PORTABLE DYNAMOMETERS FOR TESTING AEROSPACE TURBINES

KAHN SERIES
102

KAHN INDUSTRIES, INC.

KAHN SERIES 102 HYDRAULIC DYNAMOMETERS FOR LOAD TESTING AEROSPACE ENGINES

Designed primarily for steady-state and transient performance testing of medium speed turboshaft engines and small turboprop engines, the Kahn Series 102 product line includes five standard models capable of absorbing up to 3000 hp (2240 kW) and operating at rotational speeds up to 11,000 rpm.

Proven in engine test facilities around the world, the Series 102 offer long service life coupled with minimum maintenance requirements. All units are fully compatible with advanced, fast-response FADEC (Full Authority Digital Electronic Control) engine control systems and meet or exceed the test specifications of all current turboshaft and small turboprop engines, including the following:

Honeywell: AGT1500, LTS101, LTP101, T53, TPE331/T76
Pratt & Whitney: PT6A, PT6B, PT6T/T400, PW200
Rolls-Royce: 250-B, 250-C/T63, Gem
Turbomeca: Arriel, Arrius, Artouste, Astazou
Consortium: MTR390.

DESIGN BENEFITS

Built to meet the most demanding engine test requirements, the Kahn Series 102 dynamometers offer a number of important design benefits:

- Easy to install and to operate.
- Flange mounted configuration permits alignment-free installation directly to the engine or the flywheel.
- Stainless steel power elements are highly cavitation and corrosion resistant providing superior service life.
- Positive sealing assures quick and safe emergency shutdowns.
- Positive sealing permits operation at all attitude positions from horizontal to vertical.
- Perforated disc power elements absorb full power in both directions of rotation.
- Inherently steep, open-loop torque speed characteristic assures stable steady-state operation.
- Low moments of inertia and small internal water volumes permit rapid transient response.
- Grease lubrication eliminates environmental hazards associated with oil-mist lubrication.
- Simple modular design concept permits quick overhaul by the user.

CONSTRUCTION

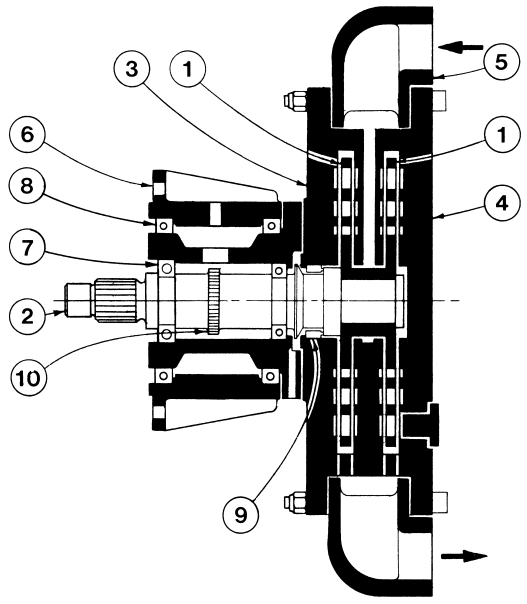
Series 102 hydraulic dynamometers feature two sets of power elements (rotors and stators) capable of fully bi-directional operation. The power elements are made from highly cavitation and corrosion resistant stainless steel. This material is also used for the shaft and other rotating components.

The rotor assembly is supported by grease-packed, spring-loaded precision ball bearings. Through the use of advanced, highly water-resistant high-speed greases, Kahn has eliminated the environmental hazards associated with oil-mist lubrication. To assure smooth, vibration-free operation, the rotor assembly is dynamically balanced in accordance with high-speed turbine requirements.

Positive sealing between the water and bearing compartments is accomplished with a mechanical carbon face seal. This feature permits operation of the dynamometer under all conditions including zero speed. Unlike with labyrinth seals, there is no need to unload the dynamometer during shutdowns to prevent water from entering the bearings.

The dynamometer module is supported in the trunnion mount by rugged, tapered roller type trunnion bearings. This results in smooth, vibration-free operation under the most severe operating conditions as well as excellent torque measurement accuracy.

Featuring a simple modular design concept, the Series 102 dynamometers consist of less than 30 components (excluding assembly hardware). Their simple design requires only minimum maintenance and allows for quick field overhaul.



1 Perforated Disk Rotors
2 Shaft
3 Housing Cap
4 Endcap
5 Housing Ring
6 Trunnion Mount
7 Shaft Bearings
8 Trunnion Bearings
9 Carbon Face Seal
10 60-tooth Gear

POWER ABSORPTION MECHANISM

The power output from the engine is absorbed by water vortices generated in the perforated disc rotors and stators. The resulting drag applies a moment to the dynamometer housing which is measured by a strain-gage load cell mounted to the torque arm.

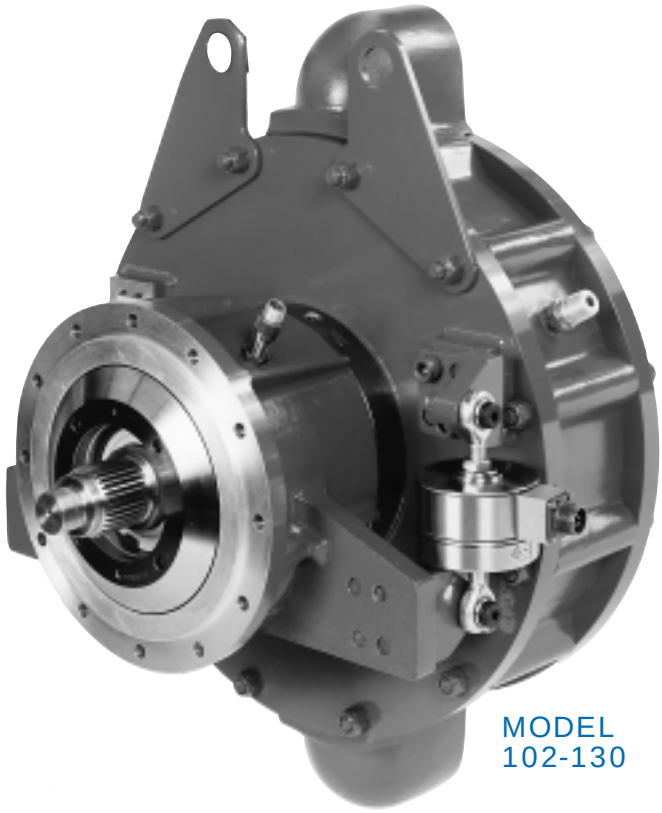
Absorbed power is controlled by modulating the amount of water in the dynamometer with the inlet and outlet control valves.

WATER REQUIREMENTS

A continuous flow of water through the dynamometer is required to provide resistance to rotation and to remove the heat generated by the power absorption process. Based on a maximum water outlet temperature of 140˚F (60˚C), water flow requirements range from 4 gal/hr hp (20 l/hr kW) for once through water systems to 6 gal/hr hp (30 l/hr kW) for recirculating water systems.

The following water flow rate and temperature data apply for installations using recirculating systems with evaporative cooling towers:

Specific Water Flow Rate	6.0 gal/hr hp (30 l/hr kW)
Water Supply Pressure	50 psig (3.5 bar)
Water Inlet Temperature	90˚F (32˚C)
Water Outlet Temperature	140˚F (60˚C)
Filtration	40-mesh screen (340 micron)

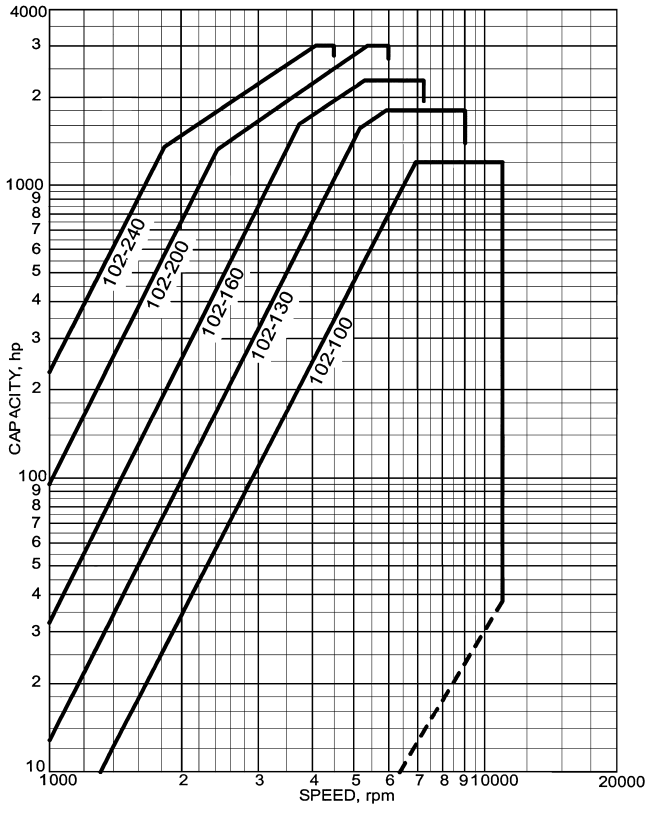


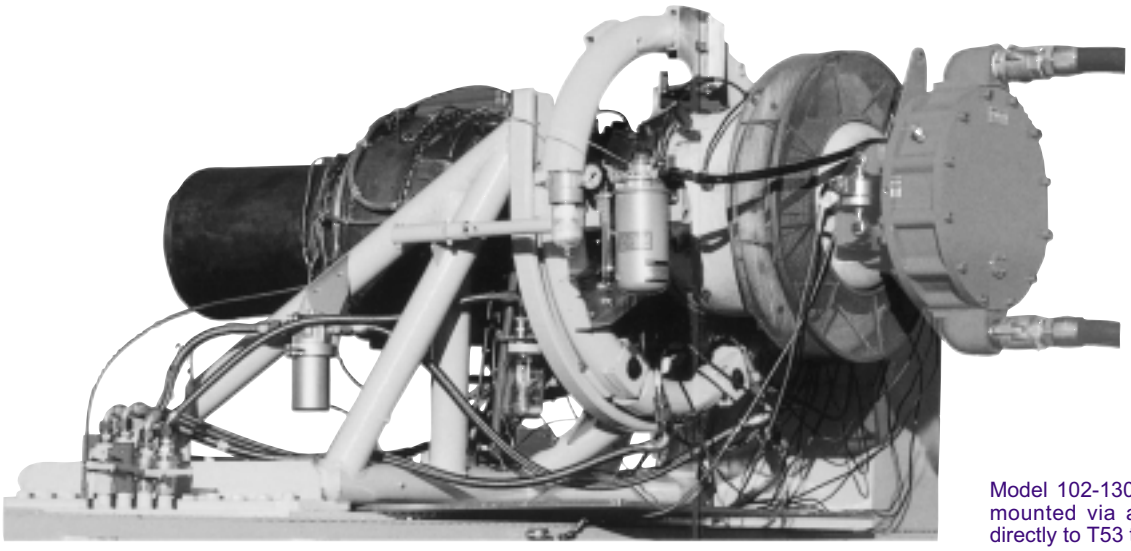
MODEL
102-130

SPECIFICATIONS

Model	Max. Power hp	Max. Speed rpm	Max. Torque lb-ft	Dry Weight lbs
102-100	1200	11000	900	285
102-130	1800	9000	1600	285
102-160	2400	7200	2400	375
102-200	3000	6000	3000	750
102-240	3000	4500	4000	880

OPERATING RANGE





Model 102-130 portable dynamometer mounted via adapter and quill shaft directly to T53 turboshaft engine.

MANUAL CONTROL SERIES 514

- Two fast-acting electro-pneumatic valves for fast dynamometer control with the ability to conduct transient testing.
- Testing applications include speed governed engines and gas turbines.

AUTOMATIC CONTROL SERIES 545

- Latest generation design, with adaptive control.
- Very fast control capability to meet the most demanding steady-state and transient test requirements for dynamometer control when testing aircraft engines and experimental gas turbines.
- Electro-hydraulic valves for fastest control, with full stroke in less than 100 milliseconds, allows the dynamometer control system to be faster than most engine control systems.
- Manual mode and three closed loop automatic modes for flexible control of all engine types:
  - Automatic speed control
  - Automatic torque control
  - Automatic power law relationship between speed and torque.
- Numerous features to suit the application and user:
  - Bumpless transfer
  - Storage/retrieval of multiple PID settings
  - Built-in speed calibration
  - Pushbutton selectable English and metric units
  - Demand signal display

ENGINE TEST STANDS SERIES 505

Manufactured from rectangular structural steel, the engine test stands are designed to rigidly support both the dynamometer and the engine during the performance test. Stationary and/or mobile engine test stands are available for a wide variety of diesel, turboprop and turboshaft engines, including the latest generation of high speed gas turbine engines. Each stand is fully analyzed to ensure that it is rigid and that trouble-free operation is inherent in the design.

- Static finite element computer analysis eliminates shaft misalignment due to deflections under engine loads.
- Dynamic finite element computer analysis ensures freedom from harmful vibration, whether due to a forced vibration or a resonant vibration.

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