight kg (lbm).....                                     | 3390 (7474)                        |
| Direction of rotation.....  | Anticlockwise (from flywheel side) |
| Max. ambient temperature restriction °C (°F).....                   | 35 (95)                            |

## Performance

|                                    |               |
|------------------------------------|---------------|
| Idle speed RPM.....                | 700-750       |
| Rated engine speed RPM.....        | 1500          |
| Mean piston speed m/s (ft/s) ..... | 9.25 (30.3)   |
| BMEP @ PRP Bar (psi).....          | 12.24 (177.6) |

## Air intake system

|  |             |
|--|-------------|
| Max. temperature rise before turbocharger °C (°F).....   | ≤5 (41)     |
| Air intake restriction with clean filter kPa (psi) ..... | ≤3 (0.44)   |
| Air intake restriction with dirty filter kPa (psi) ..... | ≤5 (0.73)   |
| Air flow Mass @ PRP kg/h (lb/hr) .....                   | 2660 (5864) |
| Air flow Volume @ PRP m <sup>3</sup> /min (cfm).....     | 37.4 (1320) |

## Fuel system

|  |             |
|--|-------------|
| Min. gas pressure of mixer inlet kPa (psi).....  | 2 (0.29)    |
| Max. gas pressure of mixer inlet kPa (psi) ..... | 7 (1.02)    |
| Pressure loss of gas mixer kPa (psi) .....       | 0.5 (0.073) |
| Suction pressure max. kPa (psi).....             | 3 (0.435)   |
| Max. gas inlet temperature °C (°F).....          | 50 (122)    |
| Min. diameter of inlet pipe mm (in.) .....       | 40 (1.57)   |

## Exhaust system

|  |              |
|--|--------------|
| Max. exhaust back pressure kPa (psi) .....                   | 7.5 (1.09)   |
| Max. exhaust temperature before turbocharger °C (°F).....    | 730 (1346)   |
| Max. exhaust temperature after turbocharger °C (°F).....     | 680 (1256)   |
| Exhaust flow Mass @ PRP kg/h (lb/hr) .....                   | 2771 (6109)  |
| Exhaust flow Volume @ PRP m <sup>3</sup> /min (cfm) .....    | 129.5 (4571) |
| Min. diameter of the exhaust pipe mm (in.) .....             | 195 (7.68)   |
| Max. bending moment at the turbocharger flange (N • m) ..... | 10           |
| Exhaust Manifold .....                                       | dry          |

## Cooling system

|   |                 |
|---|-----------------|
| Coolant capacity of engine without radiator L (Imp gal) .....           | 75.94 (16.7)    |
| Coolant flow of engine pump @ rated speed m <sup>3</sup> /h (cfm) ..... | 71 (41.7)       |
| Min. pressure in cooling system kPa (psi) .....                         | 50 (7.26)       |
| Max. additional restriction kPa (psi) .....                             | 50 (7.26)       |
| Min. inner diameter of coolant outlet pipe mm (in.) .....               | 45 (1.77)       |
| Alarm temperature of coolant °C (°F).....                               | 95 (203)        |
| Shut down temperature of coolant °C (°F).....                           | 98 (208.4)      |
| Thermostat opening temp. /full open temp. °C (°F) .....                 | 76/88 (169/190) |

### Fan

|  |     |
|--|-----|
| - rotating speed RPM .....                 | N/A |
| - diameter mm (in.).....                   | N/A |
| - number of blades .....                   | N/A |
| - Material.....                            | N/A |
| - type.....                                | N/A |
| - air flow m <sup>3</sup> /min (cfm) ..... | N/A |
| - power consumption kW (PS) .....          | N/A |

**Intercooler system**

|   |              |
|---|--------------|
| Intercooler system type .....   | Air to Water |
| Max. intake temperature after intercooler °C (°F).....                  | 55 (131)     |
| Coolant capacity of intercooler L (Imp gal) .....                       | 8.2 (1.8)    |
| Max. pressure drop of the intercooler kPa (psi) .....                   | 12 (1.74)    |
| Coolant flow of intercooler @ rated speed m <sup>3</sup> /h (cfm) ..... | 23 (13.5)    |

**Lubrication system**

|  |                     |
|--|---------------------|
| Oil capacity Low/High L (Imp gal) .....                  | 120/146 (26.4/32.1) |
| Oil pressure at idel speed kPa (psi).....                | ≥200 (29)           |
| Oil pressure at rated speed kPa (psi) .....              | 400~650 (58.1-94.3) |
| Oil pressure limit. Lowest value kPa (psi).....          | 200 (29)            |
| Oil pressure limit. Highest value kPa (psi) .....        | 1000 (145.1)        |
| Max. oil temperature °C (°F).....                        | 105 (221)           |
| Oil consumption %Gas .....                               | ≤0.3                |
| Total system capacity including filter L (Imp gal) ..... | 160 (35.2)          |
| Oil flow L/min (cfm).....                                | ≥392 (13.84)        |

**Electrical system**

|  |           |
|--|-----------|
| Electrical system voltage V .....                                    | 24        |
| Starter power kW .....   | 8.5       |
| Battery charger current A .....                                      | 55        |
| Max. electric resistance of the starting circuit mΩ .....            | 2         |
| Min. sectional area of wire mm <sup>2</sup> (in <sup>2</sup> ) ..... | 70 (0.11) |
| No. of teeth on flywheel ring gear .....                             | 194       |
| No. of teeth on starter gear.....                                    | 12        |

**Cold start capability**

|  |         |
|--|---------|
| Min. cold start temp. without air preheating °C (°F) ..... | -5 (23) |
|--|---------|

**Noise**

|                                     |       |
|-------------------------------------|-------|
| Sound pressure level dB(A) 1m ..... | 97.9  |
| Acoustic power level dB(A) .....    | 113.2 |

**Emission Limit**

|                              |       |
|------------------------------|-------|
| NOx mg/Nm <sup>3</sup> ..... | ≤500  |
| CO g/kW·h .....              | ≤1.35 |
| NMHC g/kW·h.....             | ≤0.5  |
| HC g/kW·h.....               | ≤1.5  |

**Heat balance test data**

|  |              |               |                 |               |
|--|--------------|---------------|-----------------|---------------|
| Ambient temperature                        | °C (°F)      | 28 (82.4)     |                 |               |
| Load                                       |              | 100% of PRP   | 75% of PRP      | 50% of PRP    |
| ISO standard rating                        | kWm (PS)     | 600 (816)     | 450 (612)       | 300 (408)     |
| Air ratio                                  |              | 1.41          | 1.39            | 1.35          |
| Engine total heat                          | kJ/s (BTU/s) | 1536.2 (1456) | 1267.4 (1201.3) | 929.4 (880.9) |
| Heat taken away by the coolant             | kJ/s (BTU/s) | 286.7 (271.8) | 215 (203.8)     | 143.4 (135.9) |
| Intercooler heat dissipating capacity      | kJ/s (BTU/s) | 108.5 (102.8) | 81.4 (77.2)     | 54.3 (51.5)   |
| Heat taken away by the exhaust up to 120°C | kJ/s (BTU/s) | 585.4 (554.9) | 294.5 (73.1)    | 220.9 (209.4) |
| Radiated heat to ambient                   | kJ/s (BTU/s) | 76.8 (72.8)   | 76.8 (72.8)     | 76.8 (72.8)   |
| Gas Consumption                            | (g/kW.h)     | 186.7         | 195.1           | 213.3         |
| Gas Consumption                            | (kg/h)       | 112.02        | 87.8            | 64.0          |
| Mechanical Efficiency                      | %            | 39.1          | 35.5            | 32.3          |
| Therma Efficiency                          | %            | 51.3          | 46.6            | 45.0          |
| Total Efficiency                           | %            | 90.4          | 82.1            | 77.3          |

Note: The above data are obtained from the laboratory and for reference only.