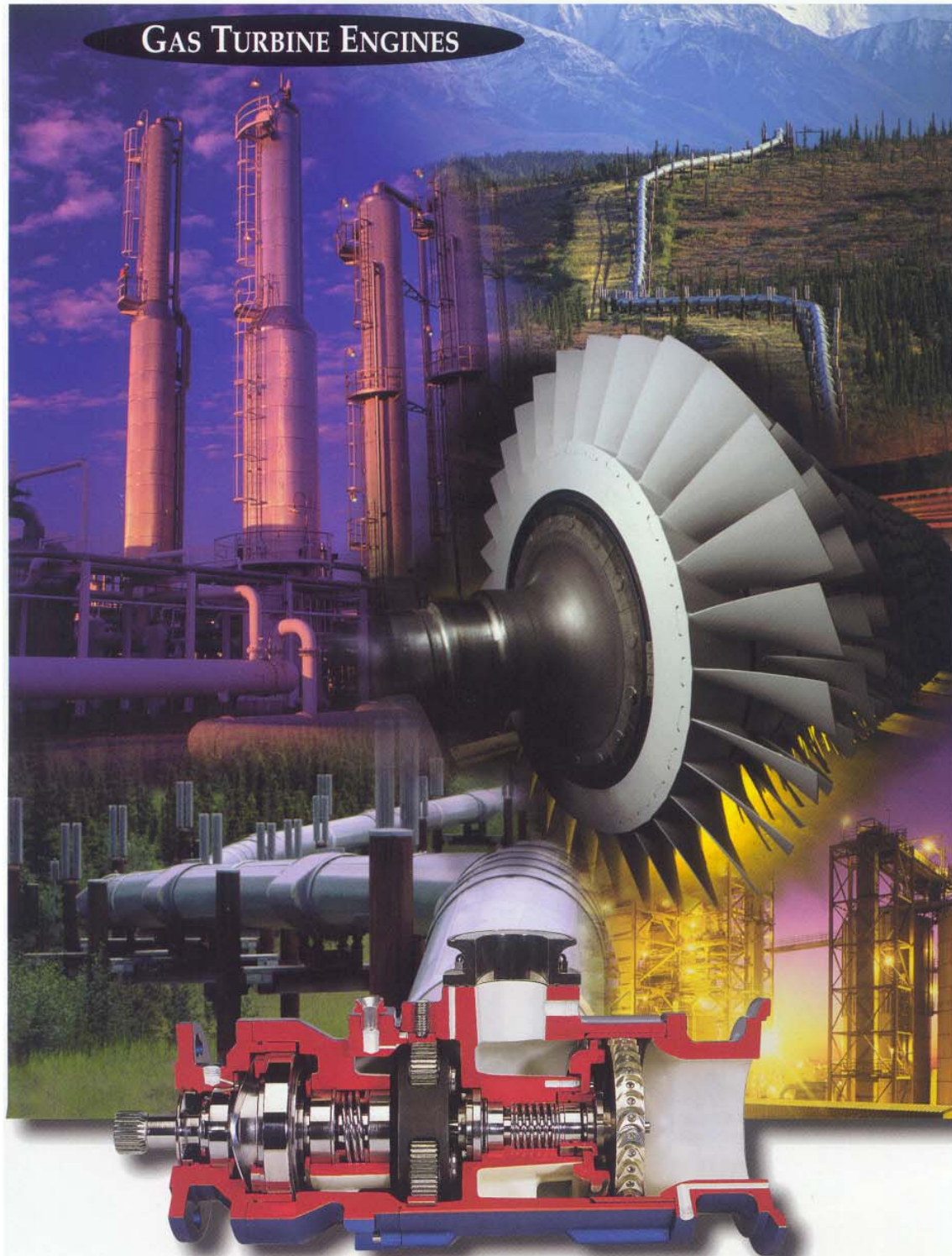


TDI **TURBOSTART™**

AIR STARTERS FOR

GAS TURBINE ENGINES



Aerospace Quality. Industrial Pricing.

TDI
TECH DEVELOPMENT INC.
www.tdiairstarters.com

Contents

2-3	TurboStart Starting Motors for Gas Turbine Engines
4-5	56 Series Turbine Air Starters for Aero-derivative Gas Engines
6-15	56 Series Specifications
16-17	51H Turbine Air Motor for Kongsberg & Kawasaki Engines
18-19	T100-C Air/Gas Starting Motor for Solar Centaur/Taurus Engines
20-21	T30-M Air Driven Pump Motor for Pre-and-Post Lubrication
22	Valves & Accessories
23	Engine Compatibility Selection Guide

TURBOSTART™ Gas Turbine Starting Motors

Aerospace Quality.
Industrial Prices.

Clearly, the highest quality, most reliable turbine starters have their roots in the aerospace industry. TurboStart™ Air Starters from Tech Development Inc. are no exception. As a leader in cutting edge aerospace turbine engine simulation and research, Tech Development

applies its turbine expertise to the design of gas turbine engine starters.

TDI engineers have always known that component requirements for stationary industrial power turbines are different than stringent FAA specifications applied to flight engine components. So instead of designing its starters to flight engine component specifications, TDI created a whole new breed of industrial turbine engine starters.

Packed with features and performance, TDI Gas Turbine Starters provide a more cost-conscious industrial grade starter tailored to stationary turbine engine requirements. All TurboStart™ 50 Series and TurboTwin™ T100 Gas Turbine Starter Models provide aerospace efficiency and durability, without the high costs of FAA compliance and testing.



Tech Development's turbine blade designs optimize air throughput for greater starting power.

**Better Design.
Better Reliability.**

At the heart of Tech Development's line of gas turbine engine starters is the principle of thoughtful design. Using its rich background of jet engine simulator research, TDI engineers created starter motors using concepts such as fewer moving parts, air optimization, torque maximization, installation simplicity, and contaminant tolerance.



Since 1958, TDI has been a leading supplier of turbine systems for wind tunnel simulation testing.



With a clear understanding that the measure of excellence in gas turbine applications is long term reliability, TDI engineers designed and built a line of starting motors and auxiliary pump motors that deliver maximum torque and horsepower, using minimal amounts of air, in packages designed to eliminate failure.



TDI is a leading provider of sophisticated turbofan engine simulators for the aerospace industry.

Field Proven in the World's Harshest Environments

At TDI, we believe that the best way to reduce maintenance is to eliminate it. That's why we made our starters tolerant of the most contaminated air/gas supplies imaginable. TDI starters are not affected by salt water, pipe scale, micro-sand, or wellhead gas liquids. For more than twenty years, the TDI brand has been synonymous with the word "dependable"...regardless of the operating conditions. Isn't it time to equip your engines with starters that eliminate regular maintenance due to the affects of harsh environments?

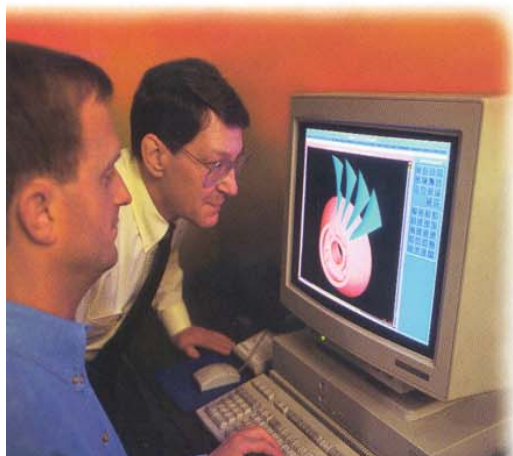


TDI maintains precision tolerances on the most intricate turbine blade designs.

TURBOSTART™ **56 Series** **Turbine** **Air Starters** **for** **Gas Turbine** **Engines**

**Aerospace Quality
for Thousands Less**

TDI's unique aerodynamic element design expertise has been called upon to develop a variety of state-of-the-art aircraft engine simulators used in the aerospace industry.



TurboStart 56 Series starter designs employ Tech Development's extensive aerospace experience in designing and manufacturing jet engine simulators. That, coupled with TDI's understanding of industrial operating environments, has established a new standard for reliability and cost efficiency for industrial turbine engine starters.

While costing many thousands of dollars less than most competitive products, the TDI 56 Series family of starter products provide impressive power, up to 210 hp (158 Kw) of cranking power at 150 psig (10 BAR). Yet, the design efficiency of the 56 Series Starter means even more, because it lasts. In fact, TDI starters resist damage by contaminated air/gas supplies, better than any other.

A Starter That Lets You "Run What You've Got"

Moisture, rust, scale, micro-sand and other contaminants that can lodge in most starters, shut them down...or at best, corrode and wear them quickly. TurboStart's open gas path design allows contaminants to pass through the motor quickly, minimizing their effects. This feature provides added insurance against starter-related downtime...especially in situations where starting air/gas quality is far less than optimum.

The Power for Starting Efficiency

The optimum gas turbine engine starter demonstrates efficient use of supply air throughout the start cycle with power to spare. TurboStart's 210 hp (158 Kw) at 150 psig (10 BAR) does just that. Our starters are precisely matched to your engine's specifications to hasten the start cycle and minimize air usage.

The Advantage of Cost Efficiency

Aeroderivative starters must comply with expensive FAA flight-worthy specifications. The question to ask is, "do you really need FAA approval for a stationary gas turbine?" We didn't think so either. As a result, we have been able to build a highly reliable starter using quality components for thousands less than our aeroderivative competitors. Doesn't that approach make sense?

Quality Parts.

You'll find no plastic parts in a TurboStart. Only quality steel and aluminum components. And no fragile cast turbine elements. The result is a solid enduring construction with the ability to withstand the wear of long cranking cycles.

The Simplicity of the Single Planetary Gear

Instead of complex sets of inefficient compound gears that have to be precisely assembled, the TurboStart uses a single planetary gear reducer. It's not only efficient from a design and power standpoint, but it actually simplifies the process of matching starter speed with your engine start cycle. And in the unlikely event your starter should ever fail, replacing its planetary gear train is a quick, simple procedure that minimizes downtime.

Finally, No Pre-Lubricated Drive Air

While some starters require "fuel quality" or a scrubbed gas supply, not so with a TDI starter. Starting air filtration and drying systems are expensive. So are air lubrication systems and oil mist traps. These systems are expensive to install, expensive to maintain and expensive to clean up after. Yet,

what can be even more expensive is punitive action by environmental agencies.

The Sprag Clutch: Another Sensible Design Feature from TDI

TurboStart's unique sprag clutch distributes torque evenly to 22 separate contact points, rather than just three points used on competitive clutch designs. This reduces wear at the contact points, reduces long term maintenance, and makes the starter itself more reliable. This is an excellent solution for windmilling applications and can be an economical replacement for pneumatic jaw-type clutches found on older gas turbine engines. TDI's unique sprag design makes clutch failures due to control system malfunctions a thing of the past.

3 Contact Points

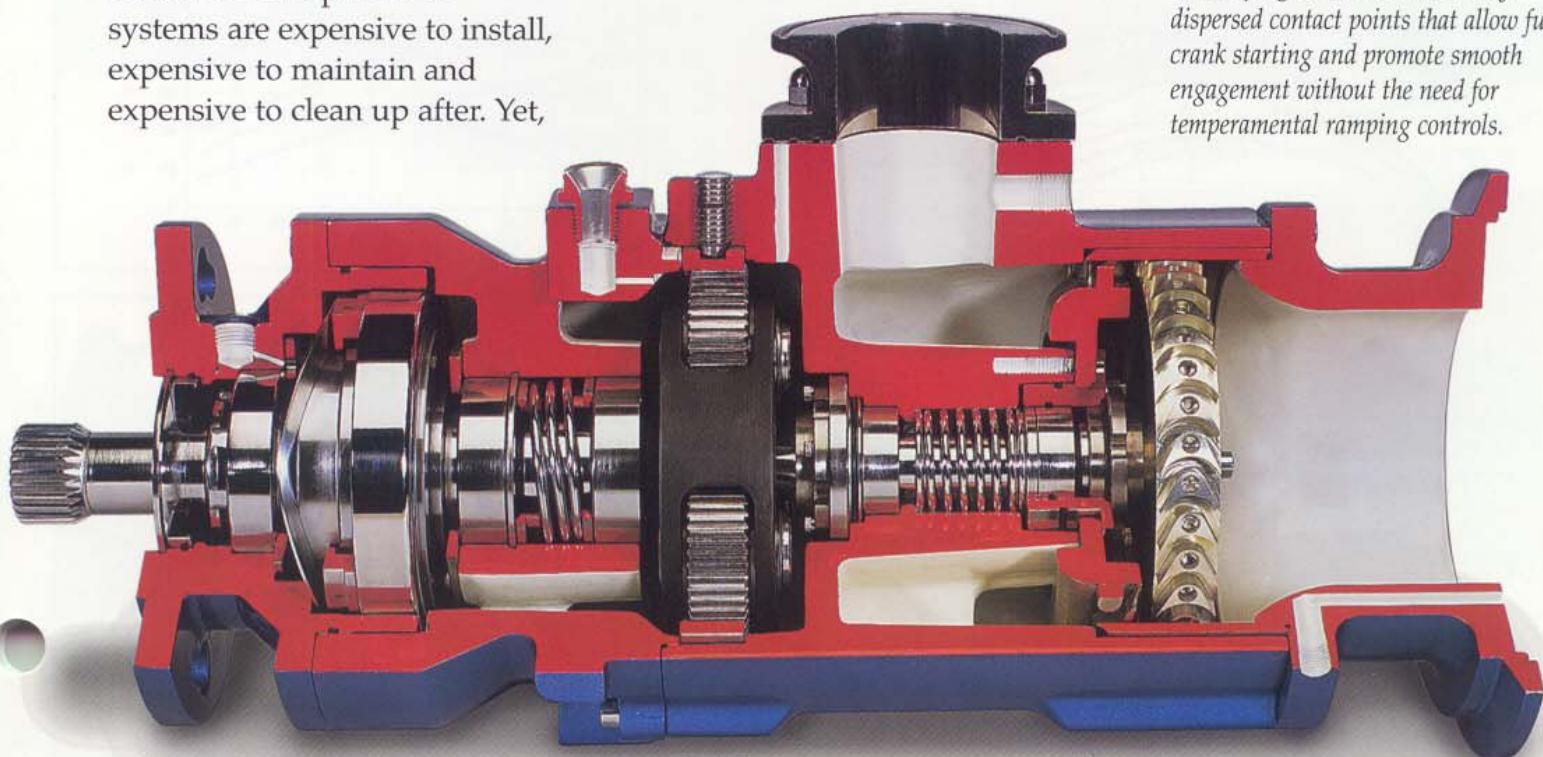


The traditional pawl and ratchet clutch design uses three sharply pointed contact arms and requires sophisticated controls to achieve the precise ramping speeds necessary for successful starting.

22 Contact Points



TDI's sprag clutch uses 22 evenly dispersed contact points that allow full crank starting and promote smooth engagement without the need for temperamental ramping controls.



Specifications:

56A

56K

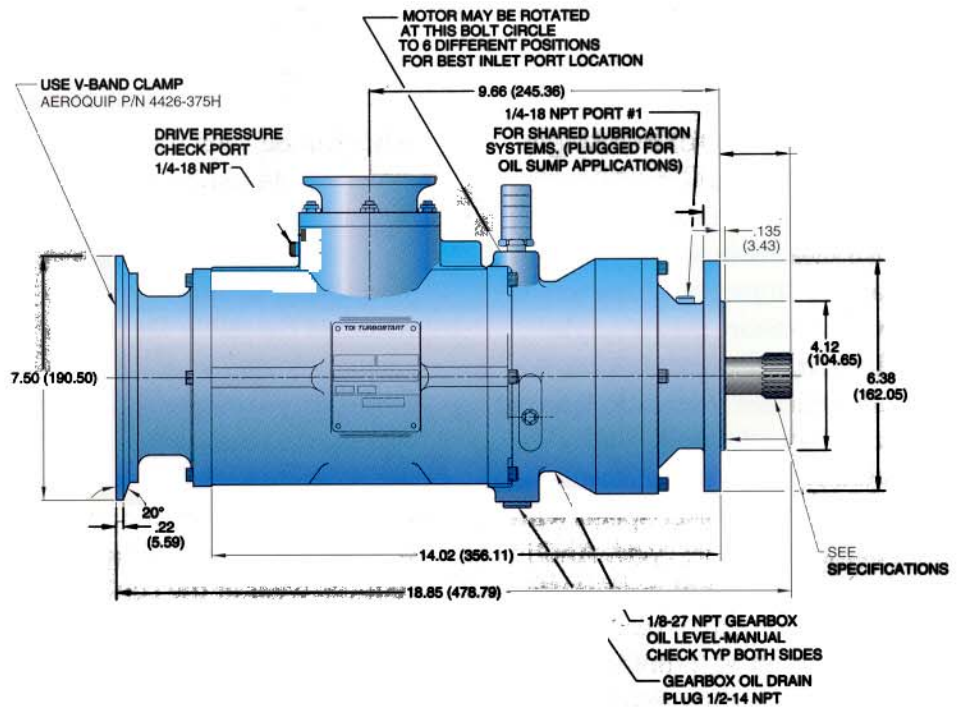
TURBOSTART™

Engine

Air Starters

DIMENSIONAL DATA

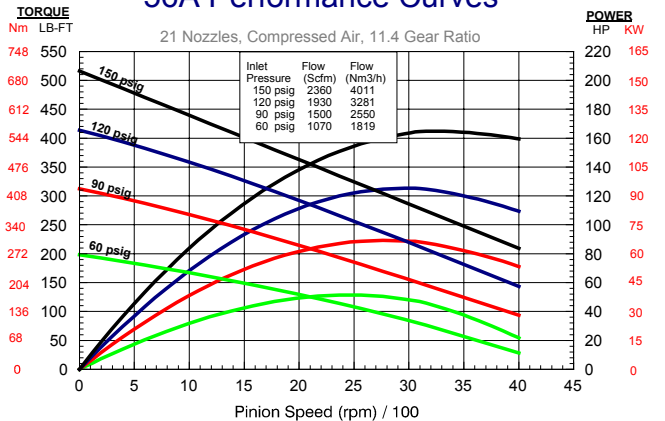
TDI 56A TURBOSTART™ TDI 56K TURBOSTART™



Our Model 56A is designed to replace aero-derived starters costing thousands more. Excellent availability, powerful performance, and a superior clutch design create a solid value for application on Pratt & Whitney® and Rolls Royce engines. The 56K is the ideal replacement starter for Allison 501K engines.

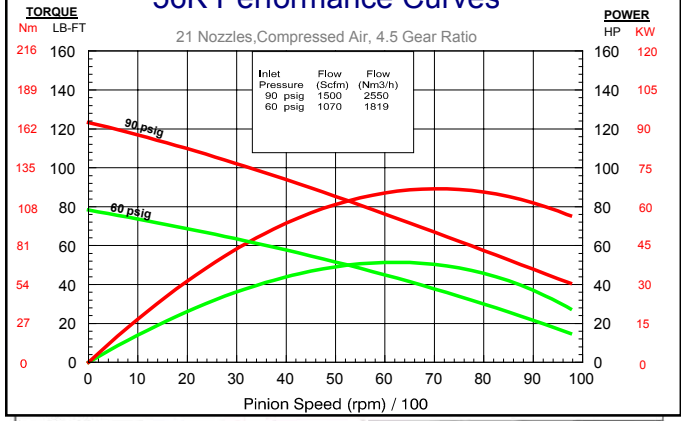
56A Performance Curves

21 Nozzles, Compressed Air, 11.4 Gear Ratio



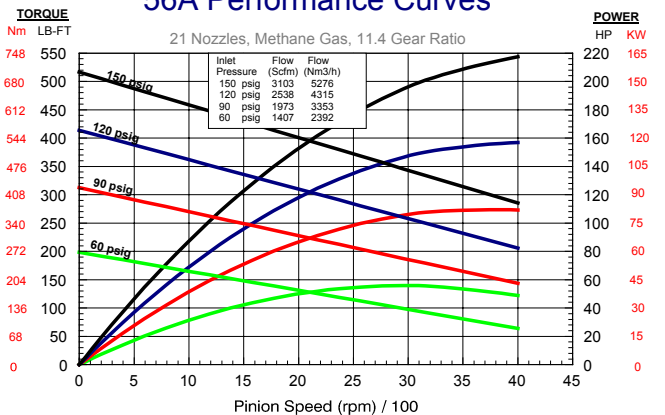
56K Performance Curves

21 Nozzles, Compressed Air, 4.5 Gear Ratio



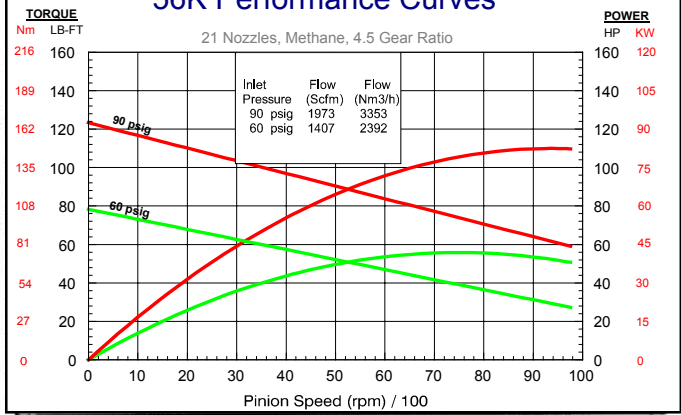
56A Performance Curves

21 Nozzles, Methane Gas, 11.4 Gear Ratio



56K Performance Curves

21 Nozzles, Methane, 4.5 Gear Ratio



SPECIFICATIONS

Engines: 56A starts Rolls Royce Spey and Avon engines as well as Pratt & Whitney GG3, GG4, FT4 and FT8 models.
56K starts Allison 501KC.

Power: 56A 165 hp (124 Kw) on compressed air
210 hp (158 Kw) on natural gas
56K 90 hp (68 Kw) on compressed air
110 hp (83 Kw) on methane gas

Weight: 48 lbs. (21.8 kg)

Air/Gas Supply: Compressed Air or Natural Gas

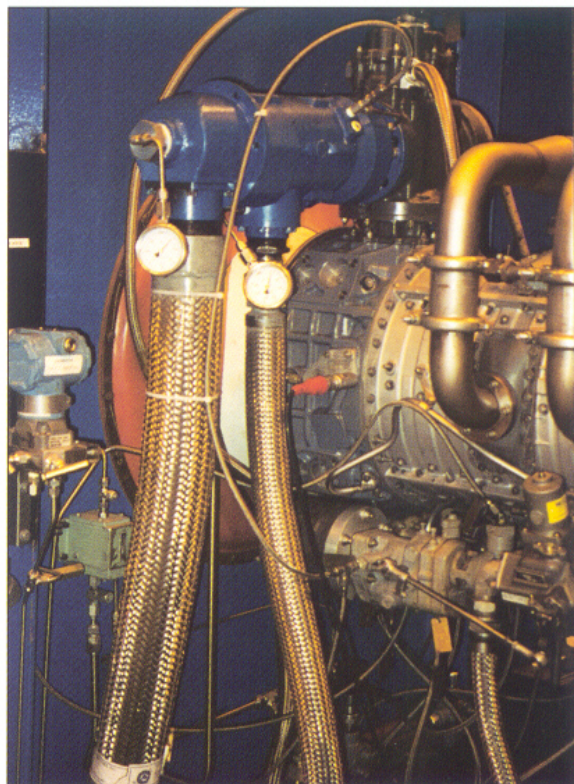
Pressure: Up to 150 psig (10 BAR)

Installation/Mounting: A mounting flange and output shaft spline that will mate with any engine utilizing an AND 20002 Type XII-S engine accessory drive pad.

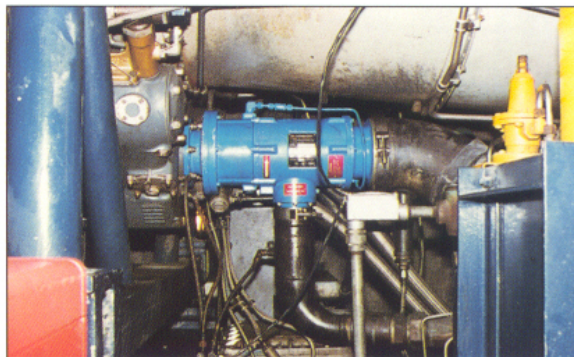
For natural gas models, Marman V-band adapters are provided on both the inlet and exhaust ports.

For compressed air models, a turbine guard screen is supplied. A variety of inlet and exhaust adapters are available.

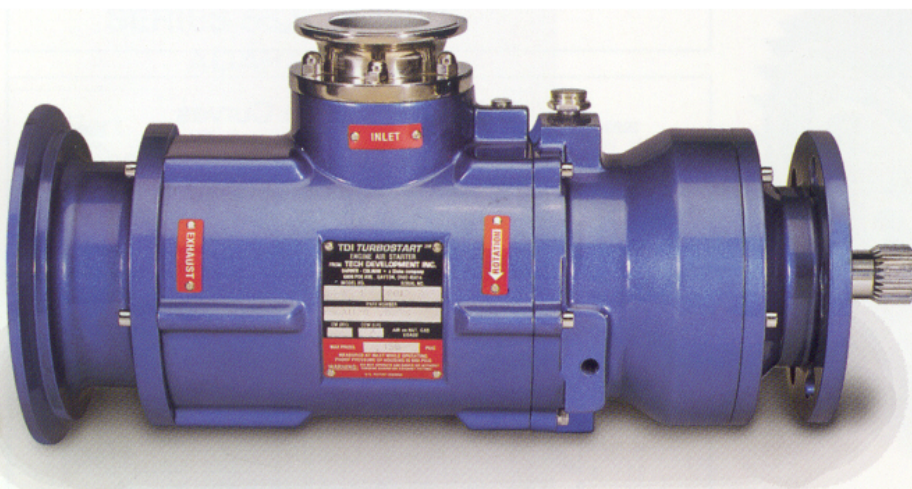
SPLINE DATA TABLE	
Feature	Model 56A & 56K
No. of Teeth	24
Pitch	20/30
Pitch Diameter	1.20" (30mm)
Spline Length	0.70" (18mm)
Pressure Angle	30°



56K on an Allison 501KC Engine.



56A is an excellent starter for Rolls Royce and Pratt & Whitney Engines.

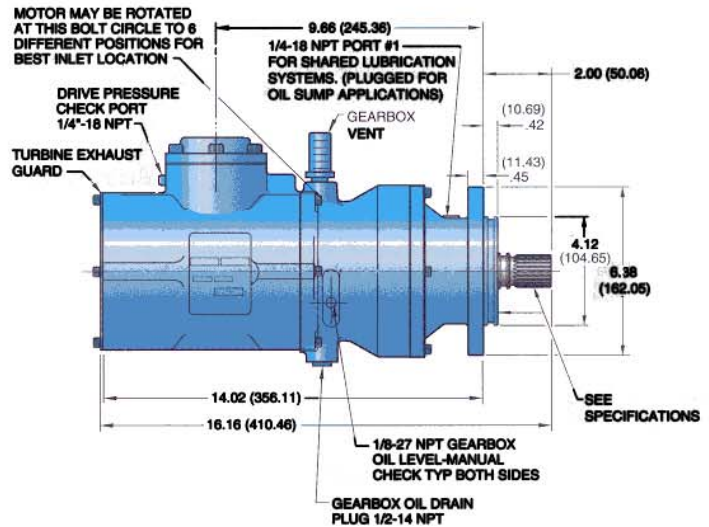


SERIES 56 EXHAUST ADAPTERS	
Part Number	Description
T100-27900	3" NPT 90 Elbow - Male Pipe Connection Adapter
52-415	Muffler Assembly
52-418	4" NPT Pipe Connection Adapter (Female)
52-419	3" NPT Pipe Connection Adapter (Female)
52-446	Marman V-Band Adapter with Vent

Specifications:

56B TURBOSTART™ Engine Air Starters

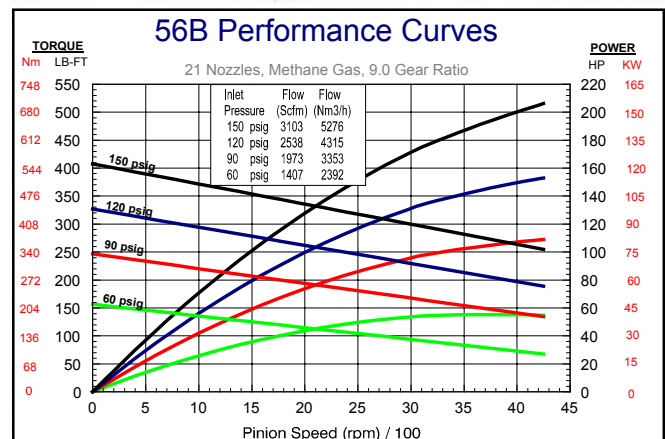
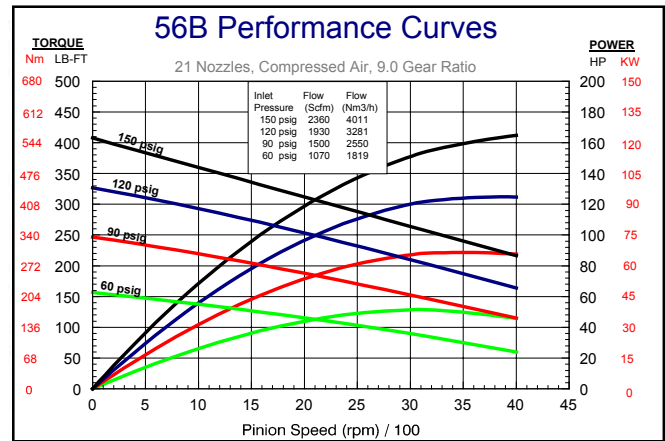
DIMENSIONAL DATA TDI 56B TURBOSTART™



Our Model 56B is designed to replace aero-derived starters costing thousands more. Excellent availability, powerful performance, and a superior clutch design create a solid value on GE, Dresser Clark, and Allison gas turbine engines.



Precision 4 and 5 axis machining allows TDI to produce extremely sophisticated turbine designs for aerospace simulation testing.



SPECIFICATIONS

Engines: Starts Dresser Rand DR990 and DJ50, Dresser Clark, and Allison gas turbine engines

Power: 165 hp (124 Kw) on compressed air
210 hp (158 Kw) on natural gas

Weight: 48 lbs. (21.8 kg)

Air/Gas Supply: Compressed Air or Natural Gas

Pressure: Up to 150 psig (10 BAR)

Installation/Mounting: A mounting flange and output shaft spline that will mate with any engine utilizing an (MS3332-2) engine accessory drive pad.

For natural gas models, Marman V-band adapters can be provided on both the inlet and exhaust ports.

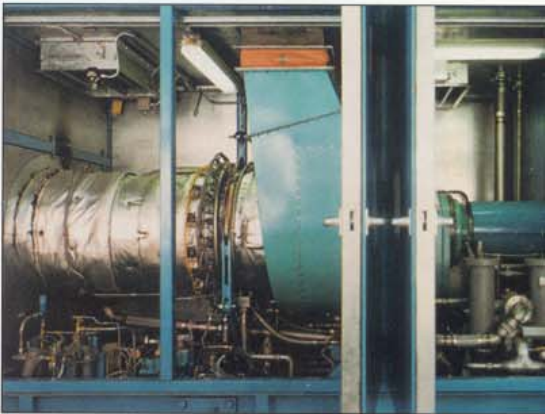
For compressed air models, a turbine guard screen is supplied. A variety of inlet and exhaust adapters are available.

SPLINE DATA TABLE	
Feature	Model 56B
No. of Teeth	24
Pitch	20/40
Pitch Diameter	1.20" (30mm)
Spline Length	0.70" (18mm)
Pressure Angle	30°

56B is an economical, aeroderivative starter solution for GE, Dresser Rand, Dresser Clark and Allison Engines.



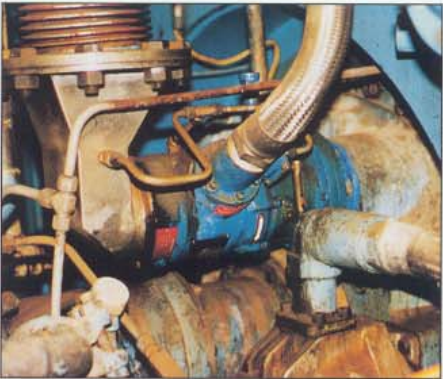
TDI Engine Air Starters have earned a reputation for high reliability, no maintenance and long life.



56B mounted on a DR 990 Gen Set package.

SERIES 56 EXHAUST ADAPTERS	
Part Number	Description
T100-27900	3" NPT 90 Elbow - Male Pipe Connection Adapter
52-415	Muffler Assembly
52-418	4" NPT Pipe Connection Adapter (Female)
52-419	3" NPT Pipe Connection Adapter (Female)
52-446	Marman V-Band Adapter with Vent

Gas compression (as shown), electrical power generation industrial drives, and marine propulsion are common applications for 56B.



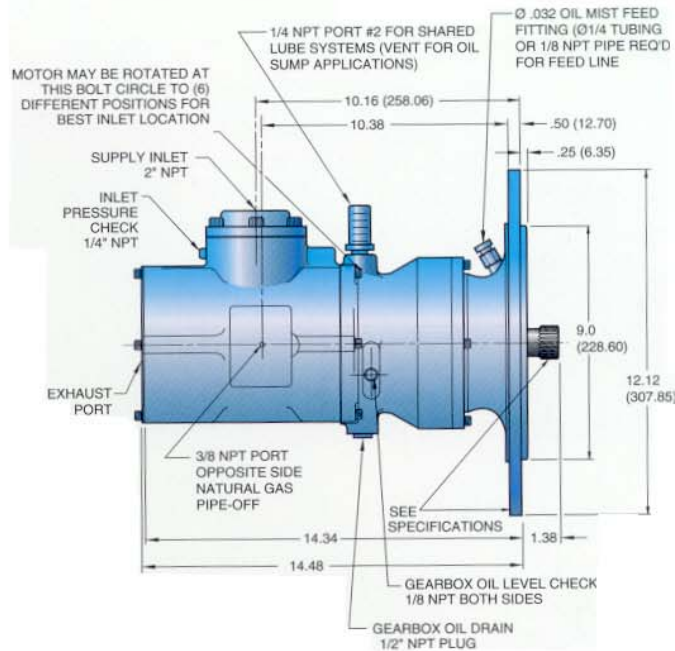
TDI 56B mounted on a Dresser Rand 990 Engine.

Specifications:

56S TURBOSTART™ Engine Air Starters

Specifically
Designed for
Solar Saturn Gas
Turbine Engines

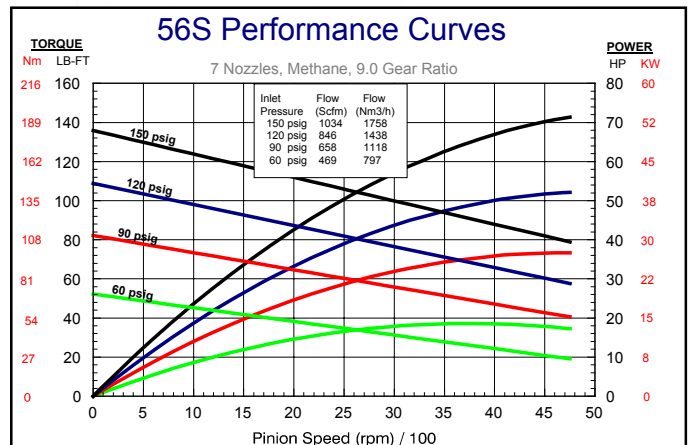
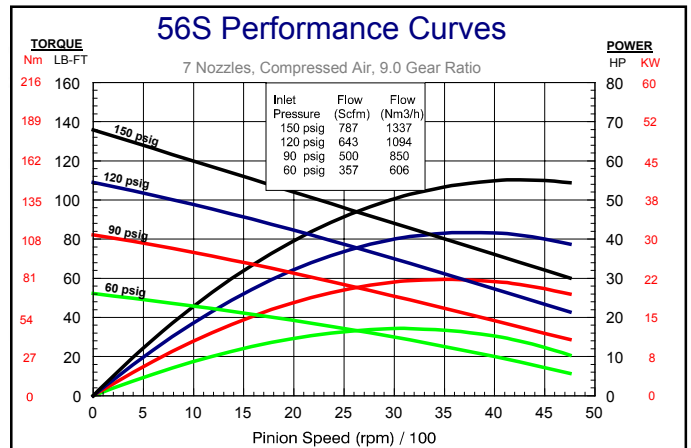
DIMENSIONAL DATA TDI 56S TURBOSTART™



Our Model 56S is designed to mount directly to Solar Saturn engines. An integral soft clutch eliminates the jaw-type clutch assembly for trouble free operation. And because the 56S motor requires no lubrication in the drive air...fugitive starter exhaust emissions can be totally eliminated.



The Model 56S is often times used to replace older vane-type air starters found on Solar Saturn Engines.

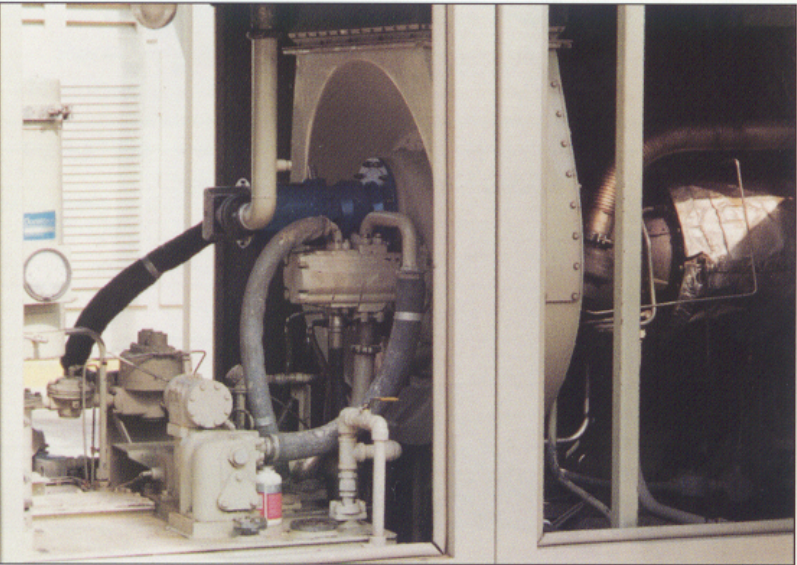


SPECIFICATIONS

- Engines:** Specifically designed for Solar Saturn gas turbine engines
- Power:** 55 hp (41 Kw) on compressed air (7 nozzle)
74 hp (56 Kw) on natural gas (7 nozzle)
- Weight:** 48 lbs. (21.8 kg)
- Air/Gas Supply:** Compressed Air or Natural Gas
- Pressure:** Up to 150 psig (10 BAR)
- Installation/Mounting:** 56S has a mounting flange and output shaft spline that mates with the accessory drive mounting pad.

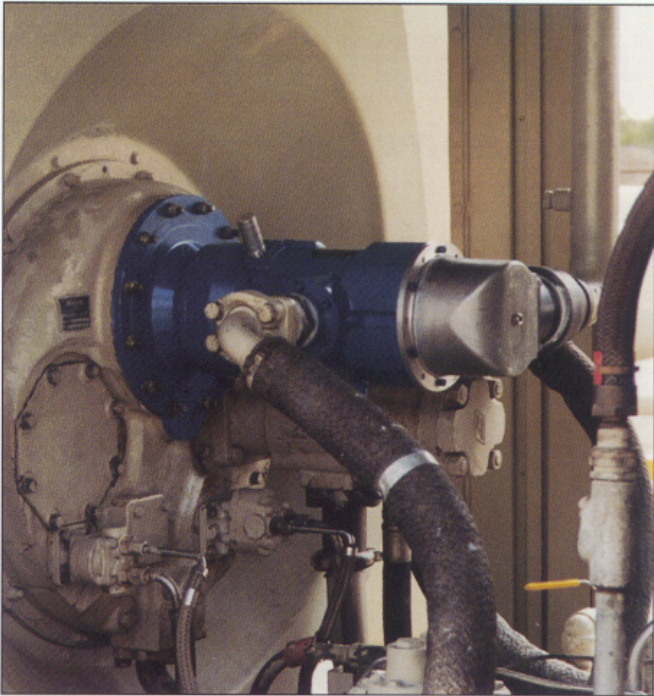
SPLINE DATA TABLE	
Feature	Model 56S
No. of Teeth	24
Pitch	20/30
Pitch Diameter	1.20" (30mm)
Spline Length	0.70" (18mm)
Pressure Angle	30°

56S turbine motor design eliminates wear, reduces maintenance, and delivers significantly longer product life.



56S mounted on a Solar Saturn Engine.

SERIES 56 EXHAUST ADAPTERS	
Part Number	Description
T100-27900	3" NPT 90 Elbow - Male Pipe Connection Adapter
52-415	Muffler Assembly
52-418	4" NPT Pipe Connection Adapter (Female)
52-419	3" NPT Pipe Connection Adapter (Female)
52-446	Marman V-Band Adapter with Vent



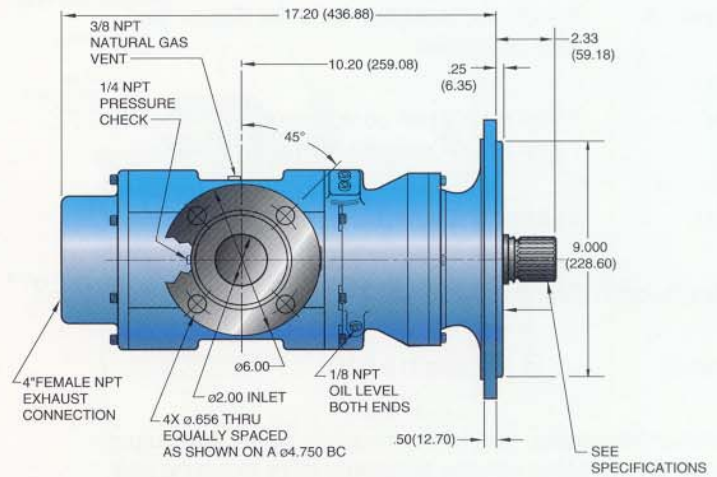
56S mounted on Solar Saturn Engine.

Specifications:

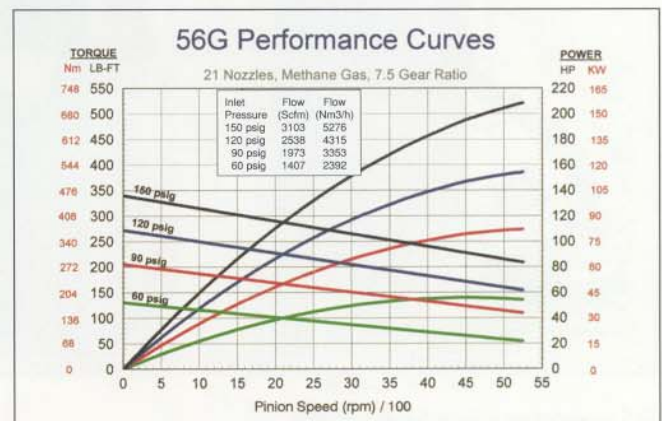
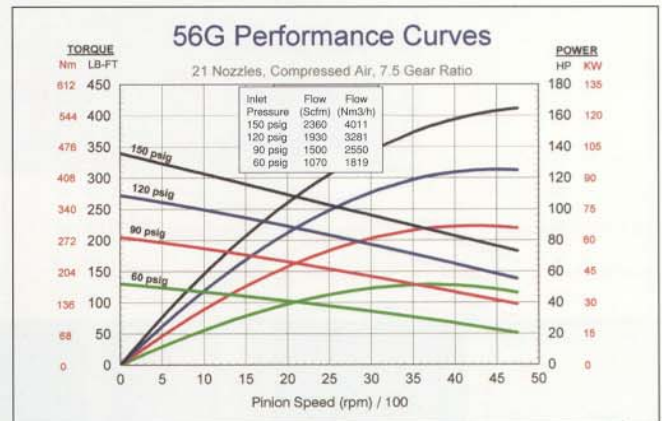
56G TURBOSTART™ Starters

Specifically
Designed for
General Electric
LM1600 and LM2500
Gas Turbine Engines

DIMENSIONAL DATA TDI 56G TURBOSTART™



The Model 56G is the lightest and most powerful in its class. It is also designed to replace aero-derived starters costing thousands more. Excellent availability, powerful performance, and a high tolerance for contaminated air supplies creates a solid value for application on GE gas turbine engines.



SPECIFICATIONS

Engines: General Electric LM1600 and LM2500

Power: 165 hp (124 Kw) on compressed air
210 hp (158 Kw) at 150 psig (10 BAR)
on natural gas

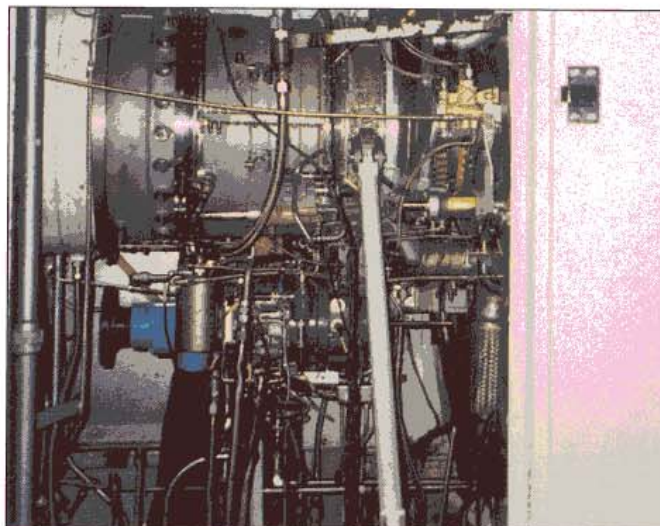
Weight: 48 lbs. (21.8 kg)

Air/Gas Supply: Compressed Air or Natural Gas

Pressure: Up to 150 psig (10 BAR)

Installation/Mounting: 56G has a mounting flange and output shaft spline that mates with the accessory drive mounting pad.

*56G is highly resistant to damage
caused by wet or hard contaminants
in the drive air/gas.*



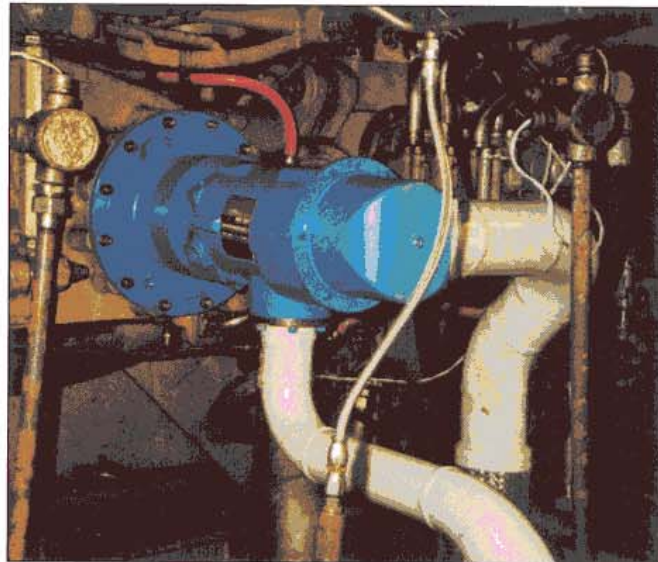
56G mounted on a GE LM1600 Engine.

SPLINE DATA TABLE

Feature	Model 56G
No. of Teeth	26
Pitch	16/32
Pressure Angle	30°
Pitch Diameter	1.625 (REF)

SERIES 56 EXHAUST ADAPTERS

Part Number	Description
T100-27900	3" NPT 90 Elbow - Male Pipe Connection Adapter
52-415	Muffler Assembly
52-418	4" NPT Pipe Connection Adapter (Female)
52-419	3" NPT Pipe Connection Adapter (Female)
52-446	Marman V-Band Adapter with Vent

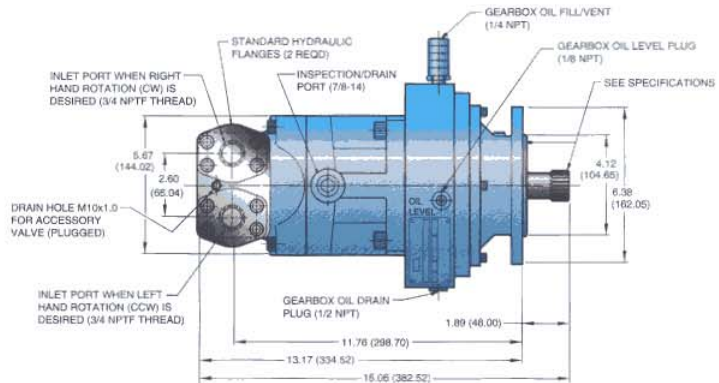


56G mounted on a GE LM2500 Engine.

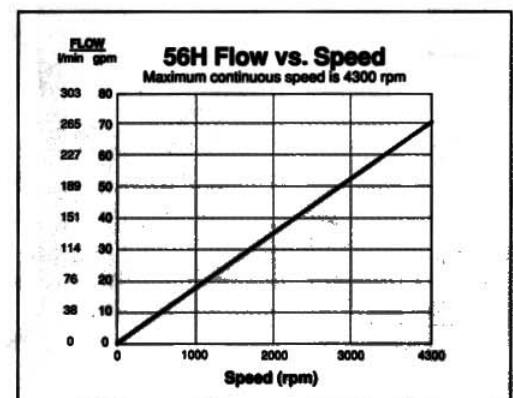
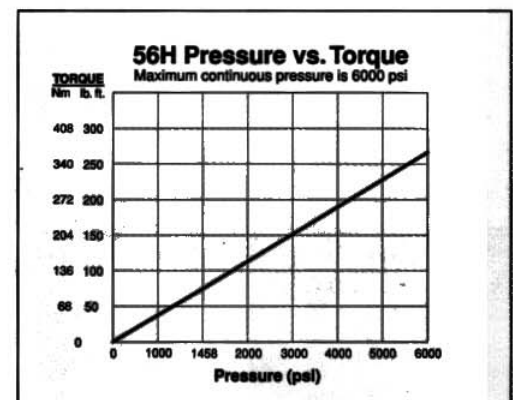
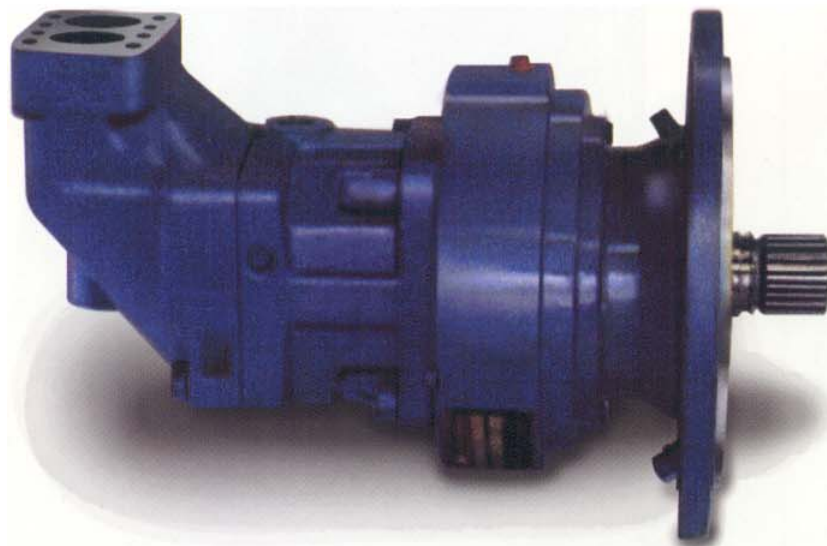
Specifications:

56H HYDROSTART Hydraulic Starter

DIMENSIONAL DATA TDI 56H HYDROSTART



56H Series Hydraulic Starters from TDI can replace hydraulic starters costing thousands more. Power-matched for performance, and a superior strength clutch design create a solid value for starting many industrial gas turbines.



SPECIFICATIONS

Displacement:	(cm3/rev)	59.8	
	(in3/rev)	3.65	
Motor Operating Speed (rpm):	maximum intermittent	5600	
	maximum continuous	4300	
	minimum continuous	50	
Max. Pump Self-Priming Speed (rpm):		2350	
Torque at (1458 psi) 100 bar:	(Nm)	95	
	(lb. ft.)	70	
Motor Input Flow	Intermittent	Continuous	
Max intermittent (l/min)	335	257	
(gpm)	88.5	67.9	
Maximum Output Power	Intermittent	Continuous	
(Kw)	175	110	
(hp)	235	150	
Maximum Operating Pressure	Intermittent	Continuous	
(bar)	480	420	
(psi)	7000	6000	
Max. Case Pressure at 1500 rpm			
(bar)	12		
(psi)	175		
Main Circuit Temperature, Max.	Max	Min	
(°C)	80	-40	
(°F)	175	-40	
Fluid Viscosity	Maximum	Minimum	
(mm2/s)	1000	8	
(SUS)	5000	58	
Fluid Contamination Level (ISO code 4406)	18/13		
Mass Moment of Inertia			
(kg m2)	5.0		
(lb. ft. s2)	3.7		
Weight	(Motor only)	(Starter)	
(kg)	21	30	
(lb.)	46	67	



TDI manufactures more than 15 different turbine air motors for aerospace R&D applications.

Hydraulic Starting of Gas Turbine Engines—Now with TDI's Legendary Front End Reliability

Sometimes pneumatic starting of gas turbine engines is not feasible. Marine and mobile applications are typical examples where hydraulic starters are a preferred solution because of space limitations and starter supply restrictions. For these situations, TDI offers a wide variety of hydraulic starter solutions featuring its highly reliable sprag clutch and front end design.

TDI Hydraulic Starters are field-proven replacements for a wide variety of gas turbine engines including GE LM 2500s, Pratt & Whitney FT4s, Dresser Rand DR 990s, Rolls Royce, Solar, Allison, and others. The robust construction, long life and superior front end design make TDI the preferred hydraulic retrofit for critical reliability environments. And TDI's sprag clutch provides unequalled load transfer from the starter to the frame, promoting better shaft alignment and reduced wear on gear box couplings.

Well-Thought-Out Design – TDI hydraulic starters are very compact. We understand the space limitations of hydraulic environments. The 56H, for example, is only 67 lbs. (30 Kg) replacing starters weighing upwards of 80 lbs. TDI starters run on a wide range of commercial and military fluids. They can be used on both continuous or intermittent applications. And other than the sprag clutch, all motor parts are self-lubricated for reduced maintenance.

Standard Components. Custom Hydraulic Starting Solutions – TDI's hydraulic starter design is based on its extensive line of pneumatic gas turbine starters to provide custom hydraulic starting solutions with a price and delivery schedule similar to "off-the-shelf" starters. Using its wide array of standard output splines, mounting pads, and gear ratios, TDI manufactures engine/starter interface configurations that are matched to your application. And because the components are "standard", the price is surprisingly low.

51H Air Turbine Motor

Improving Starter
Reliability for Your
Kawasaki or
Kongsberg Gas
Turbine Engine is
Easy and Cost
Effective

If your Kongsberg & KHI Gas Turbine Engine is still using a vane starter, you have no doubt encountered reliability problems. Parts that stick or swell, or simply wear out due to constant friction eventually lead to starter failure. Something no one in our industry can afford.

Replacing your vane motor starter with TDI turbine technology is a significant reliability and longevity upgrade. Turbine technology is inherently more reliable, requires no maintenance, and provides significantly longer life. The model 51H Turbine Motor from Tech Development is specifically designed as a replacement upgrade for Kongsberg and Kawasaki engines.

Installation is Fast and Easy.

The compact 6.1" diameter size, and lightweight (28 lbs. or 12.7 kg) frame, with an SAE "C" four bolt mounting flange make installation a one-man operation on your engine.

Contaminants are not a Problem Anymore

Dirt, moisture, rust or other contaminants that lodge inside your vane-type starter and lead to shut down won't get caught inside the 51H. Large air channels and TDI's unique open gas path design allow these same contaminants to literally "pass through". Even sour gas has no effect on the 51H.

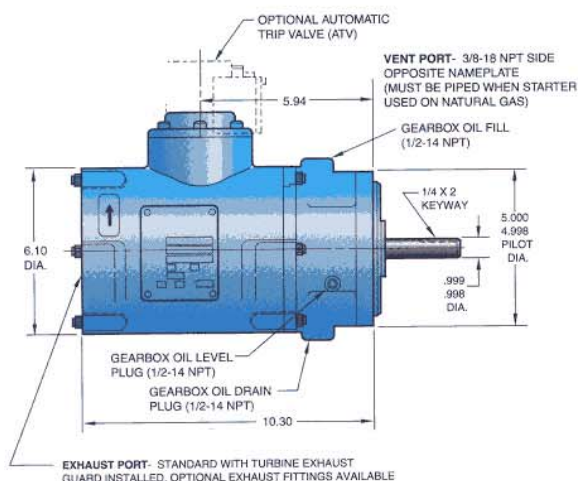
Better Design. Better Parts. Better Reliability.

The 51H features a single stage impulse turbine coupled to an integral planetary reduction set. All parts are made from rugged, high quality steels and aluminum. There are no plastic parts. No rubbing parts. And there's no need for messy lubricants in the supply line to clog the system. The clean simplicity of the 51H design minimizes potential problems and provides a longer maintenance-free product life.

Versatile Nozzle Plate Puts You in Control

Gas flow control is provided using a versatile plate that houses 1 to 21 nozzles which regulate flow to the turbine wheel, allowing you to tailor the power level of the starter to the application. Fewer nozzles lower the torque proportionally. The 51H is available with an optional automatic trip valve (ATV) which shuts off air flow if motor speeds begin to exceed predetermined limits.

DIMENSIONAL DATA TDI 51H TURBOSTART™

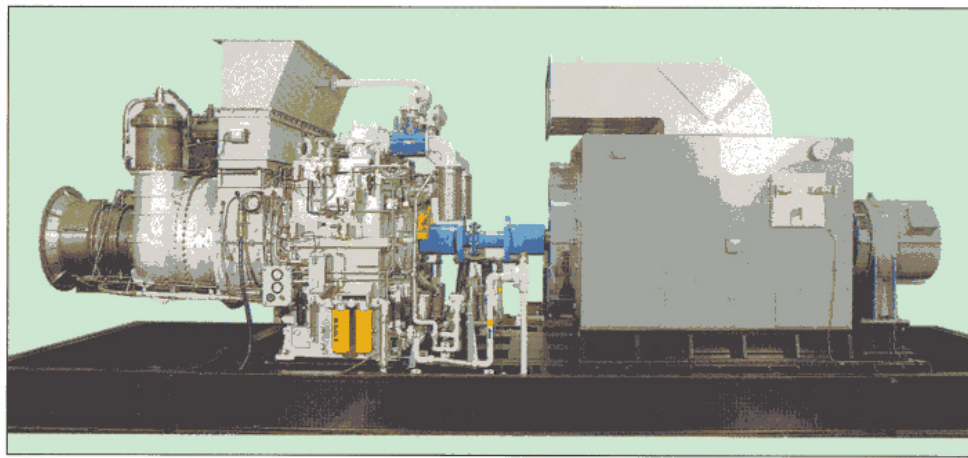


**No Drive Air Lubrication.
No Fugitive Exhaust.**

The 51H operates on non-lubricated drive air. The mess, expense, and hassle of oily air lubrication systems are eliminated. Hazardous effects of fugitive emissions and the related environmental damage are also eliminated with the 51H.

Less Air

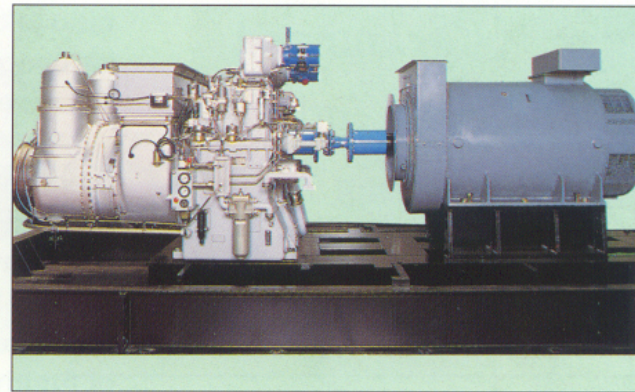
The 51H requires 33-50% less air to operate over competitive pneumatic models. Operating at 150 psig(10 BAR), the 51H yields 165 hp (124 Kw). Three gear ratios are available.



51H mounted on Kawasaki Gas Turbine Engine.



Available as 51G with spline output.



51H mounted on Kawasaki Gas Turbine Engine.



The Model 51H Turbine-driven pneumatic motor is designed for industrial applications.

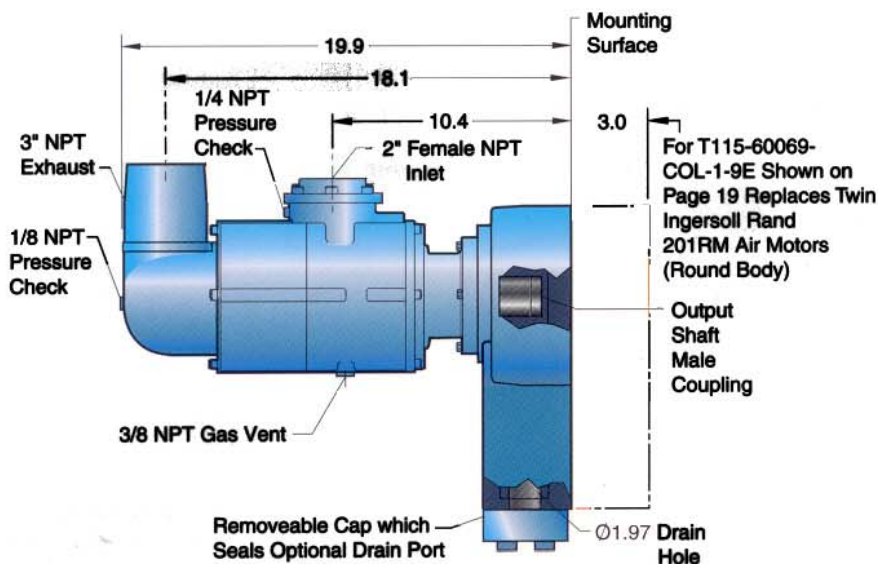
SPECIFICATIONS

Engines:	Kongsberg & Kawasaki
Power:	165 hp (124 Kw)
Weight:	28 lbs. (12.7 kg)
Air/Gas Supply:	Compressed air or natural gas
Pressure:	30–150 psig (2–10 BAR)
Installation:	SAE "C" 4-bolt flange
Gear ratio:	7.5 (See page 12 for performance curve) 9.0 (See page 8 for performance curve) 11.4 (See page 6 for performance curve)

T100-C Air/Gas Starting Motors

Designed
Specifically for
Solar Centaur and
Taurus Gas Turbine
Engines

DIMENSIONAL DATA TDI T100-C TURBOTWIN™



T115-60057-COL-1-9E Shown
Replaces Ingersoll Rand SS 800 & TS700 (Square Body Motors)

T100-C is a single starting motor upgrade and direct replacement for your original dual motor vane-type and turbine-type Ingersoll-Rand, as well as the helical lobe-type Hilliard starting motor assemblies on Solar Centaur and Taurus engines. The T100-C features TDI's successful, field-proven TurboTwin turbine motor design. We have combined this field-proven turbine motor design, with the perfect gear ratio to optimize the start cycle sequence on your Centaur and Taurus engines.

Environmentally Compliant. Meet EPA Standards Now.

In an environment continually defined by government mandated regulation, the issue of fugitive emissions is playing a larger role in the decision process. T100-C identifies and addresses the specific areas of start gas consumption and start gas lubrication. The T100-C

consumes as little as half the starting gas on a per start basis compared with competitive OE starter assemblies. Combine this with the TurboTwin motor that requires **no inlet gas mist lubrication** and you can operate a starting package capable of emissions compliance.

Tolerates Contaminates.

One reason so many users are switching to the TDI TurboTwin design on their Solar Gas Turbine Engines is the T100-C's ability to tolerate inlet gas contaminants. Unlike positive displacement (vane and helical lobe) starters and competitive turbine designs, the TurboTwin consumes and passes dirt, sand and other contaminant matter. Large gas path openings designed into the TurboTwin motor allow these contaminants to pass through the TurboTwin motor without harm—unlike other designs that cannot tolerate contaminants of any kind. Sour gas is no problem. The T100-C design is capable of operating on field gas as easily as pipeline gas. The choice is yours.

Easy Replacement.

The T100-C is comparatively small and light. At 6.1" in diameter, 13" long and weighing 35 pounds, this starter is easily installed and maintained. The T100-C is designed to bolt directly to the accessory drive housing of your Centaur or Taurus engine. Our design utilizes the existing mounting studs as well as

Fewer moving parts, aerodynamic speed control, and no need for lubrication make the T100-C the most reliable starting motor for Solar Engines.

SPECIFICATIONS

accommodating for existing oil flow and drainage from the accessory drive. Kits are available that utilize existing inlet steel braided flex hoses as well as the exhaust hoses. It's an easy bolt together operation. No welding or cutting. Your TDI representative will be able to assess your Centaur or Taurus starting package and provide the right parts for your installation.

More Power = Better Starting.

Expect more than 25% more horsepower and superior starting torque per unit of gas from the T100-C. The fast cranking RPM available also promotes faster starting cycles. This equates to less gas consumption and less wear on the starting system. The TurboTwin motor can also be designed to operate on much lower inlet gas pressures for field gas applications and fixed volume applications.

Engines: Solar Centaur and Solar Taurus.

Power: 140 hp (68 Kw) at 150 psig inlet (10 BAR)

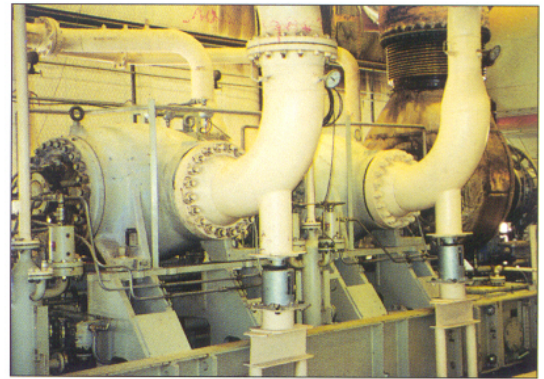
Weight: 35 lbs. (15.9 kg) Motor only
Add 30 lbs. (13.6 kg) for Special Housing 60057
OR
Add 53 lbs. (24.1 kg) for Special Housing 60069

Air/Gas Supply: Natural gas or compressed air

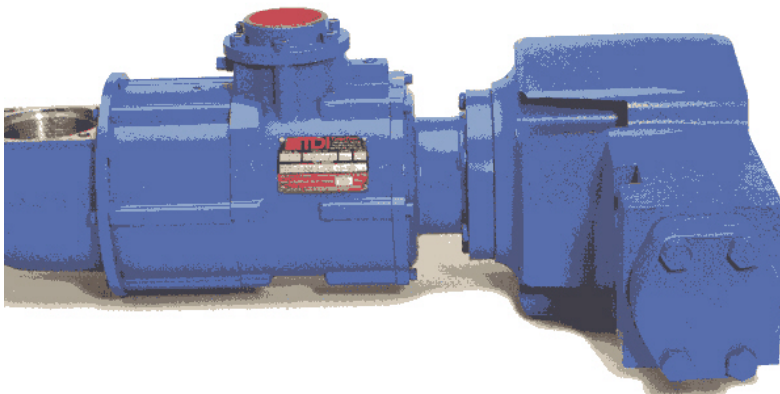
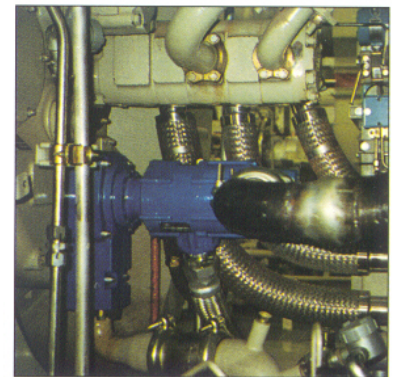
Pressure: (T115) 200 psig

Installation: TDI provides special motor housings for precise mating to Solar Centaur and Taurus Engines.

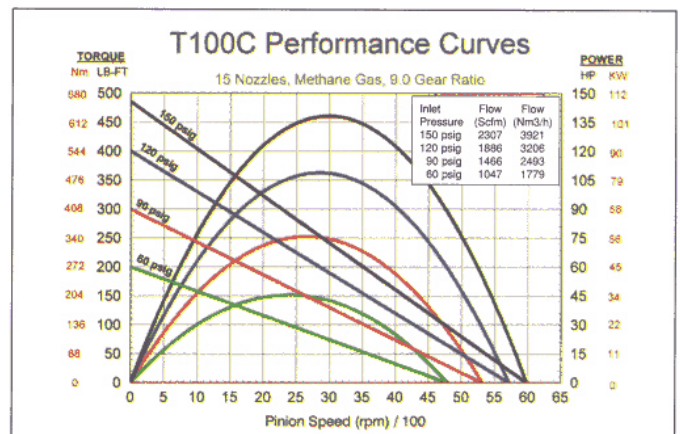
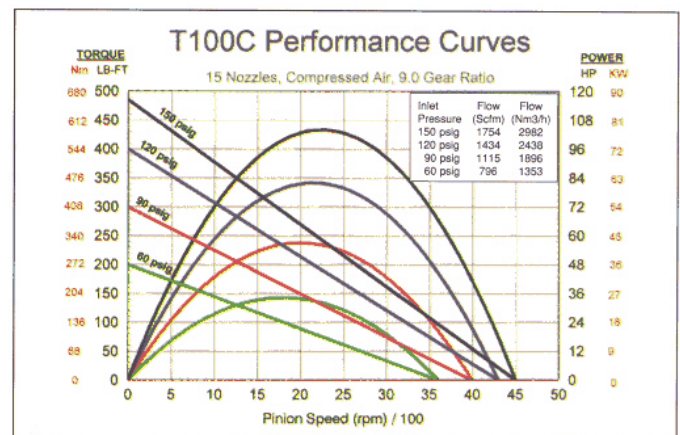
Gear ratio: 9.0



T100-C on Solar Centaur Gas Turbine Engine.



The T100-C turbine driven pneumatic starter motor has been designed to mount to the hydraulic and electric motor pad used to start the Solar Centaur Gas Turbine Engine.



TURBOTWIN™ **T30-M** **Air Driven** **Pump** **Motors**

**For Pre-and-Post
Lube and Seal Oil
Pump Operation
on Less Air**

The efficiency of the T30-M turbine motor delivers the industry's highest torque using significantly less air than any competitive air motor. The result is greater capability for continuous duty operation. The T30-M can provide up to four hours of continuous duty operation to be exact, with no burn-out, no freeze-ups and amazingly, without worries about lubrication of the drive air. It's simply not required. Furthermore, the TurboTwin turbine design eliminates the maintenance, mess and failures associated with traditional vane-type motors.

No oil. No emission problems.

To further simplify the function of pre-and-post lube pumping, T30 comes grease packed for life. This means no messy oil and no lubrication requirements. The supply air requires no prelubrication, thus eliminating hazardous fugitive emissions as well as the safety and environmental concerns that go with them.

TurboTwin is the Most Reliable. Here's Why.

TDI turbine motors not only last longer than vane motors, but they are less susceptible to damage by field contaminants that cause breakdown. Dirt, sand, rust and other contaminants that lodge inside and destroy vanes, simply pass through the turbine open air path design. Humidity, salt air, or moisture that cause vane parts to stick or swell have no effect. Add to that no rubbing parts, no plastic parts and the industry's fewest moving parts, and the T30 stands above the rest for maintenance-free operation.

Sour Gas? Bring it on.

Intake of sour gas is inevitable. It happens, and when it does your vane motor shuts down. That is, unless you have the T30. Sour gas poses no problem to the industry's most reliable air motor.

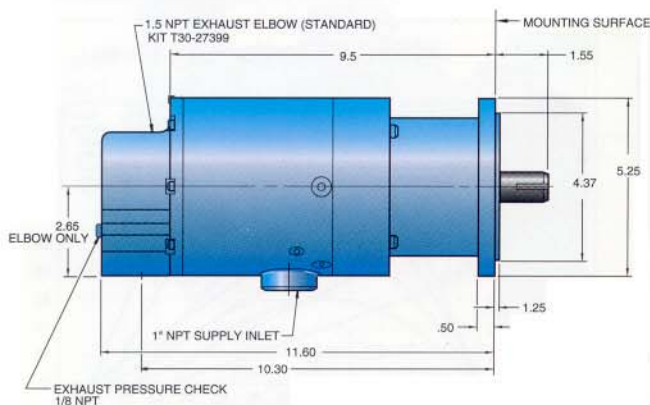
Maximum power. Minimum air.

T30 optimizes the amount of torque delivered to the driven member, and it does it with less air. Compare with any competitive model and you'll find that no one delivers more on less.

Remote Locations and Cold Weather are Ideal Conditions for T30.

Control lines and electrical wiring to faraway locations not only complicate installation, but add to the list of things that can cause failure. Remote locations

DIMENSIONAL DATA **TDI T30-M TURBOTWIN™**



SPECIFICATIONS

are perfect applications for T30 because there is no need for separate control or wiring. And T30 requires no pre-lubricated supply air, meaning the problems associated with oil at cold temperatures are no problem at all.

Easy Installation.

At only 29 lbs. (13 kg), installation is a one man operation. No sophisticated wiring or control hook ups either. Piping is easy too. Only one supply line plus a ball or relay valve.

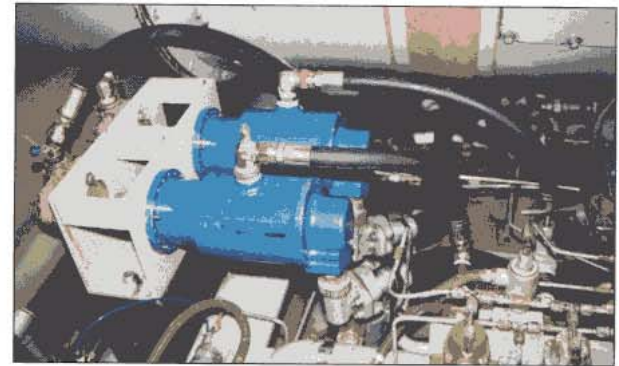
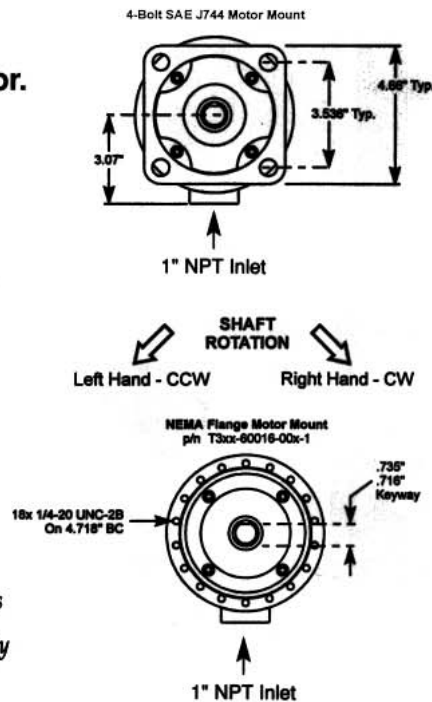
More than Just a Pump Motor.

By significantly improving the reliability of pre-lube and post-lube pumping functions, the T30 further assures the reliability of your gas turbine. The relentless operation of these turbine motors assures that when you have to be "on-line" pumping gas, your pre-lube operation won't be the thing that stops you.

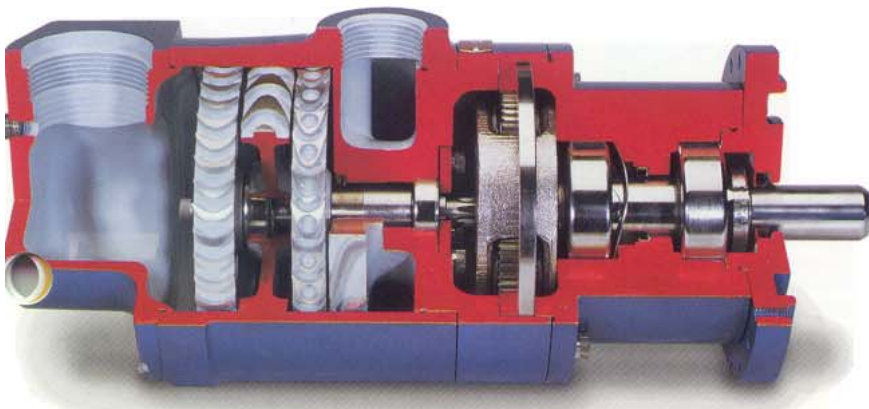
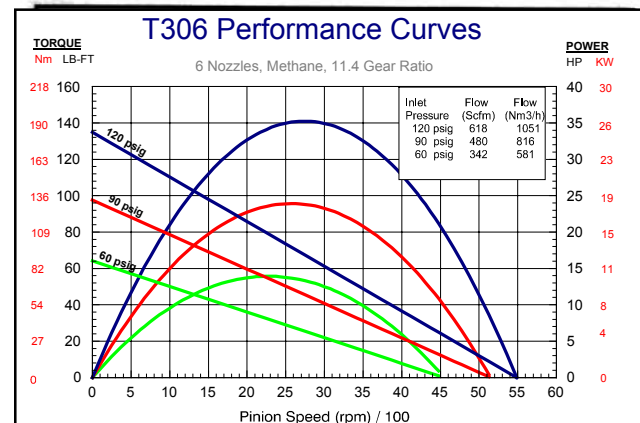
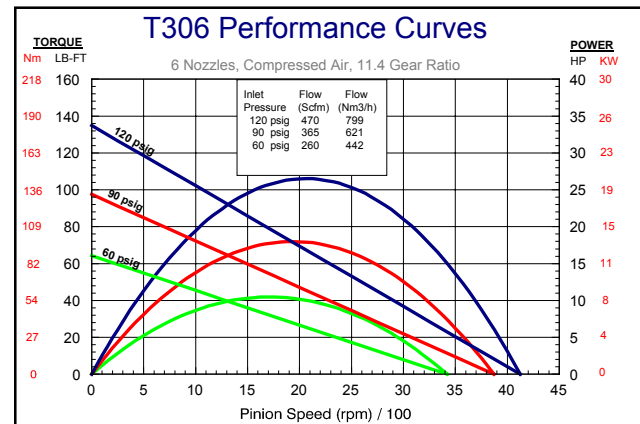
The efficiency of the T30 turbine motor delivers the industry's highest torque using significantly less air than any competitive pump motor.

Engines:	Solar Saturn and Centaur Engine
Power:	Up to 35 hp (26 Kw)
Weight:	24.5–29 lbs. (11–13 kg)
Air/Gas Supply:	Natural Gas or compressed air

Pressure:	30–150 psig (2–10 bar)
Duty Cycle:	Intermittent to 4 hours
Gear ratio:	11.4 9.0
Inlet size:	1" npt
Exhaust size:	1.5" npt threaded (90° elbow)



Typical Solar Saturn auxiliary-pump motor installation.



TURBOSTART™

Valves and Accessories

TDI offers a wide variety of valves, fittings and accessories to help maximize the efficiency of your TurboStart Starters. Featured here are some of the more popular items. For specific order numbers or additional accessory needs, contact your local distributor or visit our website at:
www.tdiairstarters.com



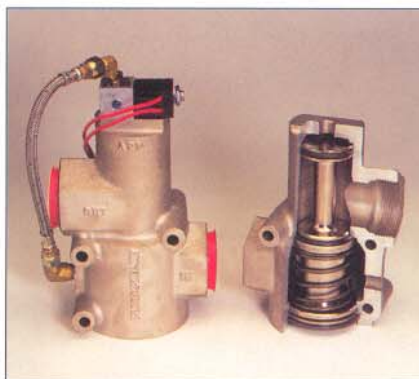
Control Valves

TDI offers both a manual pushbutton and DC solenoid version of its popular control valve for pilot operation of the TDI relay valve.



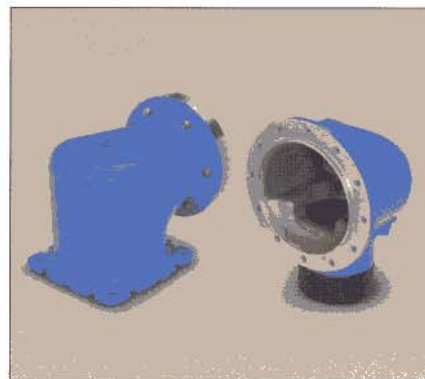
Exhaust Fittings for T30

Muffler and exhaust fittings help manage air discharge on the T30 series air starters.



TurboValve Control Relay Valves

Both manual and electrical pilot-operated TurboValves feature high flow capacity that reduce pressure drops through the valve, making it versatile for a wide range of applications. The electrical version features an integrated solenoid that eliminates extra plumbing and fittings.



Exhaust Elbows

These elbows channel air exhaust for starters. Available in both threaded and flanged versions, including ANSI type.



Air Strainers

This is an ideal attachment that helps assure long starter life by pre-filtering air or gas that is contaminated, especially at package start-up.



Exhaust Fittings

Available in 3" and 4" NPT and metric versions.

TDI Application Guide for Gas Turbine Engine Air Starters

Tech Development Quality Assurance

Tech Development's Quality Management System is certified under the ISO 9001 and AS9000 quality assurance standards.

Certifications include design, manufacture, assembly, and distribution of turbine machinery including air turbine starters/ motors, air cycle machines, and the manufacturing of air foils.

These certifications assure TDI processes adhere to the world's most stringent quality standards. Whether it's flight hardware for the aerospace industry or turbine starter motors for the oil and gas industry, every TDI product is tested before delivery. All materials and manufacturing data is recorded and stored at the factory to further assure quality and traceability. We know you buy our starters because of their quality and reliability. We want you to know that the quality of our manufacturing process is also certified among the world's best.

This selection guide will help you select the appropriate Tech Development starter based on the engine you have. Engines are listed by manufacturer and model with the corresponding TurboStart part number across from it. This chart does not list all compatible engines. For questions concerning other engines, call the factory at 937-898-9600.

MANUFACTURER	ENGINE (Model)	TDI PART NUMBER	REMARKS	MOUNT	SPLINE PITCH
ALLISON	570 KA	56B-1021L	Inst. on Gearbox Pad	MS3332-2	20/40
	501 KB	5-51680-021		SAE C	SAE C
	501 KC	56K-4021L		AND20002-XII	20/30
DRESSER CLARK	DC-990	56B-2021L		MS3332-2	20/40
DRESSER-RAND	DR-990	56B-2021L		MS3332-2	20/40
	DJ-50	56B-2021L		MS3332-2	20/40
GENERAL ELECTRIC	LM500	56B-1021L	Custom Custom	MS3332-2	20/40
	LM1600	56G-2021L-000-0-75		Special	16/32
	LM2500	56G-3021L-000-0-75		Special	16/32
KAWASAKI	PU2500 to PU4000	5-51250-021-6-20		SAE C	
		5-51250-021-6-21			
		5-51250-021-6-22			
KONGSBERG	KG2	5-51255-021-0-02	Custom	SAE C	SAE C
	KG3	5-51650-021-2-00		SAE C	
PRATT & WHITNEY	GG3 & GG4	56A-1121L-200-3	Air Use Natural Gas Air Use Natural Gas	AND20002-XII	20/30
	FT4, FT8	56A-1121L-206-3		AND20002-XII	20/30
		56A-1121L-200-3		AND20002-XII	20/30
ROLLS ROYCE	AVON SPEY	56A-1121L	Special w/ Speed P/U	AND20002-XII	20/30
		56A-1121L-001-0-09		AND20002-XII	20/30
SOLAR	SATURN MARKI or MARKII	56S-2007L	Std. Pres. Low Pres. Contact Factory	w/ Clutch	20/30
		56S-2001L		w/ Clutch	
	CENTAUR TAURUS	T106-60006-MOL-1	Replaces I-R SS800 & TS700 (Square Body)	w/o Clutch	Special Coupling
		T112-60057-COL-9E		Special Mount	
		T115-60057-COL-9E			
		T121-60057-COL-9E			
	CENTAUR TAURUS	T112-60069-COL-9E	Replaces I-R 201 RM (Round Body)	Special Mount	Special Coupling
		T115-60069-COL-9E			
		T121-60069-COL-9E			



AS9000

TDI **TURBOSTART**™

AIR STARTERS FOR

GAS TURBINE ENGINES

**Derived from Aerospace.
Designed for Industry.**

Since 1958, TDI has been a significant player in the design, testing and manufacturing of turbine-related machinery for the world's most sophisticated aircraft. So it's no surprise that when TDI engineers put their minds to designing starters for industrial gas turbines, their TurboStart motors quickly garnered recognition for their power, reliability and efficiency.



The honing and discipline of a demanding aerospace industry has enabled TDI to establish new standards for industrial turbine starters based on the concepts of more power and smaller packages. The result is a line of starters that display the precision and quality of aerospace components, yet designed to match the harsh environmental challenges facing industrial gas turbine engines.

Our engineers introduced their first industrial gas turbine starter in 1984. Twelve models and hundreds of refinements later, they continue to introduce products that break new ground for power and reliability for industrial gas turbine starters.



TDI
TECH DEVELOPMENT INC.
www.tdiairstarters.com

Aerospace Quality. Industrial Pricing.

AS9000



6800 Poe Avenue, P.O. Box 13557, Dayton, Ohio 45413-0557 • Tel: (937) 898-9600 Fax: (937) 898-8431
TURBOSTART, TURBOVALVE, TURBOSTART TWO, AND TURBOTWIN are trademarks of Tech Development Inc.,
U.S.A. © Copyright 1999, Tech Development Inc. U.S.A.

Saturn and Centaur are registered trade names of Solar, Inc. Spey and Avon are registered trade names of Rolls Royce, Ltd.
A part of Smiths Aerospace.

AN01-139 9/01