# Application & Installation Guide

## G3300, 3400, & CG137 Gas Compression Engines

LEBW0017-02

# Foreword

This section of the Application and Installation Guide lists Technical Information for Cat® engines listed on the cover of this section. Additional engine systems, components, and dynamics are addressed in other sections of this Application and Installation Guide.

Engine-specific information and data are available from a variety of sources. Refer to the Introduction section of this guide for additional references.

Systems and components described in this guide may not be available or applicable for every engine.

# Table of Contents

**Foreword** . . . . . 3

**1.0 Technical Information** . . . . . 5

**2.0 General Data** . . . . . 6-8

**3.0 Combustion Air System** . . . . . 9-10

**4.0 Exhaust Gas System** . . . . . 11

**5.0 Fuel System** . . . . . 12

**6.0 Lubricating Oil System** . . . . . 13-14

**7.0 Cooling Water System** . . . . . 15-16

**8.0 Torsional Vibration Analysis Information** . . . . . 17-19

8.1 Engine Mass Elastic Data . . . . . 17

**9.0 Flywheel and Damper Information** . . . . . 20

**10.0 TVA Limits** . . . . . 21

**11.0 Harmonic Loading** . . . . . 22

**12.0 Unbalanced Forces and Moments** . . . . . 23-24

**13.0 Starting System** . . . . . 25-28

13.1 Vane Starter Performance Curve . . . . . 25

13.2 Turbine Starter Performance Curves . . . . . 26

13.3 Electric Starter Performance Curves . . . . . 28

# 1.0 Technical Information

This guide provides technical data for the Cat G3300, G3400, and CG137 gas engine models offered to the Oil and Gas Market. At the time of publishing, this data is correct; updates will be included periodically and this section republished. Dealers may use the Technical Marketing Information system for the most current data.

# 2.0 General Data

**G3300 Engines**

| System Description Metric (English) | G3304 | G3304B | G3306 | G3306B |
|---|---|---|---|---|
| Cylinder Bore – mm (in) | 121 (4.75) | 121 (4.75) | 121 (4.75) | 121 (4.75) |
| Stroke – mm (in) | 152 (6) | 152 (6) | 152 (6) | 152 (6) |
| Displacement/Cylinder – L ($in^3$) | 1.75 (106.3) | 1.75 (106.3) | 1.75 (106.3) | 1.75 (106.3) |
| Total Displacement – L ($in^3$) | 7 (425) | 7 (425) | 10.5 (638) | 10.5 (638) |
| Rated Speed – rpm | 1800 | 1800 | 1800 | 1800 |
| Low Idle Speed* – rpm | 900 | 900 | 900 | 900 |
| Operating Speed Range* – rpm | 900-1800 | 900-1800 | 1000-1800 (NA)<br>1200-1800 (TA) | 1000-1800 (NA)<br>1200-1800 (TA) |
| Firing Order – CCW | 1-3-4-2 | 1-3-4-2 | 1-5-3-6-2-4 | 1-5-3-6-2-4 |
| Crank Radius – mm (in) | 76.2 (3) | 76.2 (3) | 76.2 (3) | 76.2 (3) |
| Connecting Rod Length – mm (in) | 243.71 (9.6) | 243.71 (9.6) | 243.71 (9.6) | 243.71 (9.6) |
| Overspeed Shutdown – % | 110 | 110 | 110 | 110 |
| Dry Weight NA (basic engine feature only) – kg (lb) | 757.5 (1670) | 885 (1950) | 925 (2040) | 1021 (2250) |
| Dry Weight TA (basic engine feature only) – kg (lb) | – | – | 948 (2090) | 1111 (2450) |
| *All speeds depend on the performance specification for the individual engine serial number, which can be found on the performance data. | | | | |

**Table 2.1**

**G3400 Engines**

| System Description Metric (English) | G3406 | G3408 G3408C | G3412 TA G3412C |
|---|---|---|---|
| Cylinder Bore – mm (in) | 137 (5.4) | 137 (5.4) | 137 (5.4) |
| Stroke – mm (in) | 165 (6.5) | 152 (6) | 152 (6) |
| Displacement/Cylinder – L ($in^3$) | 2.4 (149) | 2.25 (137.3) | 2.25 (137.3) |
| Total Displacement – L ($in^3$) | 14.6 (893) | 18 (1098) | 27 (1648) |
| Rated Speed – rpm | 1800 | 1800 | 1800 |
| Low Idle Speed* – rpm | 900 or 1200 | 900 or 1200 | 900 |
| Operating Speed Range* – rpm | 1000-1800 (NA)<br>1400-1800 (TA) | 1000-1800 (NA)<br>1400-1800 (TA) | 1400-1800 |
| Firing Order – CCW | 1-5-3-6-2-4 | 1-8-4-3-6-5-7-2 | 1-4-9-8-5-2-<br>11-10-3-6-7-12 |
| Crank Radius – mm (in) | 82.55 (3.25) | 76.2 (3) | 76.2 (3) |
| Connecting Rod Length – mm (in) | 261.62 (10.3) | 261.62 (10.3) | 261.62 (10.3) |
| Overspeed Shutdown – % | 120 | 120 | 120 |
| Dry Weight NA (basic engine feature only) – kg (lb) | 1316 (2900) | 1565 (3450) | – |
| Dry Weight TA (basic engine feature only) – kg (lb) | 1361 (3000) | 1678 (3700) | 2320 (5115) |
| Dry Weight C (basic engine feature only) – kg (lb) | – | 2041 (4500) | 2800 (6173) |
| *All speeds depend on the performance specification for the individual engine serial number, which can be found on the performance data. | | | |

**Table 2.2**

**CG137 Engines**

| System Description Metric (English) | G3406 | G3408 G3408C |
|---|---|---|
| Cylinder Bore – mm (in) | 137 (5.4) | 137 (5.4) |
| Stroke – mm (in) | 152 (6) | 152 (6) |
| Displacement/Cylinder – L ($in^3$) | 2.25 (137.3) | 2.25 (137.3) |
| Total Displacement – L ($in^3$) | 18 (1098) | 27 (1648) |
| Rated Speed – rpm | 1800 | 1800 |
| Low Idle Speed* – rpm | 900 | 900 |
| Operating Speed Range* – rpm | 1350-1800 | 1350-1800 |
| Firing Order – CCW | 1-8-4-3-6-5-7-2 | 1-4-9-8-5-2-11-10-3-6-7-12 |
| Crank Radius – mm (in) | 76.2 (3) | 76.2 (3) |
| Connecting Rod Length – mm (in) | 261.62 (10.3) | 261.62 (10.3) |
| Overspeed Shutdown – % | 108 | 108 |
| Dry Weight TA (basic engine feature only) – kg (lb) | 2200 (4850) | 2835 (6250) |
| *All speeds depend on the performance specification for the individual engine serial number, which can be found on the performance data. | | |

**Table 2.3**

# 3.0 Combustion Air System

### G3300 Engines

| System Description Metric (English) | G3304 NA G3304B NA | G3306 NA G3306B NA | G3306 TA G3306B TA ATAAC 32°C SCAC | G3306 TA G3306B TA 54°C SCAC |
|---|---|---|---|---|
| High Inlet Manifold Air Temperature – °C (°F) | 25 (77) * | 25 (77) * | 49 (120) | 66 (150) |
| Air Inlet Restriction (new/max) – mm $H_2O$ (in $H_2O$) | 125/380 (5/15) | 125/380 (5/15) | 125/380 (5/15) | 125/380 (5/15) |
| *This temperature is for an engine at an altitude of 152 m (500 ft) above sea level. A greater temperature or a higher altitude requires derating. | | | | |

**Table 3.1**

### G3406 Engines

| System Description Metric (English) | G3304 NA | G3306 TA 54°C SCAC |
|---|---|---|
| High Inlet Manifold Air Temperature – °C (°F) | 25 (77) * | 66 (150) |
| Air Inlet Restriction (new/max) – mm $H_2O$ (in $H_2O$) | 125/380 (5/15) | 125/380 (5/15) |
| *This temperature is for an engine at an altitude of 152 m (500 ft) above sea level. A greater temperature or a higher altitude requires derating. | | |

**Table 3.2**

### G3408 Engines

| System Description Metric (English) | G3408 NA | G3408 TA G3408 TA | G3408C 54°C SCAC |
|---|---|---|---|
| High Inlet Manifold Air Temperature – °C (°F) | 25 (77) * | 66 (150) | 66 (150) |
| Air Inlet Restriction (new/max) – mm $H_2O$ (in $H_2O$) | 125/380 (5/15) | 125/380 (5/15) | 125/380 (5/15) |
| *This temperature is for an engine at an altitude of 152 m (500 ft) above sea level. A greater temperature or a higher altitude requires derating. | | | |

**Table 3.3**

### G3412 Engines

| System Description Metric (English) | G3412 TA 54°C SCAC | G3412C 54°C SCAC |
|---|---|---|
| High Inlet Manifold Air Temperature – °C (°F) | 66 (150) | 66 (150) |
| Air Inlet Restriction (new/max) – mm $H_2O$ (in $H_2O$) | 125/380 (5/15) | 125/380 (5/15) |

**Table 3.4**

### CG137 Engines

| System Description Metric (English) | CG137 – 8 54°C SCAC | CG137 – 12 54°C SCAC |
|---|---|---|
| High Inlet Manifold Air Temperature – °C (°F) | 72 (162) | 72 (162) |
| Air Inlet Restriction (new/max) – mm $H_2O$ (in $H_2O$) | 125/380 (5/15) | 125/380 (5/15) |

**Table 3.5**

# 4.0 Exhaust Gas System

**All Engines**

| System Description<br>Metric (English) | G3300<br>G3400<br>CG137 |
|---|---|
| Exhaust System Backpressure, max NA – kPa (in $H_2O$) | 3 (12) |
| Exhaust System Backpressure, max TA – kPa (in $H_2O$) | 6.7 (27) |
| Loading on Turbocharger/Exhaust Outlet, maximum allowed vertical force – N (lb) | 111 (25) |
| Loading on Turbocharger/Exhaust Outlet, maximum allowed moment – N•m (lb-ft) | 120 (88.5) |

**Table 4.1**

# 5.0 Fuel System

### G3300 Engines

| System Description Metric (English) | G3304 NA G3304B NA | G3306 NA G3306B NA | G3306 TA G3306B TA |
|---|---|---|---|
| Fuel Supply Pressure min/max – kPa (psi) | 10.3/68.9 (1.5/10) | 10.3/68.9 (1.5/10) | 82.7/172.4 (12/25) |

**Table 5.1**

### G3406 Engines

| System Description Metric (English) | G3406 NA | G3406 TA High Pressure | G3406 TA Low Pressure |
|---|---|---|---|
| Fuel Supply Pressure min/max – kPa (psi) | 10.3/34.5 (1.5/5) | 137.9/172.4 (20/25) | 10.3/34.5 (1.5/5) |

**Table 5.2**

### G3408 Engines

| System Description Metric (English) | G3408 NA | G3408 TA | G3408C |
|---|---|---|---|
| Fuel Supply Pressure min/max – kPa (psi) | 10.3/34.5 (1.5/5) | 137.9/172.4 (20/25) | 10.3/34.5 (1.5/5) |

**Table 5.3**

### G3412 Engines

| System Description Metric (English) | G3412 TA | G3412C |
|---|---|---|
| Fuel Supply Pressure min/max – kPa (psi) | 137.9/172.4 (20/25) | 10.3/34.5 (1.5/5) |

**Table 5.4**

### CG137 Engines

| System Description Metric (English) | CG137 – 8 (WWF) | CG137 – 8 (ST8) | CG137 – 12 |
|---|---|---|---|
| Fuel Supply Pressure min/max – kPa (psi) | 10.3/34.5 (1.5/5) | 137.9/275.8 (20/40) | 10.3/34.5 (1.5/5) |

**Table 5.5**

### All Engines

| System Description Metric (English) | G3300/G3400/CG137 |
|---|---|
| Fuel Fluctuation Pressure – kPa (psi) | ±1.7 (±0.25) |

**Table 5.6**

# 6.0 Lubricating Oil System

**G3300 Engines**

| System Description Metric (English) | G3304 NA G3304B NA | G3306 NA G3306B NA | G3306 TA G3306B TA (2 ring)*** | G3306 TA G3306B TA (3 ring)*** |
|---|---|---|---|---|
| Low Oil Pressure Shutdown @ High Idle – kPa (psi) | 156 (23) | 156 (23) | 156 (23) | 156 (23) |
| Low Oil Pressure Shutdown @ Low Idle – kPa (psi) | 110 (16) | 110 (16) | 110 (16) | 110 (16) |
| High Engine Oil Temp* Shutdown – °C (°F) | 110 (230) | 110 (230) | 110 (230) | 110 (230) |
| BSOC @ 100% Load** – g/bkW-hr (lb/bhp-hr) | 0.913 (0.0015) | 0.913 (0.0015) | 0.73 (0.0012) | 0.487 (0.0008) |
| *See "Engine Oil Temperature" on Page 14.<br>**See "Estimating Oil Consumption" on Page 14.<br>***Piston rings. | | | | |

**Table 6.1**

**G3400 Engines**

| System Description Metric (English) | G3406 | G3408 | G3408C | G3412 TA | G3412C |
|---|---|---|---|---|---|
| Low Oil Pressure Shutdown @ High Idle – kPa (psi) | 275 (40) | 275 (40) | 275 (40) | 275 (40) | 275 (40) |
| Low Oil Pressure Shutdown @ Low Idle – kPa (psi) | 100 (15) | 100 (15) | 100 (15) | 100 (15) | 100 (15) |
| High Engine Oil Temp* Shutdown – °C (°F) | 110 (230) | 110 (230) | 110 (230) | 110 (230) | 110 (230) |
| BSOC @ 100% Load** NA only – g/bkW-hr (lb/bhp-hr) | 0.913 (0.0015) | 0.913 (0.0015) | – | – | – |
| BSOC @ 100% Load** 2 ring (TA)*** – g/bkW-hr (lb/bhp-hr) | 0.73 (0.0012) | 0.73 (0.0012) | 0.73 (0.0012) | 0.73 (0.0012) | 0.73 (0.0012) |
| BSOC @ 100% Load** 3 ring (TA)*** – g/bkW-hr (lb/bhp-hr) | 0.487 (0.0008) | 0.487 (0.0008) | 0.487 (0.0008) | 0.487 (0.0008) | 0.487 (0.0008) |
| *See "Engine Oil Temperature" on Page 14.<br>**See "Estimating Oil Consumption" on Page 14.<br>***Piston rings. | | | | | |

**Table 6.2**

**CG137 Engines**

| System Description Metric (English) | CG137 – 8 | CG137 – 12 |
|---|---|---|
| Low Oil Pressure Shutdown @ High Idle – kPa (psi) | 250 (36) | 250 (36) |
| Low Oil Pressure Shutdown @ Low Idle – kPa (psi) | 110 (16) | 110 (16) |
| High Engine Oil Temp* Shutdown – °C (°F) | 110 (230) | 110 (230) |
| BSOC @ 100% Load** – g/bkW-hr (lb/bhp-hr) | 0.487 (0.0008) | 0.487 (0.0008) |
| *See "Engine Oil Temperature" on Page 14.<br>**See "Estimating Oil Consumption" on Page 14. | | |

**Table 6.3**

### Engine Oil Temperature

The engine oil is cooled by the jacket water. If the cooling system cannot remove the heat from the jacket water, the oil will not cool properly. Oil will degrade rapidly at temperatures above 99°C (210°F). Oil temperatures that are higher than normal indicate a problem in the lubrication system and/or in the cooling system. This can damage these components: cylinder heads, cylinder liners, pistons and crankshaft bearings.

### Estimating Oil Consumption

Oil consumption, along with fuel consumption and maintenance information, can be used to estimate the total operating cost of a Cat engine. Oil consumption data may also be used to estimate the quantity of make-up oil required to accommodate maintenance intervals. Many factors can affect oil consumption. Some of these factors are percent load, oil density, oil additive packages, and maintenance practices. The rate of oil consumption is called BSOC (brake specific oil consumption) and the unit of measure is grams per brake kilowatt hour (g/bkW-hr) or pounds per brake horsepower hour (lb/bhp-hr). The above charts list the typical BSOC for the Cat engines listed above operating at 100% load factor, which are maintained according to Caterpillar recommended maintenance management guidelines.

# 7.0 Cooling Water System

**G3300 Engines**

| System Description<br>Metric (English) | G3304<br>G3304B | G3306<br>G3306B |
|---|---|---|
| Cooling Circuit Configuration – NA | JW+OC | JW+OC |
| Cooling Circuit Configuration* – TA | – | JW+OC, AC |
| High Engine Coolant Temp, max – °C (°F) | 105 (221) | 105 (221) |
| Jacket Water Circuit Volume (engine only) – L (gal) | 16 (4.23) | 20 (5.28) |
| Aftercooler Circuit Volume – L (gal) | – | 1.9 (0.5) |
| *TA engines have a separate circuit aftercooler. | | |

**Table 7.1**

**G3400 Engines**

| System Description<br>Metric (English) | G3406 | G3408<br>G3408C | G3412 TA<br>G3412C |
|---|---|---|---|
| Cooling Circuit Configuration – NA | JW+OC | JW+OC | – |
| Cooling Circuit Configuration* – TA | JW+OC, AC | JW+OC, AC | JW+OC, AC |
| High Engine Coolant Temp, max – °C (°F) | 105 (221) | 105 (221) | 105 (221) |
| Jacket Water Circuit Volume (engine only) – L (gal) | 30.3 (8) | 54.9 (14.5) | 75.7 (20) |
| Aftercooler Circuit Volume – L (gal) | 7.6 (2) | 3.8 (1) | 7.6 (2) |
| *TA engines have a separate circuit aftercooler. | | | |

**Table 7.2**

**CG137 Engines**

| System Description<br>Metric (English) | CG137 – 8 | CG137 – 12 |
|---|---|---|
| Cooling Circuit Configuration* – TA | JW+OC, AC | JW+OC, AC |
| High Engine Coolant Temp, max – °C (°F) | 110 (230) | 110 (230) |
| Jacket Water Circuit Volume (engine only) – L (gal) | 54.9 (14.5) | 75.7 (20) |
| Aftercooler Circuit Volume – L (gal) | 3.8 (1) | 7.6 (2) |
| *TA engines have a separate circuit aftercooler. | | |

**Table 7.3**

**Cooling System Temperature Limits**

| System Description<br>Metric (English) | G3300<br>G3300B | G3400 | CG137 |
|---|---|---|---|
| Oil Cooler Inlet Temperature, max – °C (°F) | 82 (180) | 82 (180) | 82 (180) |

**Table 7.4**

**Cooling System Pressure Limits**

| System Description<br>Metric (English) | G3300<br>G3300B | G3400 | CG137 |
|---|---|---|---|
| Aftercooler Core Operating Pressure Range – kPa (psi) | 248-276 (36-40) | 248-276 (36-40) | 248-276 (36-40) |
| Engine Block operating pressure range – kPa (psi) | 248-276 (36-40) | 248-276 (36-40) | 248-276 (36-40) |
| Maximum Static Head, pump inlet – kPa (psi) | 196 (28.4) | 196 (28.4) | 196 (28.4) |
| Maximum Static Head, engine outlet – kPa (psi) | 196 (28.4) | 196 (28.4) | 196 (28.4) |

**Table 7.5**

**Radiator Cap Pressure Settings**

| System Description<br>Metric (English) | G3300<br>G3300B | G3400 | CG137 |
|---|---|---|---|
| Standard Jacket Water System, 88-99°C (190-210°F) maximum cap pressure – kPa (psi) | 28-48 (4-7) | 28-48 (4-7) | 28-48 (4-7) |
| Landfill/Corrosive JW System, 110°C (230°F) maximum cap pressure – kPa (psi) | 131-151 (19-22) | 131-151 (19-22) | 131-151 (19-22) |
| Cogeneration JW System, 127°C (260°F) relief valve pressure – kPa (psi) | 196 (28.4) | 196 (28.4) | 196 (28.4) |

**Table 7.6**

**Note:** All pressure values shown are gauge pressure.

# 8.0 Torsional Vibration Analysis Information

**Note:** Torsional Vibration Analysis (TVA) information is accessible through the Technical Marketing Information (TMI) system. The TMI system will hold the most current TVA information and should be used in place of these values.

## 8.1 Engine Mass Elastic Data

Basic engine information (e.g. bore, stroke) can be found in the "General Data" section of this document.

**G3304 and G3304B Engines**

| Mass ID | Inertia N•m-s$^2$ | Spring ID | Stiffness MN-m/rad | Diameter mm |
|---|---|---|---|---|
| VD | * | – | – | – |
| FRT | 0.0046 | EK1 | 1.128 | 61.98 |
| EJ1 | 0.0893 | EK2 | 1.877 | 76.2 |
| EJ2 | 0.0893 | EK3 | 1.877 | 76.2 |
| EJ3 | 0.0893 | EK4 | 1.877 | 76.2 |
| EJ4 | 0.0893 | EK5 | 3.17 | 76.2 |
| REAR | 0.0162 | – | – | – |
| FW | * | – | – | – |
| *See separate table for damper and flywheel information. | | | | |
| Legend:<br>VD – Damper<br>REAR – Rear gear train | | FRT – Front gear train<br>FW – Flywheel | | EJn – Polar moment of inertia<br>EKn – Stiffness |

**Table 8.1**

**G3306 and G3306B Engines**

| Mass ID | Inertia N•m-s² | Spring ID | Stiffness MN-m/rad | Diameter mm |
|---|---|---|---|---|
| VD | * | – | – | – |
| FRT | 0.0046 | EK1 | 1.134 | 61.98 |
| EJ1 | 0.0926 | EK2 | 1.912 | 76.2 |
| EJ2 | 0.0633 | EK3 | 1.912 | 76.2 |
| EJ3 | 0.0893 | EK4 | 1.912 | 76.2 |
| EJ4 | 0.0893 | EK5 | 1.912 | 76.2 |
| EJ5 | 0.0633 | EK6 | 1.912 | 76.2 |
| EJ6 | 0.0926 | EK7 | 3.221 | 76.2 |
| REAR | 0.0162 | – | – | – |
| FW | * | – | – | – |
| *See separate table for damper and flywheel information. | | | | |
| Legend:<br>VD – Damper<br>REAR – Rear gear train | | FRT – Front gear train<br>FW – Flywheel | | EJn – Polar moment of inertia<br>EKn – Stiffness |

**Table 8.2**

**G3406 Engines**

| Mass ID | Inertia N•m-s² | Spring ID | Stiffness MN-m/rad | Diameter mm |
|---|---|---|---|---|
| VD | * | – | – | – |
| FRT | 0.0922 | EK1 | 5.54 | 90 |
| EJ1 | 0.2240 | EK2 | 3.68 | 90 |
| EJ2 | 0.1130 | EK3 | 3.68 | 90 |
| EJ3 | 0.2160 | EK4 | 3.6 | 90 |
| EJ4 | 0.2160 | EK5 | 3.68 | 90 |
| EJ5 | 0.1130 | EK6 | 3.68 | 90 |
| EJ6 | 0.2240 | EK7 | 5.75 | 90 |
| REAR | 0.0241 | – | – | – |
| FW | * | – | – | – |
| *See separate table for damper and flywheel information. | | | | |
| Legend:<br>VD – Damper<br>REAR – Rear gear train | | FRT – Front gear train<br>FW – Flywheel | | EJn – Polar moment of inertia<br>EKn – Stiffness |

**Table 8.3**

**G3408, G3408C, and CG137 – 8 Engines**

| Mass ID | Inertia N•m-s² | Spring ID | Stiffness MN-m/rad | Diameter mm |
|---|---|---|---|---|
| VD | * | – | – | – |
| FRT | 0.0427 | EK1 | 4.536 | 97 |
| EJ1 | 0.2592 | EK2 | 2.455 | 97 |
| EJ2 | 0.2608 | EK3 | 2.908 | 97 |
| EJ3 | 0.2466 | EK4 | 3.282 | 97 |
| EJ4 | 0.2712 | EK5 | 3.851 | 97 |
| REAR | 0.0230 | – | – | – |
| FW | * | – | – | – |
| *See separate table for damper and flywheel information. | | | | |
| Legend:<br>VD – Damper<br>REAR – Rear gear train | | FRT – Front gear train<br>FW – Flywheel | | EJn – Polar moment of inertia<br>EKn – Stiffness |

**Table 8.4**

**G3412 TA, G3412C, and CG137 – 12 Engines**

| Mass ID | Inertia N•m-s² | Spring ID | Stiffness MN-m/rad | Diameter mm |
|---|---|---|---|---|
| VD | * | – | – | – |
| FRT | 0.0464 | EK1 | 6.805 | 97 |
| EJ1 | 0.3131 | EK2 | 3.743 | 97 |
| EJ2 | 0.2724 | EK3 | 3.604 | 97 |
| EJ3 | 0.2657 | EK4 | 3.245 | 97 |
| EJ4 | 0.2673 | EK5 | 3.643 | 97 |
| EJ5 | 0.2724 | EK6 | 3.743 | 97 |
| EJ6 | 0.3129 | EK7 | 6.804 | 97 |
| REAR | 0.0163 | – | – | – |
| FW | * | – | – | – |
| *See separate table for damper and flywheel information. | | | | |
| Legend:<br>VD – Damper<br>REAR – Rear gear train | | FRT – Front gear train<br>FW – Flywheel | | EJn – Polar moment of inertia<br>EKn – Stiffness |

**Table 8.5**

# 9.0 Flywheel and Damper Information

**Flywheel Data**

| Engine | Part Number | Inertia - Flywheel and Ring Gear (N•m-s$^2$) |
|---|---|---|
| G3304 and G3304B | 7N-4137 | 2.435 |
| G3306 and G3306B | 7N-4137 | 2.435 |
| G3406 | 7W-8953 | 1.911 |
| G3408 and G3408C | 1N-3473 | 6.844 |
| G3412 and G3412C | 1N-3473 | 6.844 |
| CG137 – 8 | 381-9092 | 6.444 |
| CG137 – 12 | 351-1923 | 6.444 |

**Table 9.1**

**Damper Data**

| Engine | Part Number | Inertia - Housing (N•m-s$^2$) | Inertia - Ring (N•m-s$^2$) |
|---|---|---|---|
| G3304 and G3304B* | N/A | N/A | N/A |
| G3306 and G3306B | 3N-2885 | 0.061 | 0.145 |
| G3406 | 4P-5894 | 0.084 | 0.172 |
| G3408 and G3408C | 139-9028 | 0.299 | 0.624 |
| G3412 and G3412C | 139-9028 | 0.299 | 0.624 |
| CG137 – 8 | 381-9128 | 0.299 | 0.624 |
| CG137 – 12 | 351-1917 | 0.299 | 0.624 |
| *G3304 engines do not have a damper. | | | |

**Table 9.2**

# 10.0 TVA Limits

| System Description | G3300<br>G3304<br>CG137 |
|---|---|
| Engine Front End Amplitude Limits – 0.5 and 1st Orders | ± 0.5° |
| Engine Front End Amplitude Limits – 1.5 Order | ± 0.25° |
| Engine Front End Amplitude Limits – All Orders Above 1.5 | ± 0.15° |
| Crankshaft Stress Limits – Single Order | ± 21 MPa |

**Table 10.1**

# 11.0 Harmonic Loading

| Harmonic Order | Real Component (kPa) | | Imaginary Component* (kPa) | |
|---|---|---|---|---|
| | Engine BMEP = 0 kPa | Engine BMEP = 2068.5 kPa | Engine BMEP = 0 kPa | Engine BMEP = 2068.5 kPa |
| 0.5 | 54.34 | 579.05 | -87.62 | -577.74 |
| 1.0 | 30.56 | 305.24 | -145.48 | -1061.48 |
| 1.5 | 10.13 | 54.76 | -171.59 | -921.34 |
| 2.0 | -1.09 | -87.08 | -149.26 | -790.93 |
| 2.5 | -8.99 | -107.22 | -151.22 | -626.96 |
| 3.0 | -10.63 | -110.25 | -127.89 | -512.18 |
| 3.5 | -12.51 | -118.58 | -112.43 | -415.31 |
| 4.0 | -13.44 | -120.67 | -93.35 | -319.32 |
| 4.5 | -13.67 | -111.17 | -73.66 | -242.57 |
| 5.0 | -10.92 | -94.38 | -61.55 | -193.66 |
| 5.5 | -9.89 | -85.87 | -51.41 | -153.76 |
| 6.0 | -8.04 | -79.28 | -44.10 | -115.29 |
| 6.5 | -6.67 | -64.78 | -37.80 | -85.72 |
| 7.0 | -5.27 | -54.05 | -32.00 | -67.68 |
| 7.5 | -4.56 | -48.26 | -26.59 | -53.93 |
| 8.0 | -3.71 | -44.17 | -21.97 | -38.72 |
| 8.5 | -2.98 | -35.89 | -18.09 | -27.37 |
| 9.0 | -2.22 | -29.86 | -14.91 | -21.88 |
| 9.5 | -2.09 | -26.77 | -12.55 | -17.63 |
| 10.0 | -2.22 | -24.77 | -10.52 | -12.01 |
| 10.5 | -1.86 | -19.99 | -8.53 | -7.86 |
| 11.0 | -1.52 | -16.71 | -7.54 | -6.61 |
| 11.5 | -1.24 | -15.28 | -6.55 | -5.87 |
| 12.0 | -0.77 | -14.29 | -5.69 | -3.68 |

These values are for all G3300, G3400, and CG137 engines.
This table includes gas-only harmonics; inertial harmonics are not included.
*See the Caterpillar TVA Sign Convention for TVA below.

**Table 11.1**

### Caterpillar TVA Sign Convention

Engines are usually viewed from the rear, at which point the crankshaft is rotating counter clockwise CCW). This view creates a leading sign convention, whereas most mathematical systems work with lagging sign convention. Therefore, the signs (+ve or -ve) for imaginary component of tangential pressures based on the sign convention of the Caterpillar TVA will be different from most of the commercial FFT programs. Torsional analysts performing torsional analysis using torsional codes other than Caterpillar TVA code need to consult Caterpillar regarding the sign convention before using the values given in the table.

# 12.0 Unbalanced Forces and Moments

| B90 Unbalanced Forces and Moments for G3304, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal) | Vertical | Horizontal) | Vertical | Horizontal) |
| 253.1 | 164.0 | 801.2 | 82.5 | 302.7 | 0.9 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal | Yaw (Vertical) | Pitch (Horizontal) |
| 31.9 | 45.2 | 6.3 | 16.3 | 0.2 | 0.8 |

**Table 12.1**

| B90 Unbalanced Forces and Moments for G3306, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal) | Vertical | Horizontal) | Vertical | Horizontal) |
| 309.2 | 194.6 | 122.5 | 41.0 | 5.9 | 1.1 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) |
| 55.2 | 81.0 | 10.7 | 30.1 | 0.3 | 1.5 |

**Table 12.2**

| B90 Unbalanced Forces and Moments for G3406, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 481.0 | 336.8 | 191.9 | 73.7 | 9.1 | 1.9 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) |
| 103.3 | 144.8 | 22.4 | 55.7 | 0.6 | 2.7 |

**Table 12.3**

| B90 Unbalanced Forces and Moments for G3408, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 408.5 | 350.7 | 189.4 | 131.7 | 661.4 | 5.2 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) |
| 147.0 | 295.5 | 26.7 | 38.6 | 8.8 | 1.6 |

**Table 12.4**

| B90 Unbalanced Forces and Moments for CG137-8, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 400.0 | 348.1 | 187.6 | 130.6 | 654.4 | 5.1 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) |
| 214.7 | 403.5 | 26.5 | 38.0 | 8.7 | 1.6 |

**Table 12.5**

| B90 Unbalanced Forces and Moments for G3412, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 706.8 | 538.7 | 199.5 | 173.4 | 8.9 | 6.3 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) |
| 166.7 | 213.0 | 52.6 | 62.5 | 1.9 | 2.7 |

**Table 12.6**

| B90 Unbalanced Forces and Moments for CG137-12, 1800 rpm | | | | | |
|---|---|---|---|---|---|
| First Order Force (N) | | Second Order Force (N) | | Fourth Order Force (N) | |
| Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| 699.6 | 537.3 | 197.2 | 172.3 | 8.8 | 6.2 |
| First Order Moment (N-m) | | Second Order Moment (N-m) | | Fourth Order Moment (N-m) | |
| Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) | Yaw (Vertical) | Pitch (Horizontal) |
| 166.1 | 211.0 | 51.7 | 61.6 | 1.9 | 2.6 |

**Table 12.7**

# 13.0 Starting System

| System Description Metric (English) | G3304 G3304B | G3306 G3306B | G3406 | G3408 G3408C CG137 – 8 | G3412 TA G3412C CG137 – 12 |
|---|---|---|---|---|---|
| Breakaway Torque – N•m (ft-lb) | 149 (110) | 244 (180) | 366 (270) | 420 (310) | 644 (475) |
| Cranking Torque (100 or 150 rpm) 0°C (32°F) with SAE 30 Wt Oil – N•m (ft-lb) | 217 (160) | 278 (205) | 508 (375) | 597 (440) | 813 (600) |
| Cranking Torque (100 or 150 rpm) 10°C (50°F) with SAE 30 Wt Oil – N•m (ft-lb) | 149 (110) | 203 (150) | 305 (225) | 352 (260) | 522 (385) |
| Minimum Starting Speed – rpm | 120 | 120 | 120 | 120 | 120 |
| Flywheel Teeth | 156 | 156 | 113 | 136 | 136 |

**Table 13.1**

## 13.1 Vane Starter Performance Curve

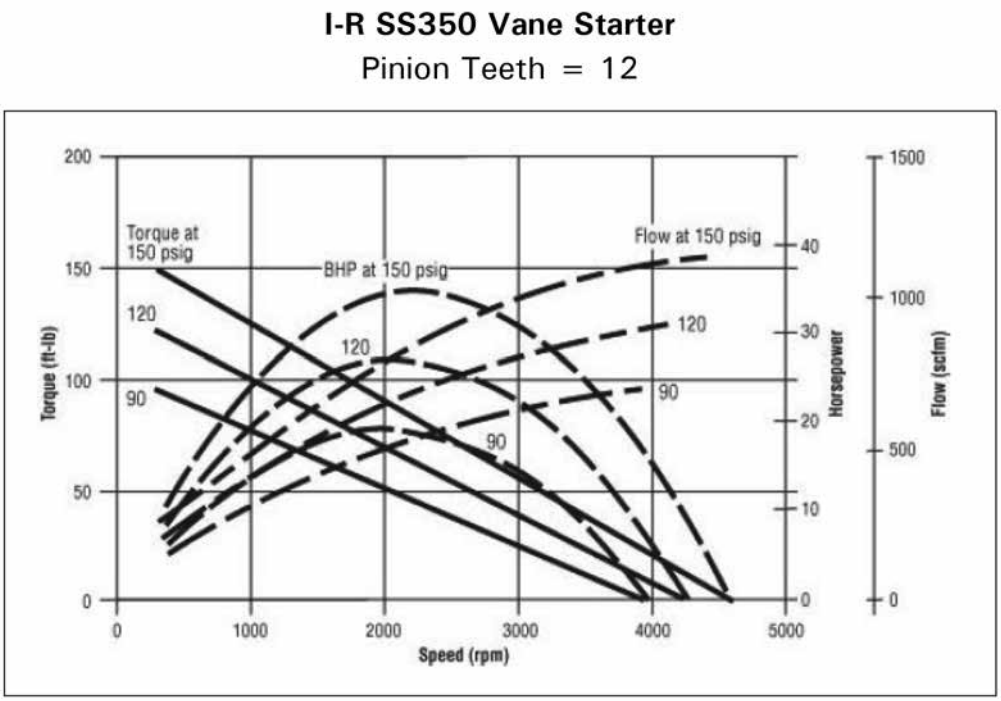



**Figure 13.1**

## 13.2 Turbine Starter Performance Curves

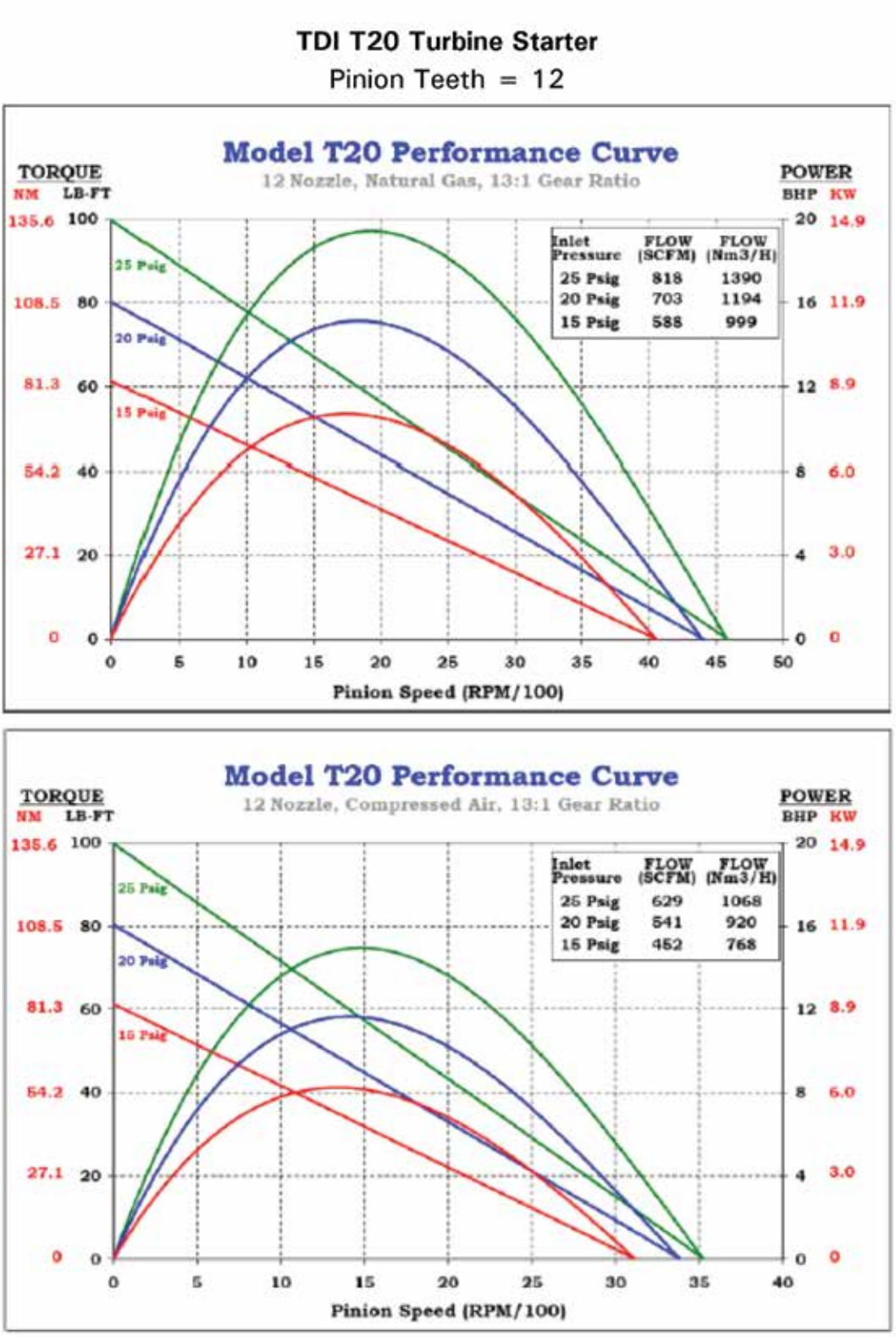



**Figure 13.2**

**TDI T312 Turbine Starter**
Pinion Teeth = 11

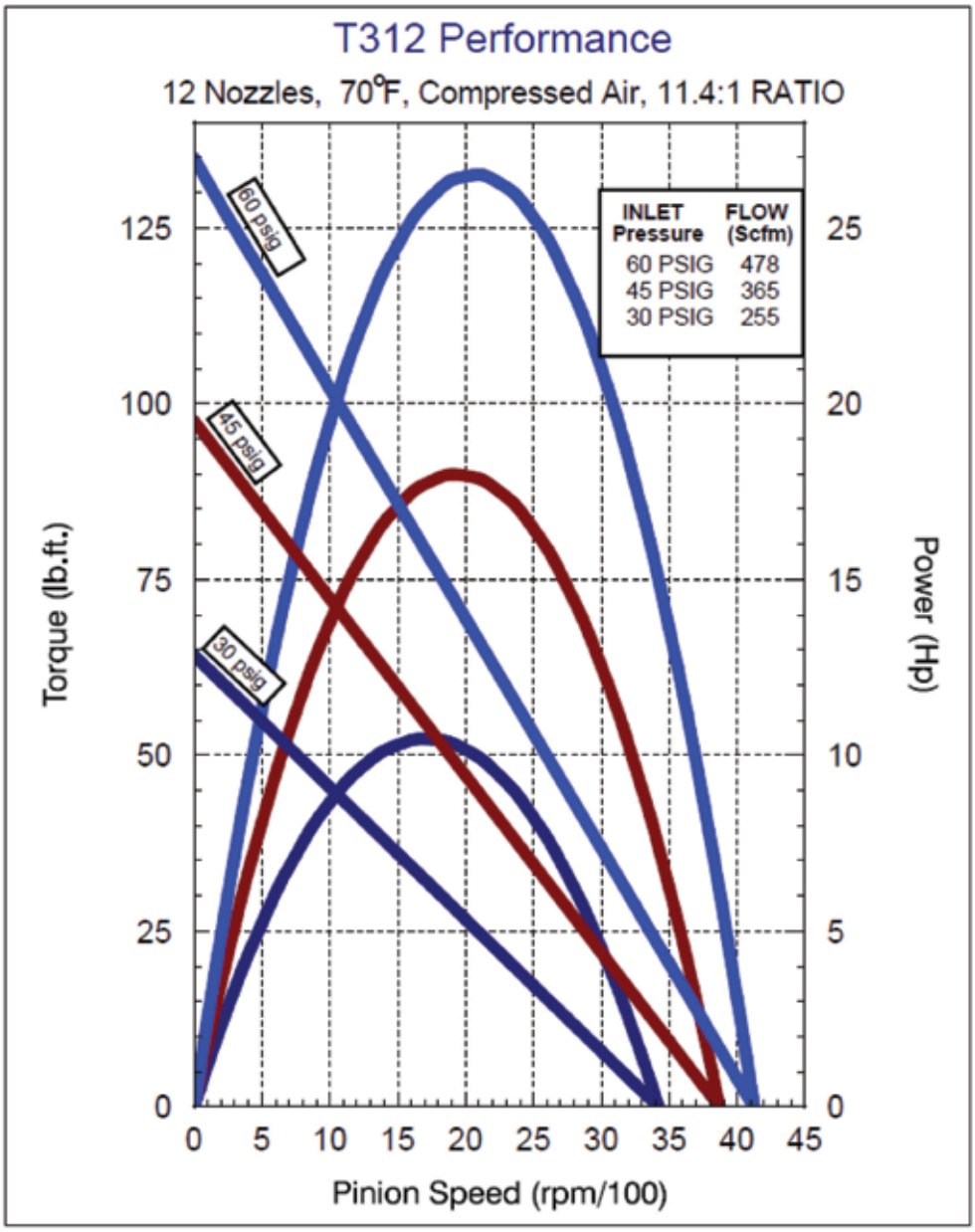
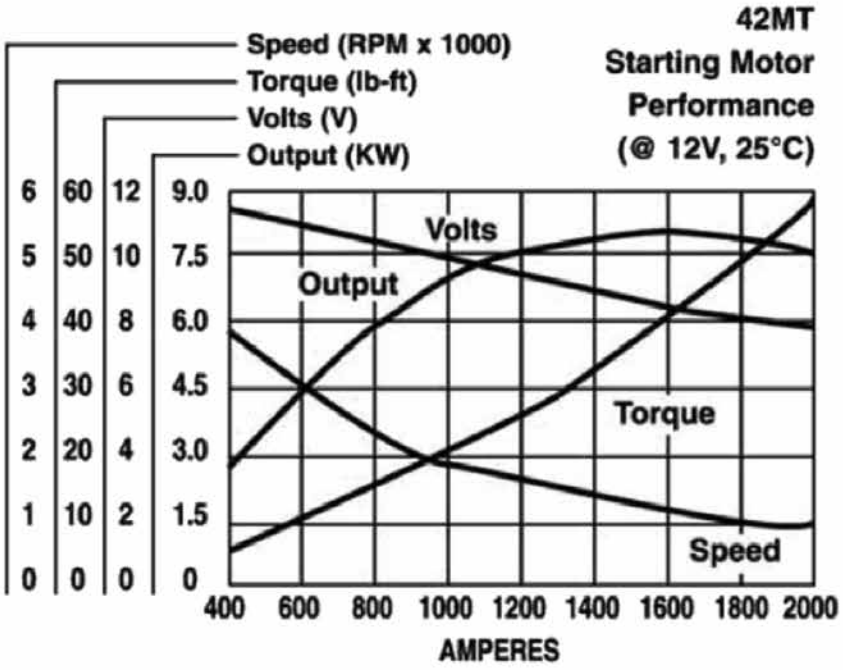



**Figure 13.3**

## 13.3 Electric Starter Performance Curves

Delco Remy America – 42 MT
Pinion Teeth = 12 (G3300)
Pinion Teeth = 11 (G3406)




Delco Remy America – 50MT
Pinion Teeth = 11

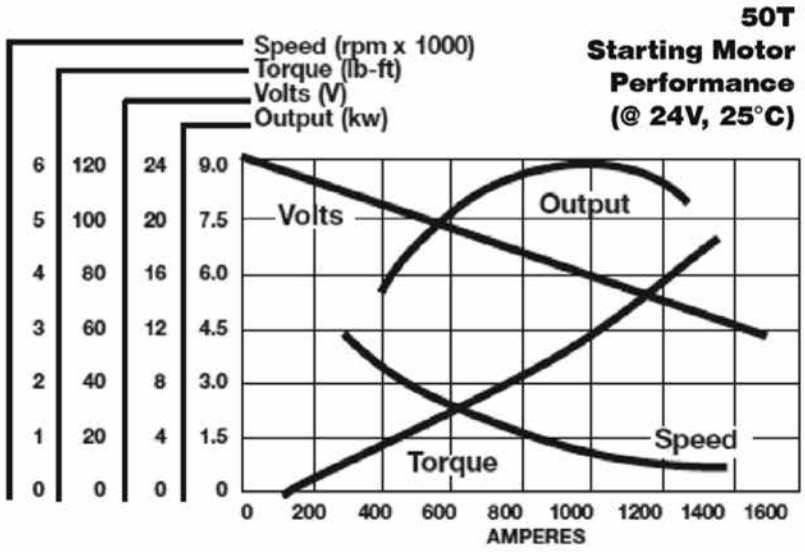



**Figure 13.4**

**www.cat.com/power-systems**

j1 (8-18)