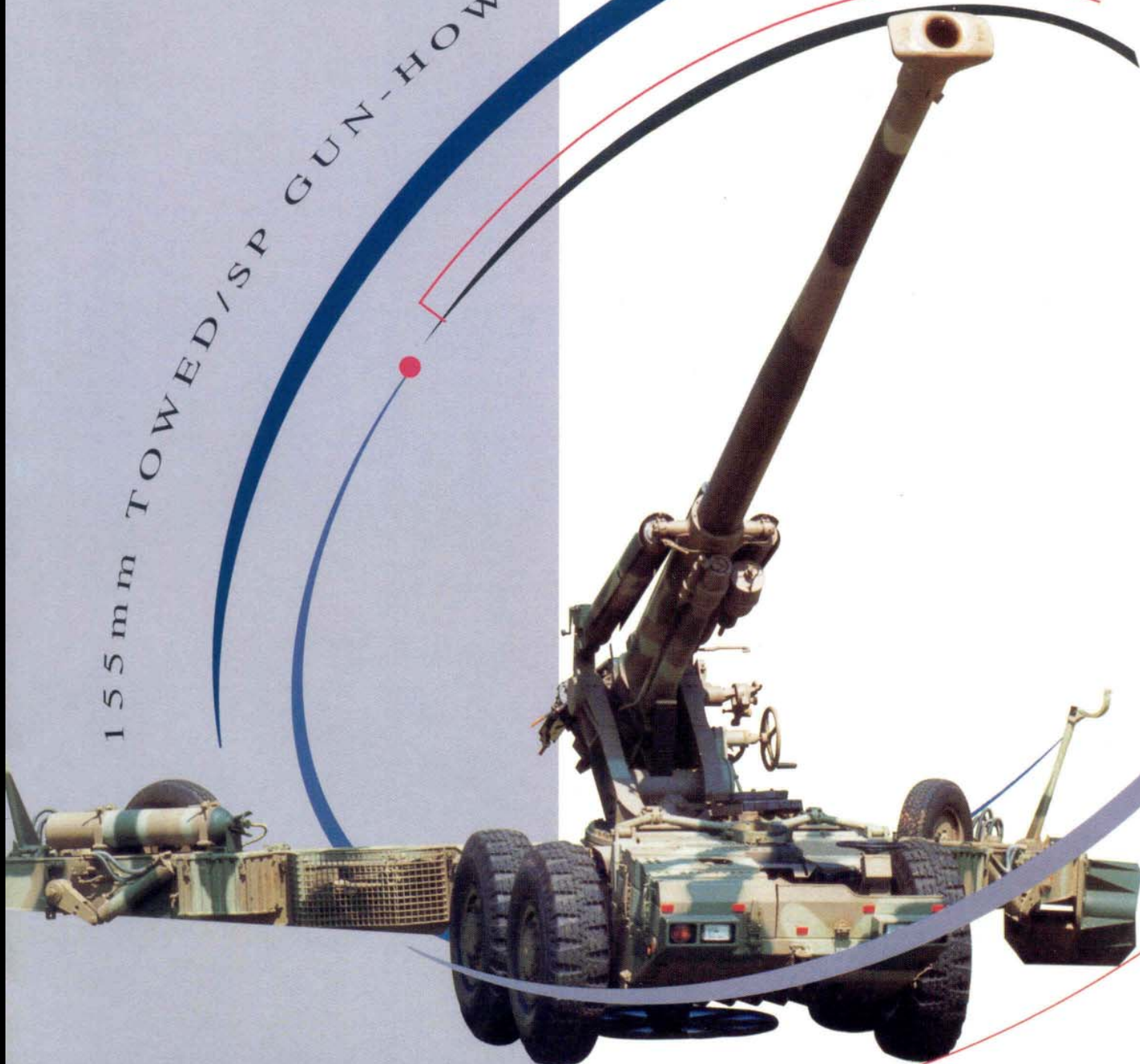




155 mm TOWED/SP GUN-HOWITZER



- LONG FIRING RANGE
- QUICK REACTION
- HIGH ACCURACY
- PROVEN RELIABILITY

INTRODUCTION

The G5 is a proven, reliable and accurate 155 mm long-range gun with an auxiliary power unit. The auxiliary power-unit provides hydraulic power for easy and rapid deployment, as well as giving the gun a self-propelled capability for tactical movement. The G5 system has been developed for modern warfare. Intensive testing under all possible conditions, as well as continuous feedback from military operations to the design engineers, have resulted in a gun that is not only immensely practical, but also extremely reliable and user-friendly.

DESCRIPTION

Main Weapon

- 45 calibre autofrettaged barrel.
- Semi-automatic screw-type breech.
- Recoil with variable recoil length.

Loading System

- Loading tray.
- Pneumatic piston-action rammer.
- Loads at all elevation angles.

Sighting and Laying

- Telescopic sight for direct fire up to 3 000 metres.
- Trunnion-mounted optical panoramic sight with compensating mechanism for trunnion cant.
- Aiming posts and beta lights storage on gun.

Gun Control

- Pneumatic equilibrators with adjustment for change in temperature.
- Elevation and traverse gearboxes with handwheels.
- Traverse clutch for rapid traverse of the barrel from travelling to firing position.

Bottom Carriage

- High-strength steel carriage with split trails.
- Four driving-wheels on walking-beam suspension.
- Two trail wheels which steer when gun moves with own power.
- Self dig-in spades on split trails.
- Large hydraulically operated stabilising platform.
- All gun equipment mounted on trails.
- Barrel clamps for travelling and firing position.

Auxiliary Power Unit

- 59 kW air-cooled four-cylinder diesel engine.
- Main hydraulic pump for propulsion.
- Separate hydraulic pump for deployment.
- 102 Litre fuel tank.

Hydraulic System

- Hydraulic opening/closing of split trails.
- Hydraulic lowering / lifting of trail wheels.
- Hydraulic steering of trail wheels.
- Hydraulic lowering/lifting of stabilising platform.

Redundancy

- In case of power unit failure, the G5 can be slaved from another gun, gun tractor or can be operated by means of a handpump.

PERFORMANCE

Mobility

The G5 can be towed by a gun-tractor in the 10-ton class at speeds of 90 km/h. In the self-propelled mode, speeds of 16 km/h on hard level surfaces and 4 km/h on sand can be attained. The gun can be driven with its barrel forward in the travelling or firing position.

In extreme terrain conditions the APU can provide additional tractive effort, forming an all-wheel drive combination with the towing vehicle.

The G5 can readily be transported by rail, sea or air, fitting comfortably into a freight aircraft such as the C130. In these instances the APU greatly simplifies loading procedures.

Thanks to the hydraulic assistance provided by the APU, a crew of five men can bring the G5 into or out of action within only 2 minutes. No ground preparation is required before firing. This, together with the auto-propulsion feature, enables a G5 battery to re-deploy very rapidly after firing a salvo, so escaping the enemy's counter-battery fire.

The "shoot and scoot" capability, together with the range advantage of the G5 is essential for high survivability on the modern battlefield.





INTEGRATED ARTILLERY SYSTEM

The G5, together with its integrated logistics system, was developed in the context of the integrated artillery system fielded by the DENEL Group.

As a result, the G5 can be offered either alone or, more usually, as part of a complete package, depending on the particular needs of the client.

Ammunition

A comprehensive and flexible ammunition system was developed in conjunction with the G5. This includes the following:

- Extended range full-bore projectiles of explosive, cargo and practice types; all ballistically matched and with field-fittable base-bleed units.
- A five-zone combustible-case modular propelling charge system, based on cool-burning propellants, which ensure a long barrel life of more than 6000 standard charges.
- Compatible fuzes of direct action, electronic time or proximity types, all suitable for full charge and maximum range application.

Related Equipment

- Command & Fire Control systems.
- Meteorological systems.
- Observation systems.
- Communication systems (for both voice and data).
- Logistic support vehicles.
- Ammunition vehicles.
- Gun Tractors.

Integrated Logistics Support (ILS)

A complete integrated logistics support package is available. This is normally tailored to a specific environment and application, taking into account the capabilities of the user's existing support infrastructure. The package could include:

- Equipment and accessories carried with the gun or at higher echelons.
- Operating, maintenance and workshop repair manuals; and illustrated parts catalogues.
- Spare parts and assemblies, tools and equipment to support everything from first-line to base-workshop repair and maintenance, including complete overhauls and rebuilds.
- Operational and technical training at all levels.
- Field support.

Fire Power and Accuracy

The G5 offers nominal sea level ranges of 30 km with standard projectiles and 39km with base-bleed projectiles. These ranges, combined with a traverse capability of up to 82° and elevation angles of -3° to $+75^{\circ}$, make this a superior gun with respect to both flexibility and area coverage.

The probable error specification at 75% of maximum range is a proven 0,48% of range and 1 mil in deflection.

The G5 can accurately cover a target zone of almost 1000 km² without change of position. The charge system provides adequate range overlap during high-angle firing.

A firing rate of three rounds per minute for 15 minutes can be achieved with the maximum charge and a normal firing rate of two rounds per minute for 60 minutes.

TYPICAL TECHNICAL DATA

Main Weapon

Calibre	155 mm
Barrel length	45 calibres
Breech	Semi-automatic interrupted-screw type
Muzzle brake	Single baffle, open type
Ammunition compatibility	All NATO 155mm

Weapon Performance

Rate of fire (maximum)	3 rounds/minute
Range (sea level)	
• standard	30 km
• base-bleed	39 km
• velocity enhanced long range projectile (VLAP)	50 km
• direct fire	0-3 km

Gun Control Equipment

Type	Mechanical (manual) with indirect and direct sights, pneumatic equilibrators
Elevation range	-3° to +75°
Firing arc	
• at elevations < 15°	82°
• at elevations > 15°	65°

Mobility

Towing speed	
• highways	90 km/h
• secondary roads	50 km/h
Self-propelled mode	
• hard level surface	16 km/h
• sand	4 km/h
• gradient	40%
• fording depth	0,6 m
• fuel-tank range	100 km
• turning circle	20 m

Physical Characteristics

Mass	13 750 kg
Length (towed position)	9,5 m
Width (towed position)	2,5 m
Height (towed position)	2,3 m
Ground clearance	0,3 m
Track width	2,1 m

Power Pack & Driveline

Engine	59 kW air-cooled diesel
Self-propulsion system	Hydro-mechanical drive

Wheels & Brakes

Main wheels (four)	14,00 x 20
Trail wheels (two)	7,50 x 16
Brakes	Hydro-pneumatic (coupled to gun tractor) with drums on main wheels. Parking brake.

Deployment

Hydraulic systems	Trails (spread/close) Trail wheels (steering/raise/lower) Firing platform (raise/lower)
Crew	5 men
Time to deploy (or bring out of action)	2 minutes (5 men) 5 minutes (2 men)





G5-52 155 mm TOWED/SP GUN-HOWITZER



G5-52

PRODUCT STRATEGY

In Modern day warfare it is not the biggest that will conquer but systems which are more autonomous, resulting in systems that are more accurate, consistent and faster to react. The current features of the G5 and G6 155 mm systems that are still leaders in the world have been retained but more advanced sub-systems fitted to improve and upgrade it resulting in:

- IMPROVED FIRING RANGE
- QUICKER REACTION TIME
- HIGHER FIRE PRECISION
- MULTIPLE ROUNDS SIMULTANEOUS IMPACT
- IMPROVED MOBILITY
- EASIER DEPLOYMENT

INTRODUCTION

To be on the forefront of artillery technology and products, it was decided by DENEL to redesign the 155 mm towed artillery system and to add it to its current product base. It will not replace the current G5, still a world leader in its class but improve on it as the next generation towed 155mm Artillery.

The G5-52 system is the latest 155mm Towed Artillery System developed for the artillery. The gun system is more accurate, transportable by transport aircraft, C130 or equivalent and it can be towed by any 10 000 kg type of truck.

The G5-52 155mm has been developed to satisfy the users requirement for modern day warfare, that is:

- The need for fewer but more mobile forces to cover the same operational area;
- To improve the fire precision, requiring less ammunition to achieve the same end result;
- To improve the firing rate;
- To improve the man machine interface making provision for the demography of the world population;
- To be deployed under all possible conditions;
- To be very reliable.

GENERAL DESCRIPTION

The weapon is a 155-mm, 52 Calibre Towed Gun Howitzer. It has such inherent indirect fire flexibility that it can be employed on the traditional gun, howitzer and mortar roles.

The weapon has been fitted with an APU that enable it to be self propelled for tactical movement.

The ordnance has been optimised for the 52 calibre 155-mm ballistic system. The projectiles are of the extended range type and provide an increased range and target effectiveness when compared with existing systems. Using base bleed projectiles, the weapon has a range of 42,5 km at sea level. Nato and other ammunition can be fired, after consultation with the supplier.

The G5-52 can be towed by a 10-ton (minimum) truck at a maximum speed of 85 km/h. In the self-propelled mode, speeds of 16 km/h on hard level surfaces and 4 km/h on sand, can be obtained for short tactical movements with the barrel clamped in the firing position.

A turbo charged diesel engine with Hydraulic pumps mounted on it provides hydraulic power to the:
Cylinders for lowering/raising the firing platform.
For spreading/closing the trails.
Lowering/raising the trail wheels.



Thereby enabling a crew of five to bring the gun into or out of action within 90 seconds.

In case the power unit or hydraulic system fails, the G5-52 has a back-up system, utilising another gun or external power pack which enables the crew to bring the G5-52 into action, still using the hydraulic assistance, as usual.

The weapon system consisting of the gun and gun tractor has a crew of six consisting four to operate the G5-52 and two to prepare and supply the ammunition.

The undercarriage is of a high strength steel construction, with split trails and self dig-in spades.

The elevating mass comprising the ordnance, cradle with integrated buffer system, ammunition handling and ramming system. The ordnance consists of the mono-block barrel fitted with double baffle muzzle brake, swing and slide breech and electrically activated firing mechanism.

The Command and control system, consisting of the ALNS, the telecommunication, the MVRS and LMC are used to lay the gun for indirect fire.

An optical-mechanical sight of the panoramic type is mounted directly onto the trunnion with a compensation system for trunnion cant acting as a back up for indirect fire. A telescopic sight for direct fire is mounted on the compensation system for direct fire up to 3000 m.

PRODUCT SPECIFICATION

Physical Characteristics

Length	:	Barrel clamped in towed position	10,53 m
	:	Barrel clamped in firing position	14,5 m
Width	:	In towed position	2,5 m
	:	In action	8,4 m
Height	:	Barrel clamped in towed position	2,9 m
	:	Barrel clamped in firing position	4,5 m
Ground clearance	:	0,31 m	
Mass	:	Total, including equipment	17 500 kg
Fording depth	:	Self-propelled mode	0,6 m
	:	Towed mode	1,2 m

WEAPON PERFORMANCE

The gun offers nominal sea level ranges of:

31,9 km plus with standard projectiles.

42,5 km plus with assisted projectiles.

55 km with rocket assisted projectile (V-LAP).

Rate of fire

MRSI up to six rounds.

A burst rate of three rounds in 18 seconds.

Rapid firing rate of 6 rounds per minute for three minutes.

11 Rounds without replenishment.

Sustained firing rate of two rounds per minute until safety precautions prevent further firing can be achieved.



ACCURACY AND CONSISTENCY

Consistency

The probable error specification at 75% of maximum range is 0,48% of range and 1,0 mil in line for BT and 0,60% of range and 1,2 mil in line for BB. This can be achieved with single lot of propellant and DENEL manufactured HE M1A4 ERFB ammunition.

Accuracy

The accuracy is 0,6 % CEP of range (in lower trajectory)

Note: Accuracy is a User defined system parameter. Accuracy is not dependent on the G5-52 characteristics alone.

Parameters playing a role are:

- Variation in projectile mass.
- Variation in muzzle velocity.
- Accuracy of laying the gun both in azimuth and elevation.
- Accuracy with which the gun position and target position is determined.
- Accuracy of MET data.
- Barrel wear, barrel history etc.

Flexibility

These ranges, combined with elevation angles of:

between - 51 mils and 400 mils, and azimuth angles of + 708 mils to - 708 mils.

between - 401 mils and 950 mils, and azimuth angles of + 495 mils to - 708 mils.

between - 951 mils to maximum, and azimuth angles of + 320 mils to - 570 mils, make this gun a superior gun with respect to both flexibility and area coverage.

MOBILITY

Towed

The G5-52 155mm gun can be towed at speeds of:

85 km/h with the barrel in the travelling position and

65 km/h with the barrel in the firing position on high ways.

The G5-52 can be towed at a maximum speed of 65 km/h on hard surface secondary roads.

The G5-52 can be towed at a maximum speed of 45 km/h on cross-country terrain.

The G5-52 can be towed at a maximum speed of 40 km/h over a level desert sand terrain.

Self Propelled

With the drive system in high range the gun can attain a maximum speed of 16 km/h.

With the drive system in low range the gun can attain a maximum speed of at least 4 km/h in desert sand.

The gun must always be clamped in the firing position when being driven for long distances.

On hard surface the G5-52 can attain a maximum gradient of 30% and be able to stop pull-away from a stationary position against a gradient of 25 %.

The G5-52 can attain a 30% side slope with the barrel clamped in the towing position.

The G5-52 can turn in a circle of less than 20m, curb to curb, on a hard surface.

The G5-52 can turn in a circle of less than 30m, curb to curb on soft sand.



MAIN WEAPON

Barrel	:	52 calibre auto-fretagged monobloc
Rifling	:	Rifling twist 1:20
Calibre	:	155 mm
Length	:	52 Calibre
Chamber volume	:	23 litres
Breech	:	Semi-automatic swing and slide-type breech Breech washing system fitted Primer loader with primer magazine fitted
Buffer	:	Buffer with maximum fixed recoil length of 1 meter
Recuperator	:	Gas type recuperator Recuperator also used to retract the gun using the hydraulics supplied to the traverse and elevation system.
Muzzle Brake	:	Double baffle muzzle brake.



AMMUNITION HANDLING SYSTEM

Rammer	:	Semi-automatic electric driven positive chain rammer. Rammer movements hydraulically operated and controlled.
Magazine	:	Projectile magazine with six ready projectiles. Hydraulic operated and controlled.
Crane	:	Telescopic crane hydraulically operated and controlled fitted with projectile clamp which with adjustment can handle any NATO projectiles.
Controls	:	Rammer control panel to operate and control the rammer and magazine. Crane control panel to operate and control the crane.



Projectiles are fed automatically onto the rammer tray from the magazine and the charge loaded by hand. They can be rammed at any elevation.

COMMAND AND CONTROL SYSTEM

The Command and Control System consist of:

- Launcher management Computer.
- Ordnance Controller.
- Gun fire panel
- Commanders hand held fire controller.
- Telecommunication system
 - Antennas.
 - Simon-Mil-S data communication radio.
 - Radio for voice communication.
 - Crew communication radios.
- Laying and Navigation system
 - Ring Laser Gyro fitted.
 - Weapon management System.
 - Automatic Laying System with joystick control.
 - Driver Display Unit for gun tractor and gun.
 - Distance Transmitter Unit.
 - Telescopic sight for directs firing up to 3000 meters.



- Panoramic sight as back-up for indirect firing.
- Sensor display unit display:
 - MV
 - Recuperator pressures
 - Recoil length
- MVRS
- Night sight camera (optional).
- Harnesses.

TRAVERSE AND ELEVATION SYSTEM

- Hydraulic system fitted with proportional control valves.
- Hydraulic elevation cylinders with integrated pneumatic equilibrators.
- Traverse gearbox with hydraulic drive motor.
- Hydraulic pump for manual elevation and traverse of the gun.
- Hydraulic RBJ.

Hydraulic pressure supplied from the auxiliary hydraulic system on the motorised carriage.



MOTORISED CARRIAGE

- High-strength steel structure with two trails and spades, deployed hydraulically.
- Turbo charged diesel engine with hydro-mechanical drive system.
- Drivers chair and controls.
- Deployment operated from a valve control bank mounted on the motorised carriage.
- Travelling clamp to clamp the barrel over the trails when the gun is towed long distances.
- Barrel clamp to clamp the barrel in the firing position.

TOP CARRIAGE

- High strength steel saddle.
- Tubular type cradle.
- Bins for all gun control panels, valves, pipes and harnesses.

ELECTRICAL SYSTEM

System voltage	:	28 volts.
Batteries	:	Six 12-Volt batteries fitted, 4 X for motorised carriage and 2X for top structure.
Charging system	:	120 Ampere 28 volt alternator.
Electrical system	:	Electrical harnesses and control boxes fitted.
		Lights, tail-lights, indicator and brake lights fitted.

POWER SOURCE

A four cylinder, air cooled, turbo charged with a power output of 70 kW at 2400 r/min, housed in the front of the carriage.

TRANSMISSION

A hydrostatic drive consisting of a main hydraulic pump and two hydraulic motors.

The drive line consist of planetary reduction gearboxes linked via chain drives to the four wheels with an automatic dog clutch on each driving wheel.

STEERING

Steering is provided by two steering cylinders, fitted one per trail leg and operated simultaneously by an orbital valve.



BRAKES

Hydrostatic braking: When mobile, if the drive system control lever is put in the neutral position, the gun is braked by the hydraulic drive system. The hydrostatic brake slows the speed of the gun on a 25 % decline.

Parking brake: The gun is equipped with a spring brake system, that when activated activates the brakes of the gun acting as a park brake, holding the G5-52 on a gradient of 25%. A special valve, hand brake valve is fitted to activate the spring brake by releasing the pneumatic pressure in the brake system.

ADDITIONAL FEATURES FITTED

- Temperature warning device to monitor barrel temperature.
- Temperature warning device to monitor recoil oil temperatures.
- Adjustable safety limits for traverse and elevation.

TRANSPORTATION

- Can be transported by C130 type of cargo plane, tank transporter or flat bed rail truck.

AMMUNITION SYSTEM

Projectiles

Charges

Fuses

Primer





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