

VAROC[®] Air Dynamometers

For Load Testing Gas Turbine Engines



CONCEPTS NREC

VAROC® Air Dynamometers

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The VAROC Air Dynamometer has established a new world standard for testing aircraft and industrial gas-turbine engines. The patented design is a VArIable-geometry, Radial Outflow Compressor (VAROC) that provides significant advantages over all other types of dynamometers. The VAROC can operate in any climate and is designed to be highly reliable, simple to operate, easy to maintain, compact, and lightweight. VAROC dynamometers are now being used by military and commercial organizations throughout the world and are the dynamometers preferred by the defense agencies of the United States, Australia, Italy, Japan, Spain, and others.

VAROC provides load testing without complex water systems and support equipment.

The VAROC uses ambient air for power absorption and does not need the substantial water systems required by conventional dynamometers. VAROC dynamometers completely eliminate the need for fixed plumbing installations, heat exchangers, cooling towers, and electrical load banks. Using air as the working fluid also eliminates environmental pollution caused by oil contamination of the water system.

VAROC simplifies fixed test-cell installations or mobile field applications regardless of climate.

Using no water and only ambient air to absorb engine output greatly enhances portability and allows the VAROC to operate in any climate. This can be a significant advantage in fixed test-cell operations and is essential for practical remote engine testing.

Patented VAROC technology provides stable operation and precise control.

The unique VAROC design uses a two-sided impeller to create a balanced double air-entry arrangement. Power absorption is precisely controlled by a moving shroud which exposes a portion of the rotating impeller blades to the flow path. This variable-length blade system is accurately regulated by a stepping motor and a rugged chain drive. The high inertia of the impeller allows very stable open-loop control even at low loads.

The VAROC system is simple to operate, easy to maintain, and inherently reliable.

No special training is required to use a VAROC dynamometer, and the simplicity of the VAROC design substantially reduces maintenance. Moving parts are limited to the impeller, bearings, and the shroud-actuating mechanism. The impeller is supported between rugged oil-damped ball bearings. With minimum regular maintenance, the proven VAROC dynamometer can achieve long overhaul periods with overhauls performed on-condition.



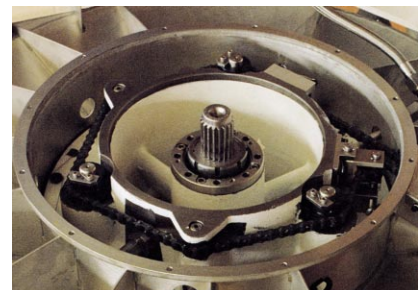
The VAROC Air Dynamometer is used worldwide by both military and commercial organizations to test a broad range of gas-turbine engines.



The VAROC-250 and the VAROC-35 can be used to test more than forty engine types covering a wide range of power and speed.



The VAROC is compact, lightweight, highly portable, and needs little support equipment, so it can be used anywhere regardless of climate.



The VAROC's only moving parts include the impeller, bearings, and the shroud-actuating mechanism which result in less maintenance and repair.

VAROC can accommodate a wide range of current and planned turboshaft engines.

The VAROC-250 and the VAROC-35 can each test engines covering a broad application of power and speed requirements. Together the two models test more than forty engine types including the popular T58 and T700 series. Engine shafts can be coupled to either end of the VAROC for rotation in either engine direction. When used with optional torque-sensor instrumentation, the VAROC dynamometer can test an entire series of engines with a single dynamometer/sensor combination.

Concepts NREC works with test-system manufacturers to supply complete test packages.

Concepts NREC can supply only the VAROC dynamometer or work with proven test-system manufacturers to produce a turnkey VAROC test cell. Concepts NREC can also supply all shafting, torque measurement systems, dynamometer control equipment, instrumentation, and special accessories.

VAROC features and user benefits overcome the many deficiencies of other dynamometer designs.

Dynamometer type	VAROC	Eddy Current	Hydraulic
Working media	● Air	● Electricity/Water	● Water
Environmental risk	● Low	● High	● High
Operating climate	● All	● Limited	● Limited
Speed range	● Low to very high	● Low to high	● Low to high
High-speed gearbox	● None	● Often	● Often
External support	● Minimal	● Complex	● Complex
Installation	● Fixed or portable	● Fixed	● Primarily fixed
Cooling	● Ambient air	● Treated water	● Treated water
System weight	● Light	● Heavy	● Heavy
System size	● Small	● Large	● Large
Operation cost	● Low	● Moderate	● Moderate

The VAROC Air Dynamometer

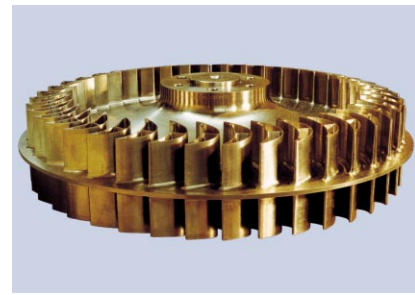
The VAROC uses a unique patented radial-outflow compressor with sliding shrouds that effectively modify the geometry of the flow path to vary engine load. The simple VAROC design provides stable operation over a wide range of speed and power, and permits low weight, small size, minimal maintenance, and high portability in any climate.

Eddy current dynamometers

Eddy current dynamometers are large, heavy devices for fixed installations with cooling systems that generally require water treatment. Besides not being portable, eddy current dynamometers are expensive to operate and maintain, and have a relatively narrow operating range which limits the number of engine models that can be supported by any one unit.

Hydraulic dynamometers

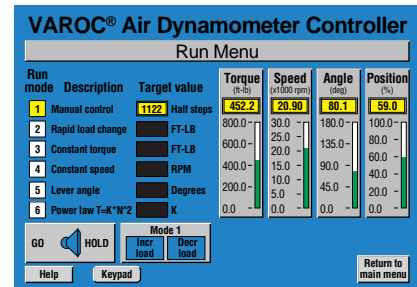
Hydraulic dynamometer systems are heavy, not easily transportable, and typically limited to low speeds. The water must be cooled for reuse and can become contaminated with chemicals that pose an environmental threat which is expensive to treat. Water impurities and corrosion can also cause poor reliability, premature rotor erosion, and the need for frequent maintenance.



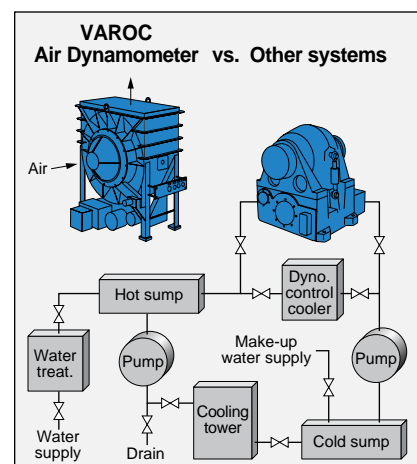
The VAROC uses a unique two-sided, variable-geometry, radial-outflow compressor impeller that provides stable operation and allows precise control.



The U.S. Army incorporates state-of-the-art Concepts NREC air dynamometers in their mobile Flexible Engine Diagnostic/ test System (FEDS).



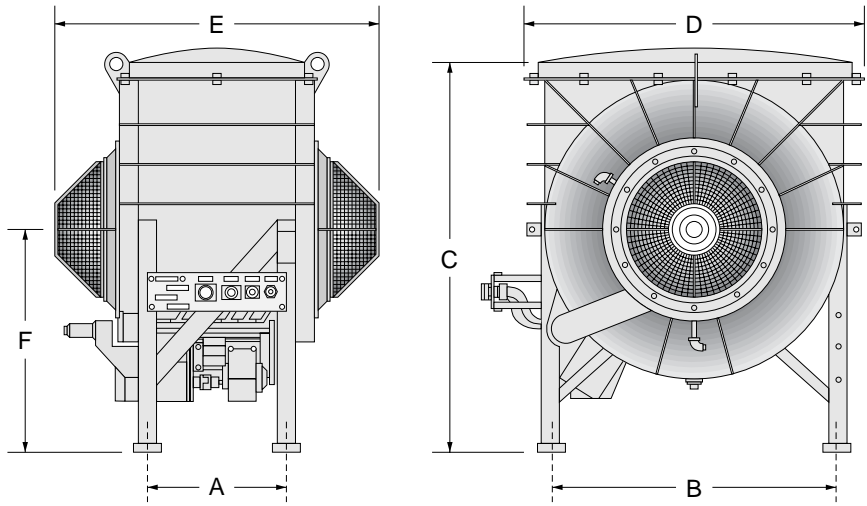
The VAROC control system digital output screens support the high precision offered by VAROC technology.



VAROC's simple design eliminates the need for complex support equipment required by other systems.

Specifications

Dimensions

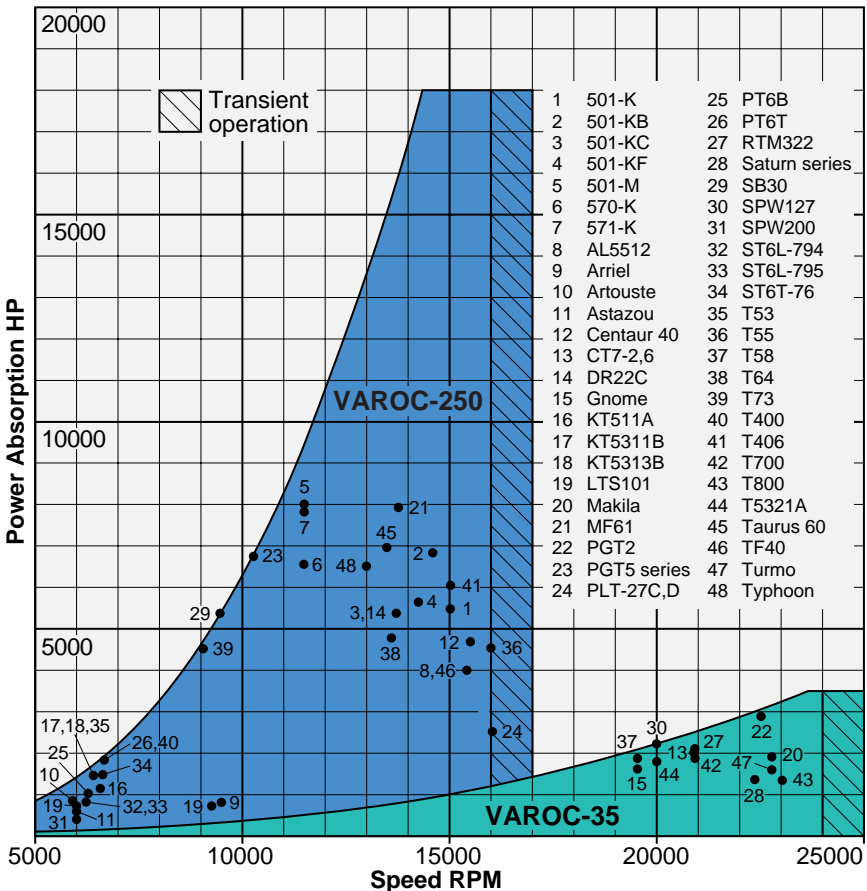


	A	B	C	D	E	F
VAROC-35	13.5	28.7	40.2	35.2	33.0	23.7
Inches (cm)	(34.3)	(72.9)	(102.1)	(89.4)	(83.8)	(60.3)
VAROC-250	24.5	50.5	58.9	60.0	47.6	30.0
Inches (cm)	(62.2)	(128.3)	(149.6)	(152.4)	(120.9)	(76.2)

Performance

	VAROC-35	VAROC-250
Speed range	0-24,000	0-16,000
RPM		
Power range	0-3,500	0-18,000
HP (kW)	(0-2,600)	(0-13,500)
Weight	830	2,875
lbs (Kg)	(376)	(1304)
Operating voltage	100-440	100-440
VAC (Hz)	(50-60)	(50-60)
Integral lube system	Integral	Optional
Torque options	Reaction	Reaction or shaft
Control options	Manual or automatic	
Mass flow	18.2	77.4
Lb/sec (Kg/sec)	(8.3)	(35.1)
Rotor inertia	0.5	2.99
Slug-ft ² (Kg-m ²)	(0.68)	(4.05)

Dynamometer Operating Envelopes



Component Characteristics

	VAROC-35	VAROC-250
Plenum	Stainless steel	
Impeller	Stainless steel	Titanium
Seals	Wear-compensated segmented carbon	
Bearings	Preloaded angular contact ball bearings	

Service

Concepts NREC maintains extensive overhaul and maintenance facilities plus a complete inventory of spare parts for fast service.

Please call or write for further information about VAROC Air Dynamometers and complete engine test systems.

CONCEPTS NREC

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