

SERIES 400 CAVITATION-FREE FLANGE-MOUNTED HYDRAULIC DYNAMOMETERS

Specifically developed for steady-state and transient load testing of high-speed turboshaft engines and experimental gas turbines, the Kahn Series 400 are the only high-speed hydraulic dynamometers in their power class which carry a special 5000 hour/5 year warranty against cavitation damage of the power elements.

Fully compatible with advanced, fast-response FADEC (Full Authority Digital Electronic Control) engine control systems, the Series 400 hydraulic dynamometers meet or exceed the test specifications of all current high-speed turboshaft engines, including the following: Allison/Garrett T800, General Electric T58, T700, Rolls-Royce Gnome, Rolls-Royce/Turbomeca RTM 322, Turbomeca Makila, Turmo.

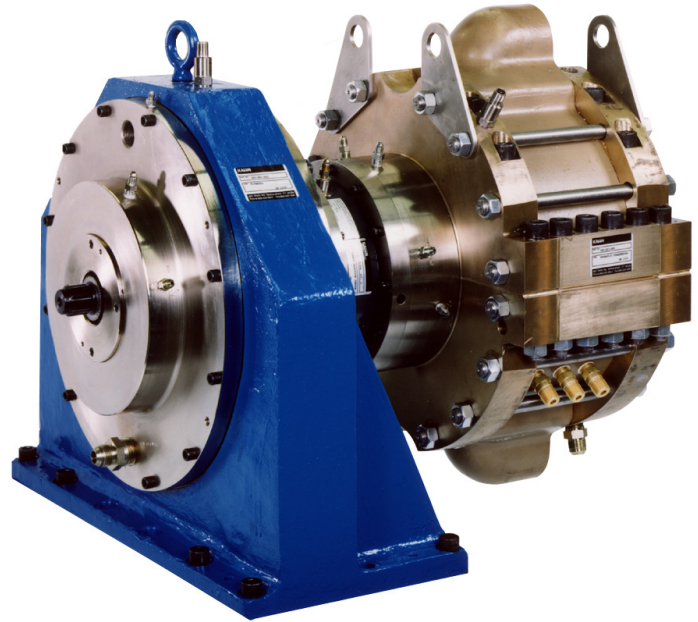
DESIGN BENEFITS

When operating at high rotational speed and high power density, conventional vaned rotor or perforated disc hydraulic dynamometers are plagued by severe cavitation erosion, which, in many instances, has led to the complete deterioration of the power elements within only a few hundred operating hours.

Equipped with smooth-disc power elements which absorb power by viscous shear rather than through highly turbulent vortex formation, the Kahn Series 400 hydraulic dynamometers inherently discourage cavitation inception, thereby eliminating the need for frequent replacement of the power elements.

Designed and built to meet the most demanding test requirements, the Kahn Series 400 dynamometers offer a number of important design benefits:

- Cavitation-free, smooth-disc power elements provide a service life in excess of 10,000 operating hours, saving money and downtime.
- Inherently steep, open-loop torque-speed characteristic assures stable steady-state operation.
- Low moment of inertia and small working water volume permit rapid transient response.
- Inherently low minimum power absorption characteristic permits performance of transient load bursts originating at near zero load.
- Smooth-disc power elements absorb full power in both directions of rotation.



SPECIFICATIONS

Model	Max. Power hp	Max. Speed rpm	Max. Torque lb-ft	Dry Weight lbs
404-012	700	60,000	80	275
404-016	1000	40,000	150	320
404-020	1600	35,000	300	510
404-025	2500	30,000	600	800
405-025	3000	30,000	750	920
404-032	3800	24,000	1100	1100
406-032	5500	24,000	1600	1750

POWER ABSORPTION MECHANISM

The power output from the turbine is absorbed by viscous shear generated in the boundary layers adjacent to the rotor and stator surfaces. The resulting drag applies a moment to the dynamometer housing which is measured by a coaxial strain-gage torque reaction sensor mounted to the dynamometer flange.

Absorbed power varies with rotational speed and with the mass of water contained in the rotor chambers. With fully filled rotor chambers, absorbed power increases and decreases with the cube of speed. The amount of water in the dynamometer is modulated with the inlet and outlet control valves.

CONSTRUCTION

A four-stage smooth-disc rotor, machined from a solid, high-strength stainless steel forging, is the key element of the Kahn Series 400 hydraulic dynamometers. To reduce disc stresses, the discs are configured with an approximate uniform stress profile. The rotating assembly is dynamically balanced in accordance with ANSI Standard S2.19-1999, Grade 2.5.

To assure smooth, vibration-free operation at high rotational speeds, the rotor is supported by spring-preloaded aircraft type ball bearings. Two methods of lubrication are offered for Series 400 hydraulic dynamometers:

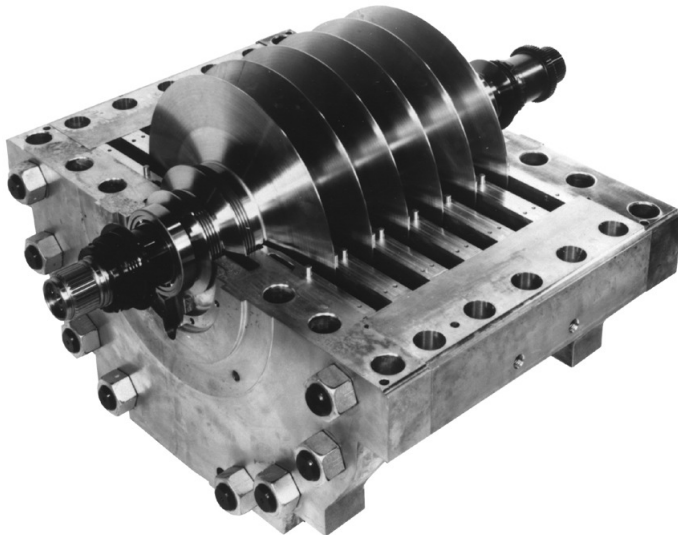
- Oil-Jet Lubrication
- Oil-Mist Lubrication

Both options use synthetic aircraft engine oils with a viscosity range of 3.0-5.0 cSt at 210°F(99°C), such as MIL-PRF-23699.

Oil-jet lubricated units are equipped with circumferential type segmented carbon seals which provide positive sealing between rotor chamber and shaft bearings under all operating conditions. Labyrinth seals with buffer air ports are provided at the shaft ends. This seal configuration permits starting the dynamometer under load and performing a full emergency shutdown under load down to zero speed.

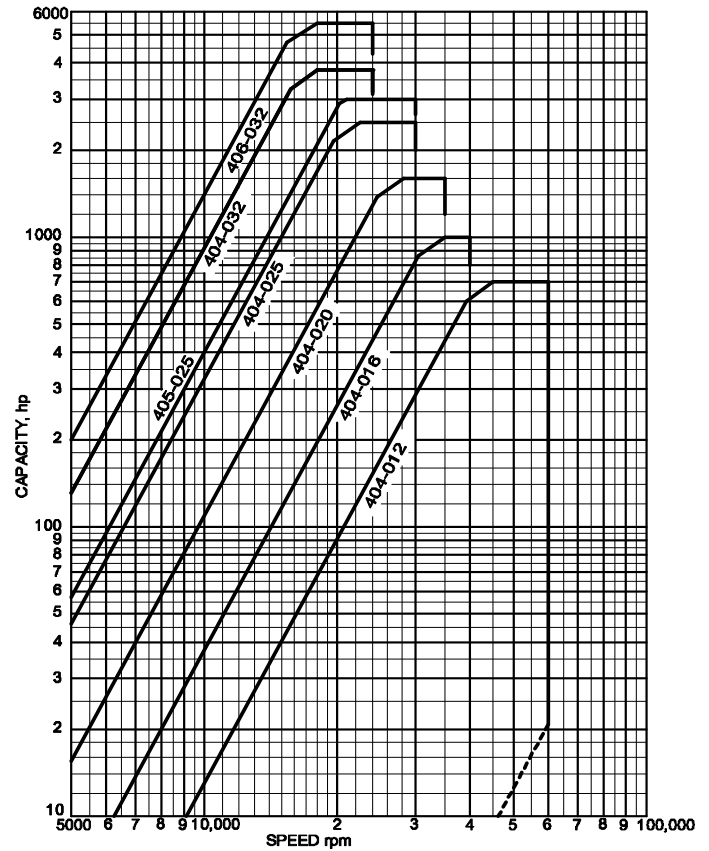
Oil-mist lubricated units are equipped with non-contacting, two-stage labyrinth seals. Minimum radial seal clearances are achieved by using "soft" seal liners in the housing. Intermediate water drain cavities with rotating flingers prevent any water leaking through the inboard seals from entering the shaft bearings.

The horizontally split housing design permits replacement of the shaft bearings with minimum downtime and installation of the rotor assembly exactly as balanced. To assure long service life, all stationary materials inside the dynamometer are manufactured from highly corrosion-resistant materials.



Partially assembled Kahn Series 400 hydraulic dynamometer. This unit is used for testing of heavy turboshaft engines.

OPERATING RANGE



FACILITY 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), the water flow requirements are:

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	340 micron

Both oil-jet and oil-mist lubricated units require a continuous supply of clean, dry compressed air for the operation of the oil-mist system and the seals:

Air Flow Rate	20-40 scfm (34-68 m ³ /h)
Air Supply Pressure	100 psig (7.0 bar)
Air Dew Point	-40°F (-40°C)
Filtration	5 micron

NOTE: The information included herein was correct at the time of publication and supersedes all previous data. It is our policy to continually improve our products to insure even better performance. Consequently, current Kahn products may incorporate modifications not shown on these pages.