

WAY Industry J-s Co | Slovak Republic

GENERAL DESCRIPTION

The *Bozena 5* is a remotely controlled mine clearance system using a medium flail machine to clear AP and AV mines (up to 9 kg of TNT). It is produced by Way Industry which has invested in considerable R & D for the Bozena range since it was first introduced in 1995. (The Bozena 4 light flail has been described earlier.) Latest improvements to the Bozena 5 include the tiller – which can be used instead of the flail where preferable. The Bozena 5 can also remove tripwires and dense, high vegetation.

The vehicle is controlled by an operator in an air-conditioned cabin placed in line of sight or in the open air using a transmitter with a range up to 5,000 m. The normal chassis is wheel-type, but for field operation it is recommended to use the easily mountable tyre tracks supplied with each machine.

The main protection against blast and flying debris is the armoured shield, attached behind the flail shaft. The hood (see picture) serves as the “dust cover” for the prime mover. The prime mover’s internal parts are further protected by 4 mm/6 mm Armox steel plates.

The manufacturers say the machine is capable of processing from 1,050 to 4,900 m² per hour, depending on ground and terrain conditions. Internal fire safety is improved with an automatic fire-extinguisher system.

The Bozena 5 has been designed (like the Bozena 4) to go beyond mechanical demining: 15 additional tool attachments can be fitted to the prime mover to replace the flail head. These include blades, shovels, buckets, drilling machine, hydraulic hammer, concrete mixer and excavating equipment. Changing attachments takes about five minutes.

For daily operations the Bozena 5 is self-transportable (up to 9 km/h). For long-distances it should be transported on a low-bed trailer. The whole system (excluding the trailer) can be shipped in one 40 ft container.



BOZENA 5

CLEARANCE METHODOLOGY

Hammers at the end of 48 chains rotate clockwise at up to 500 rpm and process the ground up to 30 cm deep, depending on conditions. The flail design ensures a dynamic overlap of the hammers. AP and AV mines can be destroyed either by activation or by direct mechanical destruction. The Bozena 5 can destroy dense vegetation, including trees up to 20 cm diameter.

A hydraulic winch helps recovery when stuck in field situations.

MACHINES IN USE TO DATE

Some 30 Bozena 5 systems have been sold to military and humanitarian customers in several countries, including Afghanistan, Albania, Angola, Azerbaijan, Bangladesh, Bosnia and Herzegovina, Cambodia, Canada, Colombia, Croatia, Czech Republic, Chile, Eritrea, Ethiopia, Iraq, Kenya, Kosovo, Lebanon, the Netherlands, Niger, Poland, Slovakia, Sri Lanka, Sudan and Thailand.

ENGINE, FUEL AND OIL

The Bozena 5 is powered by a Tatra diesel engine, with direct fuel injection and an air-cooling system. The engine serves both prime mover and flail unit by hydrostatic transmission. The standard version contains the 170 kw, eight-cylinder power unit, but a 270 kw output, ten-cylinder, turbocharged engine can be provided as an option.

FACTORY SUPPORT

The Tatra engine and Bosch-Rexroth hydraulic components are well-known brands with worldwide servicing networks so most spares can be easily obtained. Way Industry can also supply spares and service support tailored to specific customer requirements.

The following training packages are offered:

- > initial operator's training (two weeks)
- > initial mechanic's training (one to two weeks)
- > advanced electrician's training (one to two weeks)
- > on-the-job training/support (for desired period, usually four to 12 months)

Each machine is delivered with full technical documentation, including spare parts catalogue and operation/maintenance/diagnostic manuals. Prices of particular support and spare parts packages can be obtained on request.

MAINTENANCE AND SUPPORT

The producer recommends at least a two-man crew: ideally an operator and mechanic trained by Way Industry. Procedures for preventive and corrective maintenance (daily, weekly, monthly) are fully covered in supplied documentation and can be easily done by the trained crew. Any set of spare parts for any project type and duration can be supplied on request. The manufacturer can also provide specialised staff – from operators and mechanics to mechanical demining team leaders – with many years of mechanical demining experience worldwide.

On-site technical and logistic support, 24-hour call-out or e-mail support can be ordered.



BOZENA 5

TESTS AND EVALUATIONS

The Bozena 5 has undergone several tests at the Testing Institute in Slovakia. By June 2009 these included tests on about 40 AV mines and 200 AP mines.

From 2005 to 2007, it underwent the CEN WS12 test, passing it with good results. The tests proved the Bozena 5's capabilities to effectively detonate or destroy all types of AP and AV mines (up to 9kg TNT) in various soil and terrain conditions.

See: www.way-industry.sk/eng/index.php?b=bozena5&c=test_reports

Two test reports are available at www.itep.ws:

1. W.C. Roberts, R.W. Fall, and J.L. Eagles, Way Industry Bozena-5 Flail Test and Evaluation, Defence Research and Development Canada, 2007:
www.itep.ws/pdf/Bozena5_DRDC_2007.pdf
2. Geoff Coley, Machine Demonstration Analysis and Preliminary Results, International Symposium "Humanitarian Demining 2007" 24 - 27 April 2007, Šibenik, Croatia, 2007:
www.itep.ws/pdf/MachineDemoSibenik2007_Coley.pdf

REPORTED LIMITATIONS AND STRENGTHS

The Canadian test report cited above said the Bozena 5 is well-built and easy to operate and maintain. It had adequate power for both ground penetration and vegetation cutting. Mine neutralisation performance ranged from a low of 42/50 to a high of 50/50 targets. It had good survivability against several AP and one AV mine detonated by the flail. Damage from the AP mines was primarily cosmetic. Damage from the TMM-1 AV mine would have required approximately 15 minutes to repair.

No major issues were noted with the design or performance of the Bozena 5. Although a potential debris-trap may exist on the skids of the flail, this would be easily corrected through the use of a thin angular shield.

As with all flails, the Bozena-5 did scatter some debris outside the test area.



BOZENA 5

Limitations

- > Difficult to operate with precision from distances over 200 m. (This applies to all remotely controlled machines.)
- > The system creates huge dust clouds, as occurs with all flail systems in dry environments.

Strengths

- > Resistance against AV mines (up to 9 kg TNT) without significant damage (20 min repair time).
- > A variety of engineering working tools available.
- > Well-designed and proven technique.
- > Winch for self recovery fitted.
- > Can handle dense vegetation, AP and AV mines.
- > Transportation is simple. Easy to handle with a light low-bed trailer.

DIMENSIONAL DATA

1. Length without attachment	4,170 mm
2. Length total	7,320 mm
3. Width without attachment	2,400 mm Without tracks 2,240 mm
4. Width total	3,350 mm
5. Clearing Working width	2,655 mm
6. Height Overall	2,255 mm
7. Mass Basic vehicle	9,920 kg
8. Mass Detachable unit(s)	2,100 kg
9. Mass Overall	12,020 kg

OPERATIONAL DATA

10. Wheels Tracks (description)	Wheeled tracked (tracks easily detachable by the crew, mounted on foam-filled tyres)
11. Ground Bearing Pressure (kPa)	
> Tracks	0.56 kg/cm ² (with tyre tracks mounted)
> Front Wheels	—
> Rear Wheels	—
12. Hill climbing ability (in degrees)	30°
13. Number of Chains Chisels Tools	48 hammers
14. Beat Pattern (hits per m ²) at different operating speeds	Not given
15. Length of Chains Tools	Chain: 540 mm Chain with hammer: 570 mm
16. Diameter of drum	1,780 mm
17. Rotation Speed	Up to 500 rpm (exactly displayed on control panel)
18. Clearance Working depth in varying terrain	Up to 30 cm, depending on speed and terrain
19. Working Speed (m ² /h)	
> Light Soil Medium Vegetation	4,900 m ² /h
> Medium Soil Medium Vegetation	2,400 m ² /h
> Heavy Soil Dense Vegetation	1,050 m ² /h
20. Control of Clearance Working depth	a. Adjustable height of flail skids b. Boom hydraulic control
21. Additional attachable working tools	
22. Armour	4 mm / 6 mm ARMOX steel plates
23. Remote controlled	Yes
> greatest distance	5,000 m
24. Transportation	
> short distances	Self transportable (up to 9 km/h, harmless to tarmac surface)
> long distances	Recommended to use the special Bozena 5 trailer PM-180
> sea transport	Whole Bozena 5 system can be packed in one 40 ft container
> air transport	Transportable by cargo aircrafts (C130 or similar) Transportable by helicopter

SYSTEM STATUS AND DEPLOYMENT

25. Machines in use	30 units (160 of all models in use, line No. 22)
26. Other types	Bozena 1, Bozena 2, Bozena 3, Bozena 4
27. Location of use	Afghanistan, Albania, Angola, Azerbaijan, Bangladesh, Bosnia and Herzegovina, Cambodia, Canada, Colombia, Croatia, Chile, Czech Republic, Eritrea, Ethiopia, Iraq, Kenya, Kosovo, Lebanon, Niger, Poland, Slovakia, Sri Lanka, Sudan, Thailand, The Netherlands
28. Totally cleared so far (m ²)	More than 10,000,000 m ² (estimation)

ENGINE | FUEL | OIL

29. Engine	TATRA, 4 stroke, diesel with direct fuel injection, air cooled, 8 cylinders or TATRA, 4 stroke, turbocharged diesel with direct fuel injection, air cooled, 8 cylinders
30. Engine power at the flywheel	170 kw (228 hp) at 2,500 rpm or 270 kw (362 hp) at 1,800 rpm
31. Sufficient power supplied to working tool	100 kw or 200 kw (version with turbocharged engine)
32. Fuel capacity	160 l or 300 l (version with turbocharged engine)
33. Fuel consumption	30 l/h or 59 l/h (version with turbocharged engine)
34. Separate engine for working unit	No
35. Cooling system	Air cooled
36. Oil capacity of engine	30 l
37. Hydraulic oil capacity (both engines)	160 l

COSTS

38. Cost of system	On request
39. Other costs	On request
> training	(possible in country of operation or in Slovakia)
> spare part set chains belts	a. basic set of spares included b. various sets of spare parts available - tailored for specific projects and environment
> repair costs for one year	Not given
40. Availability for hire	Yes

OTHER

41. Operator comfort	Protective air-conditioned cabin with power generator provides safety and high comfort for the operator during demining operation
42. Air conditioning	Yes (separated mine-protected monitoring cabin)