R25-300

Turbojet Engine

The R25-300 two-shaft, two-rotor engine with afterburner has a three-stage low-pressure compressor and a five-stage high-pressure compressor, a cannular combustion chamber, single-staged low- and high-pressure turbines, and a fixed-area nozzle. The two-stage afterburner allows high-altitude air combat.

Basic specifications	
Thrust (H=0, M=0, ISA), kgf:	
emergency thrust	*7,100**
afterburner	*6,850*
Specific fuel consumption, kg/kgf/h	*0.91*
Air consumption, kg/sec	*68.5*
Pressure ratio	*9.1*
Gas temperature before the turbine, ºK	*1,353*
Dimensions, mm:	
length	*4,615*
max diameter	*907*
Engine dry weight, kg	*1,215*

** - 9,900 kgf at M=1.0*

The engine's main advantages are convenient maintenance, a continuous range of afterburning modes control with smooth thrust change, and easy single-handle control. The engine has two afterburning modes: afterburner and emergency thrust. The engine is designed to power the MiG-21 family aircraft.

The R25-300-94 is designed to power the MiG-21-93 aircraft. It has an integrated hydroblade drive generator with multiplier and a reinforced gearbox drive chain.

R-95Sh, R-195

Turbojet Engines

The R-95Sh and R-195 engines feature a two-shaft configuration and a modular design. There is a three-stage low-pressure compressor without a guide vane, and a five-stage high-pressure compressor. The cannular combustion chamber has twin nozzles. The low- and high-pressure turbines are single-staged. There is no afterburner, and the nozzle is of a fixed-area type.

Basic specifications	R-95Sh	R-195
Thrust, kgf:		
max continuous (H=0, M=0)	*4,100*	*4,300*
emergency (H=0, M=0)	*–*	*4,500*
Specific fuel consumption at take-off, kg/kgf/h	*0.860*	*0.890*
Air consumption, kg/sec	*67*	*66*
Pressure ratio	*8.7*	*9.0*
Gas temperature before the turbine, ºK	*1,148*	*1,188*
Dimensions (without accessories), mm:		
length	*2,700*	*2,880*
max diameter	*772*	*805*
Engine dry weight, kg	*830*	*860*

The engines are noted for ease of operation, high reliability and combat survivability. They can withstand 23mm round hits, and retain operability after considerable damage (combat proven cases).

The R-195 engine is a derivative of the R-95Sh engine. It features increased thrust, improved maintainability, reduced IR signature, and enhanced stability during missile launch. The R-195 is fully interchangeable with the R-95Sh engine.

Variants

The R-95Sh engine is fitted on Su-25K, Su-25UBK, and Su-25SMK aircraft.

The R-195 engine is designed for the Su-39 aircraft.

AL-21F-3

Turbojet Engine

The AL-21F-3 engine features a single-shaft configuration. The 14-stage compressor has a sophisticated control system. The cannular combustion chamber has 12 flame tubes. The three-stage turbine is of an impulse-reaction type. The blades of the first and second turbine stages are cooled with the bleed air taken from the compressor. The afterburner has three annular stabilisers and six fuel manifolds with spray and swirl-type nozzles. A perforated screen is installed to ensure internal cooling. The fully variable area propelling nozzle consists of the subsonic convergent and supersonic divergent rims.

Basic specifications	
Thrust (H=0, M=0, ISA), kgf:	
max continuous	*7,800*
min afterburner	*9,700*
full afterburner	*11,250*
Specific fuel consumption, kg/kgf/h:	
economy power (H=0, M=0)	*0.80*
cruising mode	*0.76*
max continuous	*1.86*
Air consumption, kg/sec	*104*
Pressure ratio	*14.55*
Gas temperature before the turbine, °K	*1,385*
Dimensions, mm:	
length /diameter	*5,340/1,030*
Engine dry weight, kg	*1,800*

RD-33

Turbofan Engine Family

The RD-33 engine has a two-shaft turbine configuration with exhaust mixing in the afterburner. The engine features a modular design. The low-pressure compressor has four stages; the high-pressure compressor has nine stages. The engine has a short annular combustion chamber and single-stage low- and high-pressure turbines. The afterburner is common for both ducts. The engine features a variable-area supersonic propelling nozzle.

Due to good gas-dynamic stability, the RD-33 engines do not impose any limitations on piloting and feature high spool-up capacity.

The RD-33 is designed to power the MiG-29 fighter family.

Variants

The RD-33 Series 3 engine with an extended service life is designed to power MiG-29M, MiG-29M2, MiG-29K and MiG-29KUB aircraft.

The RD-33N engine is designed to power the Mirage F1 fighter upgrade. It has a bottom gearbox, and can also be fitted on MiG-21 and Mirage III aircraft upgrades.

The RD-93 engine was developed for the Chinese FC-1 aircraft.

The RD-133 engine is designed for the MiG-29 aircraft. It features a fully variable nozzle with thrust vectoring and a new automatic hydromechnical electronic control system.

Basic specifications	RD-33	RD-133
Thrust (H=0, M=0), kgf:		
max continuous	*5,040*	*5,600*
full afterburner	*8,300*	*9,000*
Specific fuel consumption, max continuous (H=0, M=0), kg/kgf/h	*0.74*	*0.77*
Bypass ratio	*0.46*	*0.437*
Gas temperature before the turbine, °K	*1,680*	*1,720*
Dimensions, mm:		
length	*4,230*	*4,230*
max diameter	*1,040*	*1,040*
Engine dry weight, kg	*1,055*	*1,145*

AL-31F

Turbofan Engine Family

The AL-31F engines have modular design, with a four-stage variable low-pressure compressor and a two-shaft turbine. The nine-stage high-pressure compressor has a variable-area first group of stages. The combustor is of an annular type. The single-stage high and low-pressure turbines have active radial clearance control. The air-to-air heat exchanger of the turbine cooling system is placed in the external duct, and is fitted with a device preventing air flow in dry-thrust engine operation mode. The afterburner is common for both ducts. The supersonic nozzle has a variable-area design. The engine has a top-mounted gearbox, a looped oil system, and an autonomous start-up system. The main control system is electronic, while the auxiliary one is hydraulic. The engine features a surge termination system and high gas-dynamic stability of the compressor.

The AL-31F engines are available both in standard and tropicalised variants. They are operational in a wide altitude/airspeed envelope, and provide stable operation in deep air intake surge modes at Mach numbers of up to 2.0, in controlled, inverted and flat spins, and enable execution of aerobatics in the dynamic operation mode at negative airspeeds of up to 200 km/h.

The engines boast high gas-dynamic stability and durability, enabling their operation in extreme conditions with air intake pressure irregularities and pulsing.

Basic specifications

	AL-31F	AL-31FN	AL-31FP
Thrust, full afterburner, kgf	*12,500*	*12,500*	*12,500*
Specific fuel consumption, kg/kgf/h			
economy power (H=0, M=0)	*0.670*	*0.685*	*0.670*
Dimensions, mm:			
length	*4,950*	*4,897*	*4,990*
max diameter	*1,240*	*1,140*	*1,280*
Engine dry weight, kg	*1,530*	*1,547*	*1,570*

Variants

The AL-31F engine is designed for installation in the Su-27, Su-30, Su-32, and Su-35 aircraft.

The AL-31F Series 3 engine is designed to power the Su-33 aircraft.

The AL-31FN engine is a development of the AL-31F engine featuring both bottom and top gearboxes designed for the Chinese J-10A aircraft.

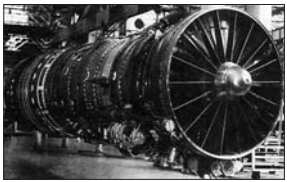
The AL-31FP engine is another development of the AL-31F engine with a swiveling nozzle for the Su-30MK.

NK-25

Turbofan Engine

The NK-25 three-stage bypass turbofan engine features turbine blade radial clearance active control and stator rings perforation for increased compressor stability. The rotor blades and the nozzle vanes are cooled with vortex flows. The engine has an anti-surge protection with automatic recovery of the initial operation mode. The engine control system is electronic.

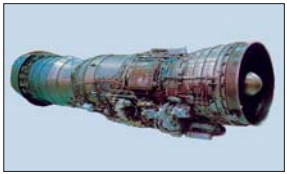
The NK-25 engine is designed for the Tu-22M3E multirole aircraft.



Basic specifications	
Thrust at take-off	
(H=0, M=0, ISA), kgf	*25,000*
Specific fuel consumption	
at take-off, kg/kgf/h	*2.08*
Pressure ratio	*25.9*
Bypass ratio	*1.45*
Gas temperature before the turbine, ºK	*1,600*

D-30F6

Turbofan Engine



The D-30F6 engine features a two-shaft configuration with exhaust mixing from both ducts. The engine consists of seven modules. It has a low-pressure five-stage compressor, a high-pressure ten-stage compressor and a cannular combustion chamber. The low- and high-pressure turbines are two-staged. The nozzle vanes and high-pressure turbine rotor blades are cooled. The afterburner houses the exhaust mixer and has four ring flame stabilisers. The multivane supersonic nozzle is cooled. The engine design enables onboard parameter monitoring. Reliability of the engine is ensured by the protection, backup, and early malfunction detection systems. The electro-hydraulic engine control system is backed up with the hydraulic system activated if the electronic one has failed to ensure flight safety and effective mission accomplishment.

The engine has unique altitude and airspeed performance, providing maximum airspeed of 3,000 km/h at altitude and 1,500 km/h near ground.

The D-30F6 engine is designed to power the MiG-31E fighter/interceptor.

Basic specifications	
Thrust, kgf:	
max continuous (H=0, M=0, ISA)	*9,500*
full afterburner	*15,500*
Specific fuel consumption, kg/kgf/h:	
max continuous (H=0, M=0)	*0.20*
full afterburner	*1.90*
Bypass ratio	*0.57*
Air consumption, kg/sec	*150*
Pressure ratio (total)	*21.15*
Gas temperature before the turbine, ºK	*1,640*
Engine dry weight, kg	*2,416*