AKKERMAN
EQUIPMENT SYSTEMS

INDEX

7 GUIDED BORING SYSTEMS 

25 MICROTUNNELING SYSTEMS 

39 PIPE JACKING & TUNNELING SYSTEMS 

53 SLIPLINING SYSTEMS 

57 EARTH PRESSURE BALANCE SYSTEMS 

UNDERGROUND CONSTRUCTION SOLUTIONS

Akkerman develops, manufactures and supports powerful and versatile guided boring, microtunneling, pipe jacking, sliplining, tunneling and earth pressure balance underground construction solutions that accurately install a variety of pipe in an extensive range of ground conditions and project challenges.

Since 1973, our industry-leading equipment has enabled contractors worldwide to productively and cost-effectively install water, wastewater, and other infrastructure.

We back our equipment systems with a powerhouse of skilled sales, engineering and technical professionals dedicated to superior reliability and responsive service. Akkerman factory certified field technicians represent an immeasurable portfolio of hands-on equipment experience to train your crew on the project site. Aftermarket parts sales are efficiently dispatched to minimize project delays and ensure that your equipment is prepared for optimal performance on its next challenge.

Akkerman equipment is available for purchase, lease-to-purchase or lease from our rental fleet, and is proudly manufactured in the USA.

COMMITTED TO EXCELLENCE

	GROUND CONDITIONS	COMMON BASE MACHINE SIZES	COMMON DRIVE LENGTHS	GUIDANCE SYSTEM	MINIMUM SHAFT SIZE
GUIDED BORING SYSTEMS	• Sand • Displaceable, N < 50 • Non-Displaceable, N > 50 with Use of Select Tooling • Non-Pressurized Ground Water	4 - 48-in OD* (102 - 1,219 mm) (Larger Diameters with Guided Auger Boring Installation)	500-lf (152 m)	Theodolite Active	8-ft (2.4 m) 8-ft
MICROTUNNEL BORING MACHINES (MTBMS)	• High Ground Water Table • Wide Range from Sand to Rock	30 - 114-in OD* (762 - 2,896 mm)	1,000+ lf (305 m)**	Laser Active	20-ft (6.1 m) 20-ft
TUNNEL BORING MACHINES (TBMS)	• Sand • Medium to Stiff Clay • Dry or Dewatered • Weathered Rock • Non-Pressurized Ground Water	48 - 96-in OD* (1,219 - 2,400 mm)	1,000+ lf (305 m)**	Laser Passive or Active	22.5-ft (7 m) 22.5-ft
EXCAVATOR BORING SHIELDS (EBSS)	• Sand • Medium to Stiff Clay • Dry or Dewatered • Weathered Rock • Non-Pressurized Ground Water	100 - 168-in OD* (2,540 - 4,267 mm)	1,000+ lf (305 m)**	Laser Passive	22.5-ft (7 m) 22.5-ft
EARTH PRESSURE BALANCE MACHINES (EPBMS)	• Soft Material Requiring Foam Slurry to Balance Ground to Prevent Settlement	102+ in OD* (2,591+ mm)	Pipe Jacking 1,000-lf (305 m)** Two-Pass Contingent on Specifications***	Laser Active	Project Specific
SLIPLINING SYSTEMS	• Rehabilitation method • Installation in live sewer	30 - 102 in OD (762 - 2,591 mm)	1,000+ lf **** (305 m)	n/a	20 - 30-ft (6.1 - 9.1 m) 20-30-ft

*Akkerman standard sizes can be customized to suit project needs.
**Extended and curved alignments are achieved with the use of the AZ100 Total Guidance System (TGS) and dependent upon specific project variables.
***Two-pass defined as segment erecting, liner plate and ring beam and lagging installations.
**** Actual drive length is dependent upon pipe diameters, project conditions and exisiting pipe friction; much longer distances have been achieved.

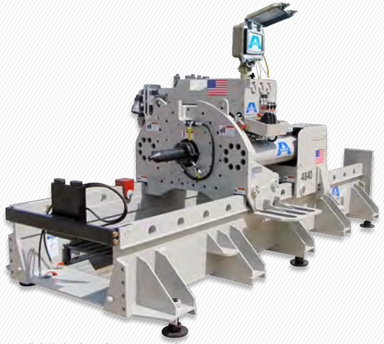
GUIDED BORING SYSTEMS

Versatility For Accurate & Extended Drives

Guided Boring Machine (GBM) systems are the leading solution for accurate and extended drive lengths in soft ground to rock geology for 4-48-in. OD pipe and larger diameters with the guided auger boring method. Our GBM systems are comprehensive and feature robust and intelligent design, adaptable functionality and sensible ease of use features. GBM jacking frames connect with a host of pipe increase tooling, skid extensions and shaft adapters for versatility on a multitude of pilot tube projects.

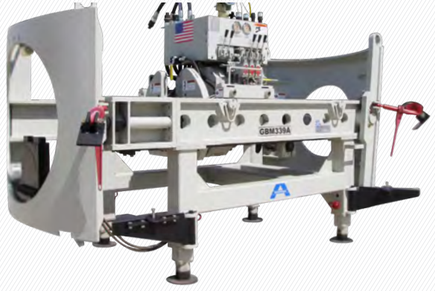
We continue to diversify our GBM offerings to exceed contractor expectations. Our newest pipe increase tooling excavates harder ground and soft rock to precisely install up to 42-in. steel casing pipe on guided boring and guided auger boring projects. Contractors can now harness the torque and jacking force of the GBM 4800 Series Jacking Frame to install steel casing on projects with or without space constraints when paired with the High Torque Casing Adapter or Augering Adapter Assembly. The newest GBM Guidance System allows for even more target clarity on today's long drives and features data logging capabilities.

GUIDED BORING SYSTEMS JACKING FRAMES

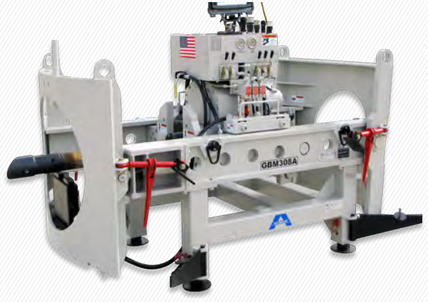


The **GBM 4800 Series Jacking Frame** is able to install up to 48-in. OD pipe and can be supplemented with skid extensions for multiple pipe lengths and shaft configurations. The frame features 30 or 40-in. stroke cylinder configurations to install one meter length pipe from a minimum 11 or 13-ft. shaft.

The **GBM 240A Jacking Frame** features a 48-in. stroke cylinder, universal auger boring machine adapter and an optional stand-alone base. As a stand-alone unit, this jacking frame installs up to 24-in. OD pipe in one meter lengths from a minimum eight by 10-ft. trenchbox shaft.



The **GBM 339A Jacking Frame** accommodates up to 31.5-in. OD pipe from a 9-ft. minimum diameter shaft and features a 10.5-in. stroke cylinder. Round and square shaft adapters and jacking frame extensions are available to conform to shaft requirements.



The **GBM 308A Jacking Frame** allows operators to install up to 28.5-in. OD pipe from a minimum 8-ft. diameter shaft and features a 10.5-in. stroke cylinder. Round and square shaft adapters and jacking frame extensions are available to conform to shaft requirements.

JACKING FRAME	MAX. PIPE OD	JACKING FORCE	PULL-BACK FORCE	SPEED/MAX. TORQUE	MIN. SHAFT SIZE	WEIGHT
GBM 4800 Series w/ 30-in (762 mm) Stroke Cylinders	48-in (1,219 mm)	265 ton (240 t)	100 ton (91 t)	High/Mid/Low Speed = 50/34/23 rpm 10,500 - 26,000 ft-lbs (14,236 - 35,251 Nm)	11-ft (3.4 m)	13,000 lbs (5,897 kg)
GBM 4800 Series w/ 40-in (1,016 mm) Stroke Cylinders					13-ft (3.9 m)	13,000 lbs (5,897 kg)
GBM 240A	24-in (610 mm)	100 ton (91 t)	50 ton (45 t)	High/Mid/Low Speed = 50/37/25 rpm 10,500 ft-lbs (14,236 Nm)	10-ft (3 m)	4,500 lbs (2,041 kg) - (without base)
GBM 308A	28.5-in (724 mm)				8-ft (2.4 m)	6,000 lbs (2,722 kg)
GBM 339A	31.5-in (800 mm)				9-ft (2.7 m)	6,600 lbs (2,994 kg)

Akkerman reserves the right to improve its products without notice or obligation.

GUIDED BORING SYSTEMS POWER PACKS

Power Packs provide hydraulic power and feature a diesel engine or electric motor to operate GBM jacking frames and tooling. Power packs include hydraulic hose reels to connect to the jacking frame, a remote pendant for in-shaft operator control, and standard tooling for pilot tube installation. The extendable power unit assembly contains the engine or motor, hydraulic hose reels with quick coupler connections, variable volume piston pumps, fluid reservoirs, and pressure gauges.

The **P4075D** and **P100E Power Packs** have a two-pump system for independent control of jacking and rotation. Doors at both ends of the container allows for walk-through access to the wall mounted tooling storage rack.

The **P200E Power Pack** feature a three-pump system for independent control of jacking, rotation and the PCH cutter bit.

POWER PACK	POWER UNIT	FUEL TANK CAPACITY	HYDRAULIC RESERVOIR	PUMPS	DIMENSIONS H x W x L	WEIGHT w/ TOOLING
P4075D	74 HP (55 kW) Tier IV, 4-Cylinder Diesel Engine	50 gal (189 L)	50 gal (189 L)	(2) Variable Piston - Jacking & Rotation - 0-34 gpm (0-129 L/min) Operating Pressure max. - 5,000 psi (345 bar)	82 x 58 x 96-in (2,083 x 1,473 x 2,428 mm)	5,500 lbs (2,821 kg)
P100E	100 HP (75 kW) Electric Motor	n/a		(2) Variable Piston - Jacking & Rotation - 0-30 gpm (0-151 L/min) Operating Pressure max. - 5,000 psi (345 bar) Gear pump - 20 gpm (76 L/min)		7,000 lbs (3,175 kg)
P200E	200 HP (149 kW) Electric Motor	n/a	100 gal (379 L)	(3) Variable Piston Jacking - 0-34 gpm (0-129 L/min) Auger Rotation & PCH Cutter Bit - 0-62 gpm (0-235 L/min) Operating Pressure max. - Rotation - 5,000 psi (344.7 bar), Jacking - 6,000 psi (413.6 bar) Gear pump - 44 gpm (167 L/min)	96 x 96 x 77.5-in (2,438 x 2,438 x 1,969 mm)	10,000 lbs (4,536 kg)

GUIDED BORING SYSTEMS GUIDANCE SYSTEM

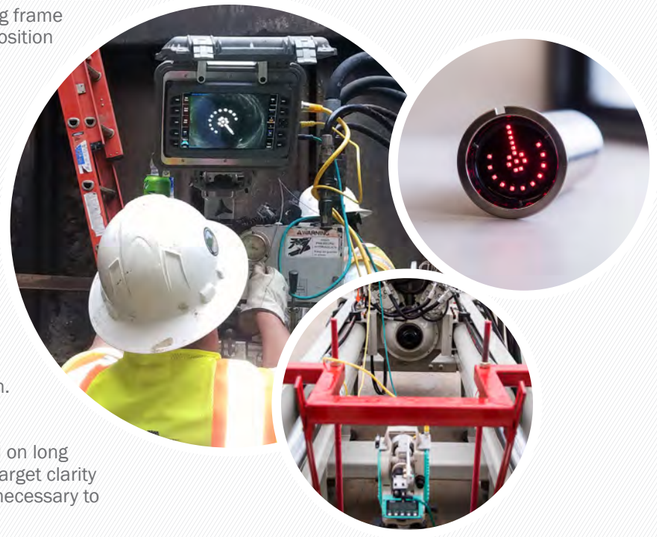
The **GBM Guidance System** provides line and grade accuracy for the GBM system with full target optic clarity up to 600-lf.

The GBM Guidance System consists of a theodolite with remote focus, an illuminated LED target, camera, monitor with computer, lateral slide and elevator column assemblies, counterweight, alignment holder, bore sight laser, plumb bobs and protective cases.

For line and grade control, the illuminated LED target is placed in the lead pilot tube's steering head. The theodolite's cross hairs are aligned to the drive's line and grade and the camera relays this data to the monitor with computer positioned on the GBM jacking frame mount. The operator assesses the target's position and makes adjustments as necessary to maintain alignment.

The monitor contains an outdoor flat screen computer to view the illuminated LED target in the steering head via the theodolite mounted camera. The target image can be fully adjusted for clarity and the monitor case lid acts as a visor for reduced screen glare. The monitor can be configured for data logging of thrust and rotation pressures, and number of installed pilot tubes. This information is recorded every five seconds with a concurrent image of the target screen on a flash drive for analysis upon drive completion.

The optional GBM Smart Target is a multi-functional programmable target, that is used on long distance, multiple shift installations, where target clarity adjustments are required, or sleep mode is necessary to preserve battery life.



GBM GUIDANCE SYSTEM	DIMENSIONS H x W x L	THEODOLITE ACCURACY	TARGET	BORE SIGHT LASER	WEIGHT
GBM Guidance System	Theodolite Case 12 x 19.5 x 12-in (305 x 494 x 305 mm) System Case 15 x 24 x 10-in (381 x 610 x 254 mm) Monitor Case 11.5 x 13 x 6-in (292 x 330 x 152 mm)	5 sec. (1.5 mgon) DIN	Red LED, Replaceable Battery Powered Optional LED Smart Target	Visible Red Diode Laser Operation - on/off end cap Power Supply = (3) 392 button batteries	100 lbs (45 kg)

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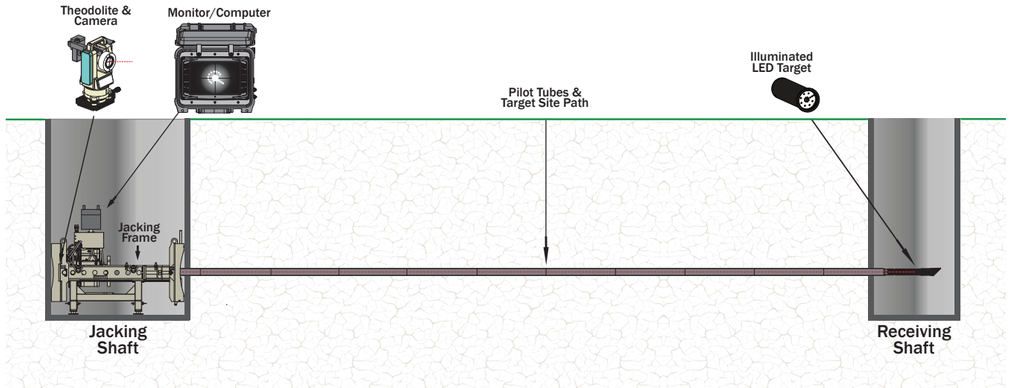

GUIDED BORING SYSTEMS TOOLING ESSENTIALS

Dual-Wall **Pilot Tubes** allow for fluid passage to the steering head through an outside ring while maintaining visibility of the illuminated LED target in the inner tube for steering control. Vertical and Horizontal Pilot Tube Racks hold 12 or 40, 30-in. pilot tubes.

Thrust Casings and Augers Assemblies are available in 11-in. and 16-in. OD in quantities of 20, 11-in. or 9, 16-in. casing and auger pairs and are provided in a convenient wire basket for ease in transport.

The **Steering Head Kit** includes 30° 5-in. and 45° steering heads to displace various types of soil, a steering head adapter, steering head inner tube, target holder and an air and fluid adapter. Optional 30° 5.5-in., 30° 4-in., and bullet steering heads are also available for specific ground conditions.

The **Rock Drill Adapter (RDA)** provides a means for accurate rock pilot tube installations in rock formations up to 12,000 psi UCS with a cutting diameter ranging from 4.8 to 5.5-in. The RDA features a bolt-less, square drive spline to accept TriHawk® I, III, IV, V and VI drill bits.

PILOT TUBES/THRUST CASINGS	QTY.	INSTALLED LENGTH/ TOTAL PER RACK	OD	MAX. THRUST/TORQUE	ASSEMBLY WEIGHT
Vertical Pilot Tube Rack	12	30-in (762 mm)/ 30-ft (9.1 m)	4.1-in (104 mm)	100 ton (91 t) 10,500 ft-lbs (14,236 Nm)	1,050 lbs (476 kg)
Horizontal Pilot Tube Rack	40	30-in (762 mm)/ 100-ft (30.5 m)	4.1-in (104 mm)		3,100 lbs (1,406 kg)
11-in Thrust Casings and Augers Assembly	20	39.37-in (1 m)/ 66-ft (20 m)	11-in (279 mm)		5,650 lbs (2,563 kg)
16-in Thrust Casings and Augers Assembly	9	41.85-in (1.06 m)/ 31.3-ft (9.6 m)	16-in (406 mm)		4,800 lbs (2,177 kg)
16-in HD Thrust Casings and Augers Assembly		62.5-in (1.59 m)/ 46.8-ft (14.2 m)		265 ton (240 t) 26,000 ft-lbs (35,251 Nm)	7,250 lbs (3,289 kg)

STEERING HEAD KIT	DIMENSIONS OD x l	SOIL CONDITION	WEIGHT
30° - 4-in (Optional)	4-in OD x 17.08-in (102 mm OD x 434 mm)	Very Soft or Unstable	40 lbs (18 kg)
30° - 5-in (Included in kit)	5-in OD x 17.08-in (127 mm OD x 434 mm)	Soft or Low Blow Count	50 lbs (22.6 kg)
30° - 5.5-in (Optional)	5.5-in OD x 17.08-in (140 mm OD x 434 mm)	Medium Density	60 lbs (27 kg)
45° (Included in kit)	5-in OD x 13.25-in (127 mm OD x 337 mm)	Medium Density	39 lbs (17.7 kg)
Bullet (Optional)	5-in OD x 15.87-in (127 mm OD x 403 mm)	Very Hard or High Blow Count	44 lbs (20 kg)
Steering Head Adapter (Included in kit)	4.15-in OD x 27.25-in (105 mm OD x 692 mm)	n/a	44 lbs (20 kg)
Air/Fluid Adapter (Included in kit)	4.13-in OD x 5.13-in (105 mm OD x 130 mm)	n/a	12.5 lbs (5.7 kg)

ROCK DRILL ADAPTER	DIMENSIONS CUTTING OD x l	SOIL CONDITION	WEIGHT
Rock Drill Adapter for TriHawk® I, III, IV, V and VI drill bits	4.8–5.5-in OD x 17.08-in. (122–140 mm OD x 434 mm)	8,000 - 12,000 psi UCS	44 lbs (20 kg)

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GUIDED BORING SYSTEMS PIPE INCREASE TOOLING

Powered Cutter Heads (PCHs) increase the bore to match the pipe diameter and feature two independent hydraulic drive systems for the cutter bit and augers to convey soil to the reception shaft. Standard PCHs are available in 20 - 44-in. OD with increase kits for 22.5 - 48-in. OD pipe. They feature independent ports for lubrication to reduce jacking forces.

Powered Reaming Heads (PRHs) increase the bore diameter and reverse the augers to force soil to the reception shaft while providing lubrication to the soil to reduce jacking forces. PRHs can be configured from 14 to 48-in. OD with one of three auger drive torque packages.

The **Rock Boring Unit (RBU)** is used for up to 25,000 psi UCS unguided rock boring. Disc cutters on the RBU face excavate rock for up to 90,000 foot pound thrust loads.

The **Integral Bearing Swivel Cutter** is an upsizing tool between the pilot tube adapter and the lead 11 or 16-in. thrust casing. It is used in ground conditions above 35 blow count and functions to keep the pilot tubes stationary while the cutter bit rotates to excavate the soil while fluid ports release lubrication to reduce cutting torque.

PCH	OD	MAX. TORQUE	MAX. SPEED	POWER	LENGTH	WEIGHT
PCH 20	20-in (508 mm)	10,500 ft-lbs (14,236 Nm)	40 rpm	32 HP (24 kW)	72-in (1,829 mm)	2,700 lbs (1,225 kg)
PCH 22.5	22.5-in (572 mm)			48 HP (36 kW)		3,000 lbs (1,361 kg)
PCH 30.5	30.5-in (775 mm)			61 HP (45.5 kw)		5,700 lbs (2,586 kg)
PCH 36	36-in (914 mm)	26,000 ft-lbs (35,251 Nm)	38 rpm	79 HP (59 kW)	91-in (2,311 mm)	7,300 lbs (3,311 kg)
PCH 44	44-in (1,118 mm)			93 HP (69 kW)		11,000 lbs (4,990 kg)

PRH	OD	MAX. TORQUE	MAX. SPEED	LENGTH
PRH Series II 10.5K Drive	14-20-in (356 - 508 mm)	10,500 ft-lbs (14,236 Nm)	40 rpm	68-72-in (1,727-1,829 mm)
PRH Series II 20K Drive	20-30-in (508-762 mm)	20,000 ft-lbs (14,236 Nm)	38 rpm	
PRH Series II 26K Drive	30-48-in (762 - 1,219 mm)	26,000 ft-lbs (35,251 Nm)	26 rpm	

INTEGRAL BEARING SWIVEL CUTTER	OD	THRUST CAPACITY	LENGTH	WEIGHT
11-in Integral Bearing Swivel Cutter	12.5-in (318 mm)	35 ton cont. 70 ton max. int.	43-in (1,092 mm)	700 lbs (318 kg)
16-in Integral Bearing Swivel Cutter	17.5-in (444 mm)	50 ton cont. 100 ton max. int.		1,200 lbs (544 kg)

RBU	OD	HEX	DISC CUTTERS	THRUST LOAD	LENGTH	WEIGHT
RBU 24	24-in (610 mm)	4-in. (102 mm)	9, 6.5-in. ea. (170 mm)	50,000 lbf (222,500 N)	42-in (1.067 mm)	2,200 lbs (998 kg)
RBU 30	30-in (762 mm)		9, 6.5-in. ea. (170 mm)	50,000 lbf (222,500 N)		2,800 lbs (1,270 kg)
RBU 36	36-in (914 mm)		11, 6.5-in. ea. (170 mm)	68,000 lbf (302,600 N)		4,000 lbs (1,815 kg)
RBU 42	42-in (1,067 mm)		16, 6.5-in. ea. (170 mm)	90,000 lbf (400,500 N)		4,700 lbs (2,132 kg)

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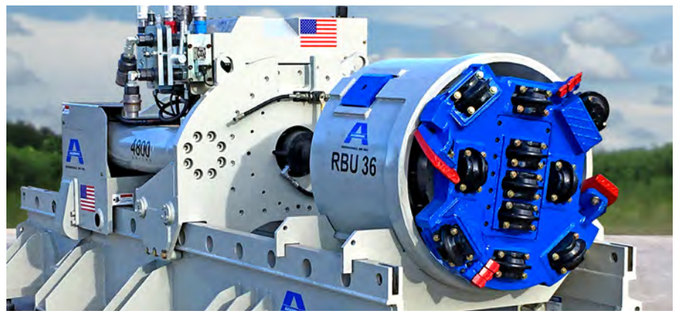
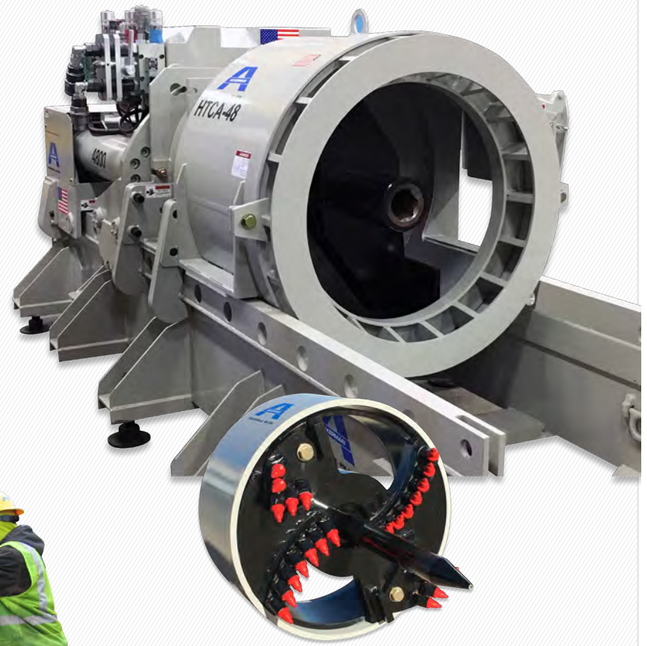


GUIDED BORING SYSTEMS GBM 4800 SERIES JACKING FRAME TOOLING

The **High Torque Casing Adapter (HTCA) 48** is used with the GBM 4800 Series Jacking Frame for up to 100,000 ft-lbs. of torque and 530,000 lbs. of jacking force for auger boring applications. The HTCA - 48 is positioned between the jacking frame gear box and lead casing to adapt to up to 48-in. steel casing pipe while the two dirt paddles manage the soil.

The **Augering Adapter Assembly** provides a means for soil discharge when installing up to 36-in. steel casing pipe with a GBM 4800 Series Jacking Frame. Up to 26,000 ft-lbs. of auger torque drive takes place through the gear box of the jacking frame and soil emerges from the unit's discharge chute.

The **Guide Rod Swivel (GRS) 50** family of high thrust bearing upsizing tools keep pilot tubes stationary and are able to withstand up to fifty tons of continuous thrust loads for steel casing pipe installations. The GRS-50 is used in densely compacted soil instead of a Weld-On Reaming Head or follows the Rock Drill Adapter with TriHawk® drill bit tooling in weathered rock conditions.



HTCA	OD	DIMENSIONS L x W x H	DRIVE SYSTEM*	HEX	WEIGHT
High Torque Casing Adapter 48	48-in (1,219 mm)	57.84 x 62.3 x 37.13-in (1,469 x 1,582 x 943 mm)	Thrust Bearing Gear Ratio: 3.4:1 Output Torque: 40,000 - 88,000 ft-lbs (54,233-119,312 Nm) Speed: 10 rpm @ 88,000 ft-lbs (119,312 Nm), 16 rpm @ 60,000 ft-lbs (81,349 Nm), 23 rpm @ 40,000 ft-lbs (54,233 Nm)	5-in hex (127 mm)	4,800 lbs (2,177 kg)

*Additional drive system options available.

AUGERING ADAPTER	OD	WEIGHT
Augering Adapter Assembly	Up to 36-in (914 mm)	1,500 lbs (680 kg)

GRS-50	OD	HEX	BEARING	THRUST CAPACITY	LENGTH	WEIGHT
GRS-50 24	24-in (609 mm)	5-in hex (127 mm)	(1) 7-in (178 mm) (1) 5.5-in (140 mm)	50 ton (45 mt)	44-in (1,118 mm)	1,200 lbs (544 kg)
GRS-50 26	26-in (660 mm)					1,300 lbs (590 kg)
GRS-50 28	28-in (711 mm)					1,400 lbs (635 kg)
GRS-50 30	30-in (762 mm)					1,500 lbs (680 kg)
GRS-50 36	36-in (914 mm)					1,800 lbs (816 kg)

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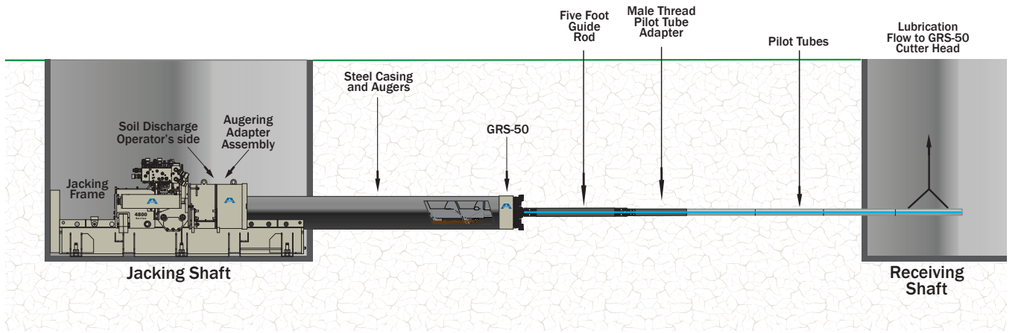

GUIDED BORING SYSTEMS GUIDED STEEL CASING TOOLING

The **Guide Rod Swivel (GRS) 50** family of high thrust bearing upsizing tools keep pilot tubes stationary and are able to withstand up to fifty tons of continuous thrust loads when installing steel casing on guided boring, guided auger boring, and soft rock pilot tube projects.

The **Guide Rod Swivel (GRS) 25** is used between the pilot tube adapter and cutter bit, and is able to withstand up to twenty five tons of continuous thrust loads on guided auger boring projects. It maintains pilot tube line and grade for the cutter bit and prevents pilot tube rotation on steel casing projects under 24-in. OD and 200-lf. drive lengths.

The **GBM Bearing Swivel Assembly** is used between the pilot tube adapter and the cutter bit and able to withstand up to fifty tons of continuous thrust loads on guided auger boring projects. It is recommended for 24-in. OD and larger steel casing installations and drive lengths ranging from 200-400-lf.

Weld-On Reaming Heads (WORHs) are used to increase from 12 to 72-in. steel casing diameters in one or two stages in soft, non-compacted ground, where pipe can be easily advanced with the thrust of the auger boring machine. WORHs arms are flush with the inside diameter of the steel casing to allow for correct positioning of the cutter bit and soil removal from the pipeline with augers.

Guided Ramming Head (GRHs) is like a WORH only optimized for fatigue resistance and absorption of force transfered from a pneumatic hammer. The GRH arms allow for dynamic soil movement during the ramming process.

GRS-50	OD	HEX	BEARINGS	THRUST CAPACITY	LENGTH	WEIGHT
GRS-50 24	24-in (609 mm)	5-in hex (127 mm)	(1) 7-in (178 mm) (1) 5.5-in (140 mm)	50 ton (45 mt)	44-in (1,118 mm)	1,200 lbs (544 kg)
GRS-50 26	26-in (660 mm)					1,300 lbs (590 kg)
GRS-50 28	28-in (711 mm)					1,400 lbs (635 kg)
GRS-50 30	30-in (762 mm)					1,500 lbs (680 kg)
GRS-50 36	36-in (914 mm)					1,800 lbs (816 kg)

SWIVELS	CONNECTION	THRUST CAPACITY	PIPE DIAMETER	DRIVE LENGTH
GBM Bearing Swivel Assembly	3-in hex (76 mm)	50 ton (25 ton pullback) (45/23 mt)	24-30-in (609-762 mm)	200-400-ft (61 - 122 m)

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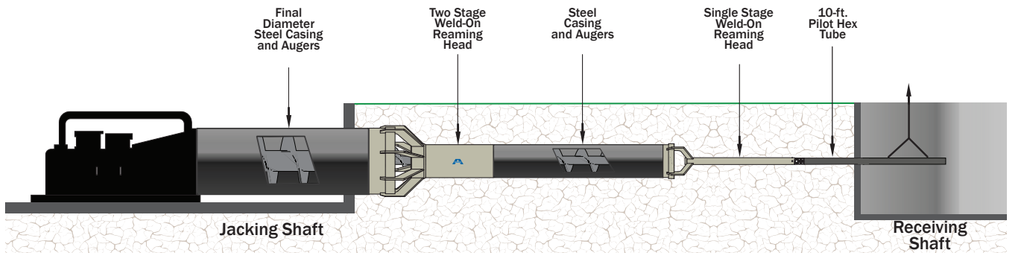
WORH/GRH	OD/ASSEMBLY LENGTH	QTY. ARMS	WEIGHT
WORH Single Stage	12-in = 75-in (2m)	4	405 lbs (184 kg)
	14-in = 75-in (2m)		420 lbs (191 kg)
	16-in = 75-in (2m)		440 lbs (200 kg)
	18-in = 75-in (2m)		452 lbs (205 kg)
	20-in = 75-in (2m)		465 lbs (211 kg)
	22-in = 75-in (2m)		476 lbs (216 kg)
	24-in = 116-in (3m)		490 lbs (222 kg)
	28-in = 116-in (3m)		530 lbs (240 kg)
	30-in = 116-in (3m)		550 lbs (249 kg)
	36-in = 116-in (3m)		1,600 lbs (726 kg)
WORH Two Stage	24 - 42-in = 84.5-in (2.14m)	6	1,488 lbs (675 kg)
	24 - 48-in = 90.5-in (2.3m)	8	1,763 lbs (800 kg)
	24 - 54-in = 90.5-in (2.3m)		1,858 lbs (843 kg)
	24 - 60-in = 93.4-in (2.4m)		2,100 lbs (953 kg)
	30 - 42-in = ECO 5/7/19		
	30 - 54-in = 90.5-in (2.3m)		2,034 lbs (923 kg)
	30 - 60-in = 90.5-in (2.3m)		2,125 lbs (964 kg)
	30 - 66-in = 93.5-in (2.4m)		2,270 lbs (1,030 kg)
	30 - 72-in = 96.5-in (2.5m)		2,414 lbs (1,095 kg)
	36 - 72-in = 93-in (2.4m)		2,700 lbs (1,225 kg)
GRH-20	20-in OD x 101.2-in L (2.6m)	4	630 lbs (286 kg)
GRH-24	24-in OD x 108-in L (2.7m)		755 lbs (342 kg)
GRH-30	30-in OD x 110-in L (2.8m)		1,080 lbs (490 kg)
GRH-36	36-in OD x 114-in L (3m)		1,225 lbs (556 kg)



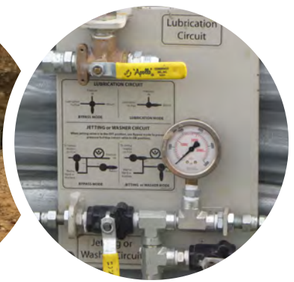
GUIDED BORING SYSTEMS BENTONITE & LUBRICATION PUMPS

2325B/D and **2325B/E Bentonite and Lubrication Pumps** offer operators independent flow control of pumping applications of water and water with polymer with a Marsh Funnel viscosity up to 50 seconds and 2,500 psi of pressure. The pumps feature independent or a combination of 6, 10 or 16 gpm fluid pressure output. Aggressive in-tank hydraulically-driven agitators keep mixtures blended in the two 325-gallon tanks. Mixtures are supplied from one or both tanks with bypass valves to allow for mixing and pumping, or pump supply from both tanks. The 2325B/D features a 3,000 rpm 30 HP diesel engine with an 18 gallon fuel tank. The 2325B/E features a 1,750 rpm 30 HP electric motor.

The **1525B/D, 1525B/E and 1325B Bentonite and Lubrication Pumps** are hydraulically-driven, high pressure bentonite pumps for effective pilot tube lubrication and flushing of cuttings or other pipe jacking operations, particularly long bores and downward slope alignments. They will displace a Marsh Funnel viscosity as high as 50 seconds to flush cuttings with pump flow up to 10 gpm at 2,500 psi. The 1525B/D features a 3,200 rpm 20.7 HP diesel engine with an 8 gallon fuel tank and 525 gallon lubrication tank. The 1525B/E features an 1,800 rpm, 20 HP electric motor and 525 gallon lubrication tank. The 1325B features a 3,000 rpm 14 HP gasoline engine with an 1.9 gallon fuel tank and 325 gallon lubrication tank. The 1325B is sized for Quadcon container storage in colder climates. The 1525B/D and 1525B/E models fit inside a Bicon container.

PUMP	DIMENSIONS l x w x h	WEIGHT	POWER UNIT	TANK FLUID CAPACITIES	PUMPS
2325B/D Bentonite and Lubrication Pump	64 x 86.75 x 93-in (1,625 x 2,203 x 2,362 mm)	Empty 3,150 lbs (1,429 kg) Full 8,300 lbs (3,765 kg)	Diesel Engine 3,000 rpm, 30 HP (22.5 kW)	Fuel = 18 gal (68 L) (2) 325 gal (1,230 L) Tanks Hydraulic Reservoir = 25 gal (94.6 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump 1 = 6 gpm (22 L/min) Pump 2 = 10 gpm (38 L/min) Pumps 1 & 2 = 16 gpm (60 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator
2325B/E Bentonite and Lubrication Pump	64 x 86.75 x 93-in (1,625 x 2,203 x 2,362 mm)	Empty 3,150 lbs (1,429 kg) Full 8,300 lbs (3,765 kg)	Electric Motor 1,750 rpm, 30 HP (22.5 kW)	(2) 325 gal (1,230 L) Tanks Hydraulic Reservoir = 25 gal (94.6 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump 1 = 6 gpm (22 L/min) Pump 2 = 10 gpm (38 L/min) Pumps 1 & 2 = 16 gpm (60 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator
1525B/D Bentonite and Lubrication Pump	95 x 64 x 68-in (2,413 x 1,626 x 1,727 mm)	Empty 2,200 lbs (998 kg) Full 6,400 lbs (2,903 kg)	Diesel Engine 3,200 rpm, 20.7 HP (15.4 kW)	Fuel = 8 gal (30.3 L) 525 gal (1,987 L) Tank Engine Oil = 4 qt (3.79 L) Hydraulic Reservoir = 15 gal (57 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump Flow = 10 gpm (39.7 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator
1525B/E Bentonite and Lubrication Pump	95 x 64 x 68-in (2,413 x 1,626 x 1,727 mm)	Empty 2,200 lbs (998 kg) Full 6,400 lbs (2,903 kg)	Electric Motor 1,800 rpm, 20 HP (15 kW)	525 gal (1,987 L) Tank Hydraulic Reservoir = 15 gal (57 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump Flow = 10 gpm (39.7 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator
1325B Bentonite and Lubrication Pump	58 x 46.5 x 88.25-in (1,473 x 1,181 x 2,242 mm)	Empty 1,000 lbs (454 kg) Full 3,700 lbs (1,678 kg)	Gasoline Engine 3,600 rpm, 14 HP (10.4 kW)	Fuel = 1.9 gal (7.3 L) 325 gal (1,230 L) Tank Engine Oil = 1.16 qt (1 L) Hydraulic Reservoir = 15 gal (57 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump flow = 6 gpm (22.7 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator

Akkerman reserves the right to improve its products without notice or obligation.

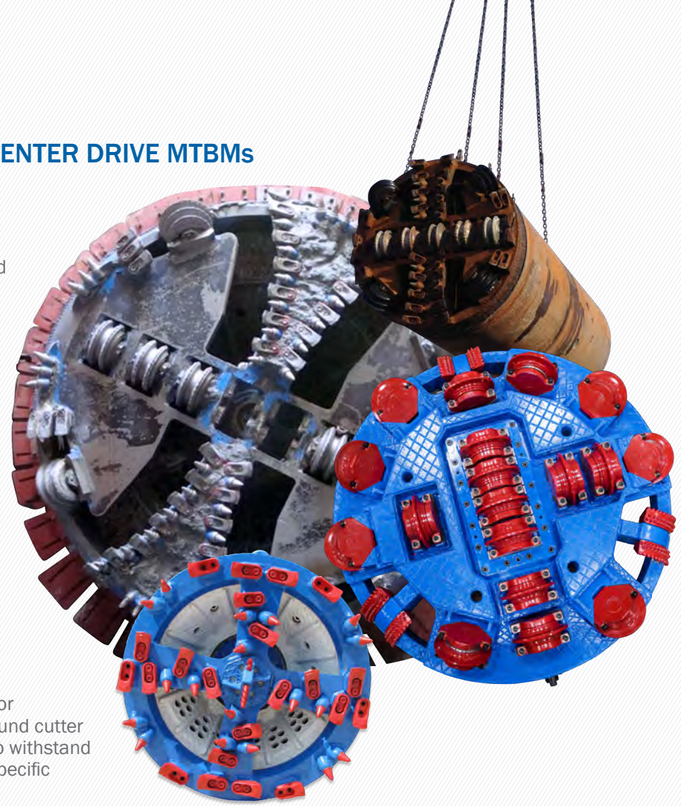


MICROTUNNELING SYSTEMS

Productivity, Dependability & Accuracy In Virtually Any Ground Condition

Microtunnel Boring Machines (MTBMs) install gravity flow pipelines that require precise line and grade in poor soil. Microtunneling is a remote-controlled, continuously supported pipe jacking method. Standard center drive and face access, periphery drive MTBMs are sized in the 30-114-in. OD range. Microtunneling operations are managed by an operator in an above ground control container alongside of the shaft. Soil excavation takes place by infusing the soil with slurry at the face of the bore and cuttings are forced into slurry inlet holes in the MTBM's crushing cone for circulation to and from a slurry separation plant through a closed system. A complete slurry microtunneling system commonly comprises a pipe specific MTBM, control container, guidance system, remote hydraulic power pack, keyhole jacking frame, a series of pumps, water cooling tank, slurry and additional lines, and a slurry separation plant. The launch shaft is outfitted with a pit seal to prevent shaft flooding and a project specific thrust block to distribute jacking force.

MICROTUNNELING SYSTEMS CENTER DRIVE MTBMs

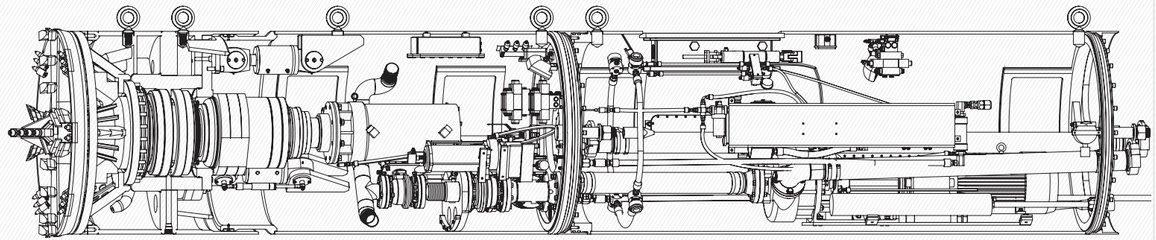


Center drive **Microtunnel Boring Machines (MTBMs)** in standard sizes of 30-74-in. OD, accurately install pipe in virtually any ground condition, allowing for remotely controlled pipe installation in low blow count geology. MTBMs feature high pressure jetting nozzles, an articulated steering joint with three-point steering control, and hydraulically activated dirt wings to minimize MTBM roll.

The guidance system relays all critical operation data to the control container using Akkerman proprietary control software programs.

Additional MTBM attributes include a live, one or two-way audio system and camera allowing for system monitoring during operation, a gas detector, and submersible pump.

MTBMs can be outfitted with increase kits for adaptability. The soft ground and mixed ground cutter heads and crushing cones are hard faced to withstand wear. Cutter heads can be customized for specific ground conditions.



MTBM SL44C Starting and Trailing Sections

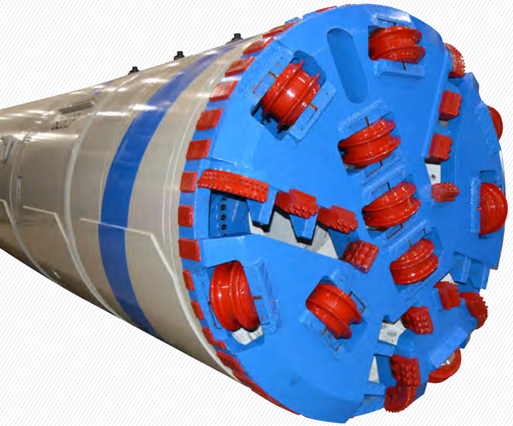
MTBM-C	PIPE OD	FRONT SECTION/ TOTAL LENGTH	HEAVIEST SECTION/ TOTAL WEIGHT*	CUTTER HEAD SPEED/ MAX. TORQUE (cont./int.)	DRIVE MOTOR	SLURRY BOOSTER PUMP	STEERING CYLINDER TRUST CAPACITY
MTBM SL30C	30-in (762 mm)	130/257-in (3,302/6,528 mm)	10,000/13,000 lbs (4,536/5,897 kg)	0-13 rpm, 30,500 ft-lbs (41,353 Nm)/ 38,000 ft-lbs (51,521 Nm)	75 HP (56 kW), Water-Cooled, Electric with VFD	15 HP (11 kW) Sanko	3 point, 69,750 lbs (31,638 kg) ea.
MTBM SL34C	34-in (864 mm)	125/253-in (3,175/6,426 mm)	12,000/16,000 lbs (5,443/7,257 kg)	0-11 rpm, 35,000 ft-lbs (47,454 Nm)/ 44,000 ft-lbs (59,656 Nm) or 0-8 rpm, 49,500 ft-lbs (67,113 Nm)/ 61,700 ft-lbs (83,654 Nm)			
MTBM SL36C	36-in (914 mm)	139/261-in (3,531/6,629 mm)	14,000/18,500 lbs (6,350/8,391 kg)				
MTBM SL44C	44-in (1,118 mm)	123/249-in (3,124/6,325 mm)	15,000/21,500 lbs (6,804/9,752 kg)			30 HP (22 kW)	3 point, 114,000 lbs (51,710 kg) ea.
MTBM SL46C	46-in (1,168 mm)		16,000/23,500 lbs (7,257-10,659 kg)				
MTBM SL51C	51-in (1,295 mm)	126/252-in (3,200/6,401 mm)	18,000/25,500 lbs (8,164-11,566 kg)	0-9.5 rpm, 68,500 ft-lbs (92,874 Nm)/ 86,000 ft-lbs (116,601 Nm)	125 HP (93 kW), Water-Cooled, Electric with VFD	30 HP (22 kW) Standard 40 HP (30 kW) Recommended	
MTBM SL60C	60-in (1,524 mm)	162.5-in (4,128 mm)	36,000 lbs (16,329 kg)	0-7.7 rpm, 170,000 ft-lbs (230,489 Nm)/ 213,000 ft-lbs (288,790 Nm) or 0-13.5 rpm, 97,000 ft-lbs (131,515 Nm)/ 121,000 ft-lbs (164,054 Nm)	250 HP (186 kW), Water-Cooled, Electric with VFD	30 HP (22 kW) Standard 50 HP (37 kW) Recommended	3 point, 172,250 lbs (78,131 kg) ea.
MTBM SL74C	74-in (1,880 mm)	162.5-in (4,128 mm)	42,000 lbs (19,051 kg)			30 HP (22 kW) Standard 60 HP (45 kW) Recommended	

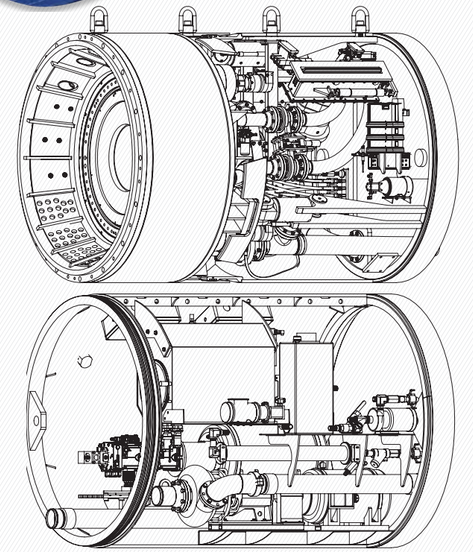
Note: Akkerman standard sizes can be customized to suit project needs. Akkerman reserves the right to improve its products without notice or obligation.
*Actual weights may vary based on specific configuration.

MICROTUNNELING SYSTEMS FACE ACCESS PERIPHERY DRIVE MTBMs

Face access, periphery drive **Microtunnel Boring Machines (MTBMs)** are available in standard sizes of 60-114-in. OD to precisely complete extended and curved tunnels* with exceptional drive and cutting torque. The periphery drive, face access MTBM features an on-board electric over hydraulic power pack for cutter head drive with low, medium, and high torque modes for accurate control in changeable geology. Back-loaded tooling mounts on the cutter head make access and replacement of worn tooling a simple process. Soft ground, mixed ground and rock cutter heads and crushing cones are hard-faced to withstand wear. Cutter heads can be customized for specific ground conditions. The SL82P-SL114P face access, periphery drive MTBMs can be configured for use with a compressed airlock package.

*Extended and curved alignments are achieved with the use of the AZ100 Total Guidance System.





MTBM SL86P Starting and Trailing Sections without Cutter Head

MTBM-P	PIPE OD	STARTING SECTION LENGTH*/WEIGHT*	TRAILING SECTION LENGTH/ WEIGHT*	LUBRICATION JACKING SECTION LENGTH*/WEIGHT*	CUTTER HEAD SPEED/ MAX. TORQUE/DRIVE	CUTTER HEAD BEARING & SEALING	SLURRY BOOSTER PUMP	STEERING CYLINDER THRUST CAPACITY
MTBM SL60P	72-in (1,829 mm)	11.5-ft/48,000 lbs (3.5 m/21,772 kg)	10-ft/23,000 lbs (3 m/10,432 kg)	10-ft/18,400 lbs (3 m/8,346 kg)	0-9 rpm, 300,000 - 600,000 ft-lbs (406,746 - 813,492 Nm) Continuously variable in CW or CCW (4) Two-speed drive motors, 480 cc, 29.3 in.³ 300-500 HP (224-373 kW) Water-cooled, electric Hydrostatic drive	Three-Row Roller Slewing Bearing with Integral Drive Gear Sealing System with Lip Seals and Automated Pressurized Grease Flushing Bearing Cavity = 25.5 gal (96.5 L) Fully Automated Oil Circulation System (2) 3 Gallon (12 L) Seal Grease Container	100 HP (75 kW)	3 Point, 278,980 lbs (126,544 kg) ea.
MTBM SL82P	82-in (2,083 mm)	11.5-ft/50,000 lbs (3.5 m/22,680 kg)	10-ft/24,000 lbs (3 m/10,886 kg)	10-ft/19,200 lbs (3 m/8,709 kg)				
MTBM SL86P	86-in (2,184 mm)	11.5-ft/52,000 lbs (3.5 m/23,587 kg)	10-ft/25,000 lbs (3 m/11,340 kg)	10-ft/20,000 lbs (3 m/9,072 kg)				
MTBM SL100P	100-in (2,540 mm)	11.5-ft /60,000 lbs (3.5 m/27,215 kg)	10-ft/29,000 lbs (3 mm/13,154 kg)	10-ft/23,200 lbs (3 m/10,523 kg)				
MTBM SL114P	114-in (2,896 mm)	11.5-ft /69,000 lbs (3.5 m/31,298 kg)	10-ft/33,200 lbs (3 m/15,059 kg)	10-ft/26,600 lbs (3 m/12,066 kg)				

Note: Akkerman standard sizes can be customized to suit project needs. Akkerman reserves the right to improve its products without notice or obligation.
*Actual weights may vary based on specific configuration.

MICROTUNNELING SYSTEMS CONTAINERS

The **Control Container** houses the operator's control console, motor control center for the slurry pumps, MTBM drive motor and bulkhead panel for electrical and communication connections. The operator monitors and controls all facets of microtunneling operations from a multi-monitor display console using our proprietary software programs in a climate controlled cabin. These functions include MTBM pitch and yaw, rotation, torque, jetting, jacking thrust, steering, slurry flows and pressures, MTBM's anticipated position at the cutter face, as well as live interior assessment of the MTBM with video and audio feed. Behind the control console are the motor control center module units, bus bar for power and raceway network of load and control wiring. The other chamber of the Control Container houses the variable frequency drives which control the electric motors for the MTBM drive, and feed, booster and return pumps.

The **Remote Hydraulic Power Pack** is the power distribution center for hydraulic power to the jacking frame and microtunneling auxiliary functions. It is housed in a Bicon container for ease in transport.

The **Main Drive Power Container** offers increased voltage to run the face access, periphery drive MTBM's main drive.

CONTAINER	DIMENSIONS L x W x H	WEIGHT	ELECTRICAL	COMMUNICATIONS	HARDWARE/SOFTWARE
Control Container	20 x 8 x 8.5-ft (6 x 2.4 x 2.6 m)	11,000 lbs (4,990 kg)	Main Disconnect = 1,000 amp, 480V, 3-phase Transformer = 480 - 575V Cutter Head VFD = 250 HP (186 kW), 600V Feed, Return & Booster Pump VFD = 100/100/100 HP (75 kW), 480V Optional utilities for additional 100 HP (75 kW) Mid/Return Pump VFD (6) Auxiliary Power Outlets = 120V Power Input for Console & Lights = 240/120V	Wired = Ethernet Distributed Computing = Wago® PLC Audio = One or two-way wired Video = Ethernet	Computer = Intel® Core™ i5 Graphics card = Dual Monitor Computer OS = Windows® 7/32-bit MTBM Control Software = Akkerman Proprietary OPC Server = Kepware®

REMOTE HYDRAULIC POWER PACK	DIMENSIONS L x W x H	WEIGHT	RESERVOIR CAPACITY	HYDRAULICS	ELECTRICAL
Remote Hydraulic Power Pack	9.8 x 8 x 8.5-ft (3 x 2.4 x 2.6 m)	9,500 lbs (4,309 kg)	195 gal (738 L)	Main Pump Speed = 1,800 rpm Flow = 0 - 13 gpm (0 - 49 L/min) Pressure = 8,000 psi (550 bar) Pilot Pressure Pump = 1 gpm @ 300 psi (3.8 L/min @ 21 bar) Cooling Pump = 12 gpm (45 L/min) Jacking/IJS/Auxiliary Functions 13 gpm @ 8,000 psi (49 L/min @ 550 bar)	Power Requirement 200 amp, 480V, 3-phase Main Hydraulic Motor 75 HP (56 kW), 480V Cooling/Pilot Pressure Motor 2 HP (1.5 kW), 480V

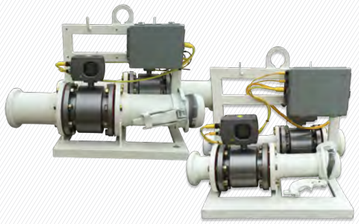
POWER CONTAINER	DIMENSIONS L x W x H	WEIGHT	ELECTRICAL
Main Drive Power Container	20 x 8 x 9.5-ft (6 x 2.4 x 2.9 m)	15,300 lbs (6,940 kg)	Main Disconnect = 800 amp, 480V, 3-phase, 60 Hz Transformer = 500 kVA Tunnel Cable = 4,160V

MICROTUNNELING SYSTEMS ACCESSORIES

The **SC-115 High Pressure Jetting Pump** provides high velocity jetting water to the MTBM cutter face to break down clay and silty soil, clean the crushing chamber, and assist with soil intake and flow. The jetting water flows through 21-ft. **High Pressure Jetting Line** in the tunnel.

The **Water Cooling Tank** and cooling pumps keep the drive motor cool, flushes seals and features a 1,685 gallon capacity supply.

Feed and Return Pumps assist with slurry circulation. **Booster Pumps** are used to assist slurry return flows from the MTBM cutter head face through the slurry line in the tunnel. **Mid Pumps** are used to aid the Booster Pump with return slurry flows on extended length tunnels or deep jacking shafts.



Flow Meters register slurry feed and return flow pressure for balanced excavation during microtunneling operations and optimum production rates. Inlet and outlet psi are operator controlled by varying the speed of the pumps through the VFDs in the control container. The 4 and 6-in. flow meters match flow requirements for various diameter MTBMs. The 6-in. flow meter adapts to match 5-in. microtunneling utility line.

HIGH PRESSURE JETTING PUMP	DIMENSIONS L x W x H	WEIGHT	MAIN PUMP	LIQUID DATA
SC-115 High Pressure Jetting Pump	36.25 x 37.75 x 14.75-in (921 x 959 x 375 mm)	1,240 lbs (562 kg)	Max. Input HP Speed 75 @ 280 rpm Oil capacity = 15 US qt (14.2 L)	Plunger size diameter - 1.75-in (44 mm) Max. Discharge pressure 3,000 psi (207 bar) US gpm @ max. rpm 40 gpm

WATER COOLING TANK	DIMENSIONS L x W x H	WEIGHT	MOTORS	CAPACITY
Water Cooling Tank	14.5 x 6 x 6.5-ft (4.4 x 1.8 x 2 m)	2,200 lbs (998 kg)	Large Drive Motor Pump Assembly - 125+ HP Drive Motor Motor = 3 HP (2.2 kW), 1,740 rpm Small Drive Motor Pump Assembly - 30 & 75 HP Drive Motor Motor = .5 HP (0.37 kW)	1,685 gal (6,378 L)

SLURRY PUMPS	WEIGHT	MOTOR	CASE SIZE	MAX. GPM*
Feed Center Drive	2,000 lbs (907 kg)	50 HP (37 kW)	4 x 3 x 13-in (102 x 76 x 330 mm)	750 gpm (2,839 L/min)
		60 HP (Optional) (44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
Feed Periphery Drive	2,000 lbs (907 kg)	50 HP (Optional) (33.7 kW)	4 x 3 x 13-in (102 x 76 x 330 mm)	750 gpm (2,839 L/min)
		60 HP (Optional) (44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
		75 HP (56 kW)	6 x 5 x 14-in (152 x 127 x 356 mm)	1,200 gpm (4,163 L/min)
		100 HP (75 kW)	6 x 5 x 14-in (152 x 127 x 356 mm)	1,200 gpm (4,163 L/min)
Booster Center Drive SL30-36C	551 lbs (250 kg)	17.4 HP (13 kW)	4 x 4 x 60-in (102 x 102 x 1,524 mm)	370 gpm (1,400 L/min)
Booster Center Drive SL44-52.5C	2,000 lbs (907 kg)	30 HP (22.3 kW)	4 x 3 x 13-in (102 x 76 x 330 mm)	750 gpm (2,839 L/min)
		40 HP (Optional, SL 52.5C only) (30 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
Booster Center Drive SL60C	2,000 lbs (907 kg)	50 HP (37 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
Center Drive & Periphery SL72-74C/P	2,000 lbs (907 kg)	60 HP (44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
Booster Periphery Drive SL82-114P	2,200 lbs (998 kg)	60 HP (Optional) (44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
		100 HP (75 kW)	6 x 5 x 14-in (152 x 127 x 356 mm)	1,200 gpm (4,163 L/min)
Mid-Center Drive Dolly Mounted	2,000 lbs (907 kg)	50 HP or 60 HP (37 or 44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
Return Center Drive	2,000 lbs (907 kg)	60 HP (44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
Return/Mid Periphery Drive	2,200 lbs (998 kg)	60 HP (Optional) (44.7 kW)	5 x 4 x 14-in (127 x 102 x 356 mm)	1,100 gpm (4,163 L/min)
		75/100 HP (56/75 kW)	6 x 5 x 14-in (152 x 127 x 356 mm)	1,200 gpm (4,163 L/min)

LINE	UTILITY	DIMENSIONS OD x L
Microtunneling Utility Line	Slurry Feed and Slurry Return Line	4-in x 10.5-ft (102 mm x 3.2 m) 5-in x 10.5-in (127 mm x 3.2 m) 6-in x 10.5-in (152 mm x 3.2 m)
	Bentonite Line	2.5-in x 10.5-ft (64 mm x 3.2 m)
	Cooling Line	1-in x 10.5-ft (25 mm x 3.2 m)

DUAL FLOW METER	FLOW RATE	DIMENSIONS OD x L
4-in (102 mm) SL30-74C	150 psi @ 1,000 gpm (10 bar @ 3,785 L/min)	33 x 21 x 28.5-in (838 x 533 x 724 mm)
6-in (152 mm) SL72-114P	150 psi @ 2,500 gpm (10 bar @ 9,464 L/min)	46 x 24 x 29-in (1,168 x 610 x 737 mm)

Akkerman reserves the right to improve its products without notice or obligation.

MICROTUNNELING SYSTEMS ACCESSORIES

Keyhole Jacking Frames are a high capacity jacking frame to fit a minimum 20-32-ft. shaft. They feature 400-1,200 tons of thrust capacity to advance up to 114-in. OD pipe. As the Keyhole Jacking Frame's hydraulic cylinders extend, notches on the cylinders lock into place to ensure smooth continuous advancement. The hydraulic winch at the base of the reaction wall retracts the jacking frame thrust block.

2325B/D and **2325B/E Bentonite and Lubrication Pumps** offer independent flow control of pumping applications of water and water with polymer with a Marsh Funnel viscosity up to 50 seconds with 2,500 psi of pressure. In-tank hydraulically-driven agitators keep mixtures blended in the two 325 gallon tanks. Mixtures are supplied from one or both tanks with bypass valves to allow for mixing and pumping, or pump supply from both tanks.

The **Akkerman Bentonite Injection System (ABIS)** is used to reduce jacking forces on microtunneling and pipe jacking operations by delivering automated bentonite injection at exact intervals from a monitor touch screen. Remote Station Control Boxes each link three Automated Injection Ball Valve Assemblies for precise bentonite injection at the desired location within the tunnel. Intermediate Jacking Station functions are also controlled with the ABIS system.

KEYHOLE JACKING FRAME	DIMENSIONS L x W x H	PIPE CAPACITY MIN./MAX. OD*	THRUST CAPACITY	MIN. SHAFT SIZE**	NO. OF CYLINDERS/ STROKE	HYDRAULIC FUNCTIONS	WEIGHT***
MT460K	15.6 x 9 x 6.5-ft (4.8 x 2.7 x 2 m)	n/a /60-in (1,524 mm)	400 ton @ 8,000 psi (363 mt @ 552 bar)	20-ft (6.1 m)	2, 50-in (1,270 mm)	Extend, Retract, High Flow Return, Auxiliary Control	27,000 lbs (12,247 kg)
MT860K		n/a /60-in (1,524 mm)	800 ton @ 8,500 psi (726 mt @ 586 bar)		4, 50-in (1,270 mm)		30,000 lbs (13,608 kg)
MT875K	15.9 x 10.9 x 7.3-ft (4.8 x 3.3 x 2.2 m)	60-75-in (1,524-1,905 mm)					40,000 lbs (18,144 kg)
MT890K	16.3 x 12.7 x 8.5-ft (5 x 3.9 x 2.6 m)	75-90-in (1,905-2,286 mm)					43,500 lbs (19,731 kg)
MT8102K	16.4 x 13 x 9.6-ft (5 x 4 x 2.9 m)	90-102-in (2,286-2,591 mm)	800 ton @ 8,500 psi (726 mt @ 586 bar)****	24-ft (7.3 m)	4 or 6, 50-in (1,270 mm)		58,000 lbs (26,308 kg)
MT8114K	16.4 x 14 x 10.6-ft (5 x 4 x 3.2 m)	102-114-in (2,591-2,896 mm)					72,500 lbs (32,885 kg)

Note: Akkerman standard sizes can be customized to suit project needs.
*Smaller sized pipe can be used in conjunction with a thrust adapter.
**Shaft size is dependent upon launch shaft seal and reaction block configuration.
***Actual weights may vary based on specific configuration.
****The thrust capacity on the MT8102K and MT8114K models can be increased to 1,200 tons (1,090 t) with the addition of a cylinder kit.

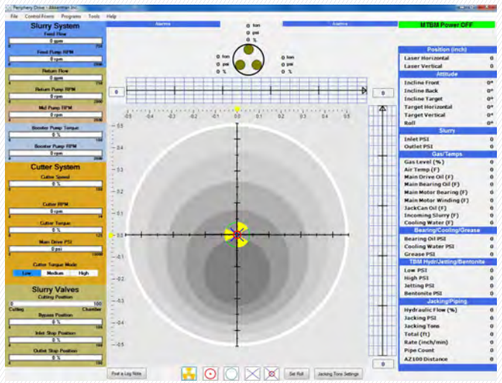
PUMP	DIMENSIONS L x W x H	WEIGHT	POWER UNIT	TANK FLUID CAPACITIES	PUMPS
2325B/D Bentonite and Lubrication Pump	64 x 86.75 x 93-in (1,625 x 2,203 x 2,362 mm)	Empty 3,150 lbs (1,429 kg) Full 8,300 lbs (3,765 kg)	Diesel Engine 3,000 rpm, 30 HP (22.5 kW)	Fuel = 18 gal (68 L) (2) 325 gal (1,230 L) Tanks Hydraulic Reservoir = 25 gal (94.6 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump 1 = 6 gpm (22 L/min) Pump 2 = 10 gpm (38 L/min) Pumps 1 & 2 = 16 gpm (60 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator
2325B/E Bentonite and Lubrication Pump	64 x 86.75 x 93-in (1,625 x 2,203 x 2,362 mm)	Empty 3,150 lbs (1,429 kg) Full 8,300 lbs (3,765 kg)	Electric Motor 1,750 rpm, 30 HP (22.5 kW)	(2) 325 gal (1,230 L) Tanks Hydraulic Reservoir = 25 gal (94.6 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump 1 = 6 gpm (22 L/min) Pump 2 = 10 gpm (38 L/min) Pumps 1 & 2 = 16 gpm (60 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator

ABIS	CONTROL SKID DIMENSIONS L x W x H	FLOW METER	REMOTE STATION CONTROL BOX DIMENSIONS L x W x H	SENSOR VALVE CONTROL ELECTRICAL BULKHEAD
Akkerman Bentonite Injection System	Dimensions 40 x 26 x 36-in (1,016 x 508 x 203 mm) Power In/Out 120 VAC, single-phase Communications - MODbus Resistive Touch Screen Monitor Box 16 x 20 x 8-in (406 x 508 x 203 mm)	Signal - 4-20 mA Pressure Transducer 0-300 psi Flow Rate - 0-30 gpm	Dimensions 12 x 12 x 6-in (305 x 205 x 152 mm) Power In/Out 120 VAC, Single-Phase Communications - MODbus Integrated Light & Remote Work Light	Bentonite & IJS Pressure Transducers Bentonite Circulation & Flow Meter Valves IJS Position & Control

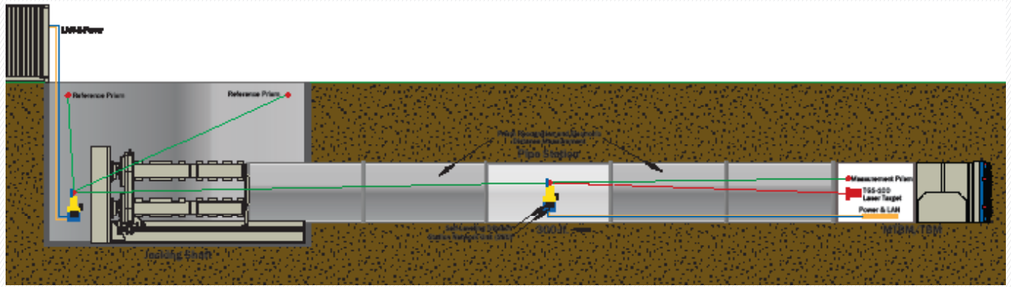
Akkerman reserves the right to improve its products without notice or obligation.

MICROTUNNELING SYSTEMS MICROTUNNELING GUIDANCE SYSTEM

The **Microtunneling Guidance System** utilizes an active target and three inclinometers to read and transmit data to the control console in the control container. The active target monitors and reports X and Y coordinates and the internal inclinometers determine MTBM attitude. Akkerman proprietary software programs display MTBM pitch and yaw, rotation, torque, jetting, jacking thrust, steering, slurry flows and pressures, MTBM's current and anticipated position, and the AZ100 Total Guidance System interface. The Microtunneling Guidance System logs over 100 data points for customizable report generation at any mining interval.



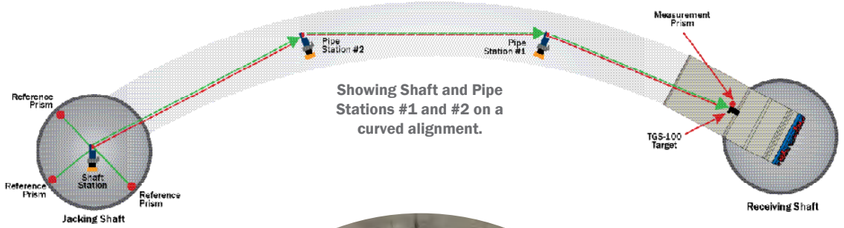
The **AZ100 Total Guidance System (TGS)** is an azimuth based tunneling navigation system for extended lengths and curved alignments. The AZ100 TGS comprises individual, self-leveling station units that maintain a surveyed connection throughout the alignment without the need for continuous, manual surveying. The first pipe station is added at 300-lf. and additional pipe stations are inserted as required to maintain a line of sight between all stations. An impressive range of distance between stations can be achieved, on average 1,000-3,500-lf. dependent upon prism size, tunnel diameter and atmospherics.



AZ100 TGS Diagram Showing the Shaft Station and Pipe Station #1

OPERATOR'S CONSOLE	PROGRAMS
3rd Generation Operator's Control Console	Machine Select Target Screen, with integrated AZ100 TGS Interface Log, MTBM Screen Camera Pit Operational Variable Data Editor MTBM Operational Data Editor Console Operational Data Editor Report Generator KEPServerEX5 Configuration

AZ100 TGS	PROGRAMS & ASSEMBLY
AZ100 Total Guidance System (TGS)	Option 1: Extended Distance Package Option 2: Extended Distance Package for Curved Applications Additional Pipe Stations added per 2,000-lf (610 m)
	Assembly includes: TGS 100 Active Target, Shaft Station Assembly, Pipe Station Assembly, prism mount with adjustable pipe ring, storage container and license key



Showing Shaft and Pipe Stations #1 and #2 on a curved alignment.

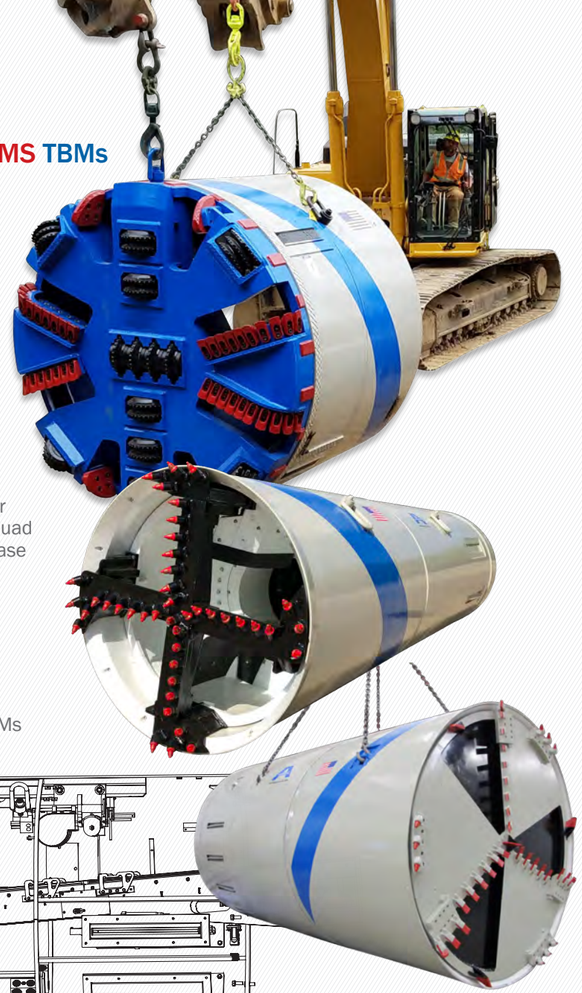
PIPE JACKING & TUNNELING SYSTEMS

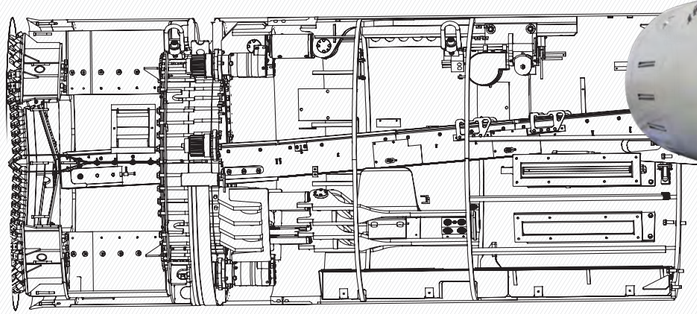
Powerful, Precise & Productive

Tunnel Boring Machines (TBMs) and Excavator Boring Shields (EBS) are used to install 48-96-in. and 100-168-in. OD jacking pipe. Both systems are interiorly controlled by an operator. The TBM's hydraulic motors rotate the inner drum and the cutter head excavates while the soil is transported via conveyor and haul unit for disposal in the launch shaft. The Excavator Boring Shield excavates soil with a backhoe excavator at the face of the bore and soil is removed in the same manner as with the TBMs. Alignment accuracy is achieved with a pipe laser in the launch shaft which projects a laser point on to the cutter face for the operator to monitor and make steering corrections as necessary. For extended length drives, the AZ100 Total Guidance System is used for tunnel navigation. The all-in-one Tunnel Boring System easily adapts to any jacking pipe with an appropriately sized TBM, yoke and skid sections. A complete Tunnel Boring System comprises a TBM, pump unit, yoke, skid, haul unit, conveyor, pipe laser and often a bentonite and lubrication pump. An Excavator Boring Shield System contains a boring shield with excavator, conveyor, haul unit, power pack or pump unit, pipe laser and jacking frame.

PIPE JACKING & TUNNELING SYSTEMS TBMs

Tunnel Boring Machines (TBMs) range in size from 48-96-in. and consist of nine TBM models with common ease of operating controls. The sealed steering joint allows for articulation. The TBM is hydraulic steered using the high capacity main bearing. Two-speed drive motors operate in either low-speed/high-torque or high-speed/low-torque modes allow operators to precisely tailor cutting speeds and torque in varying geology for optimal productivity. The operator controls steering, maintains line and grade and monitors the soil removal process from an interior control station. As soil is excavated, dirt paddles propel it onto the belt or into the screw conveyor for transport to the haul unit. Carbide single bar and quad bar cutter heads come standard with a TBM purchase and feature rotating cutter arms for use in dry, dewatered ground and comprise a combination of durable carbide gauge cutter bits and clay spades. Standard cutter heads can be changed underground. Mixed-ground disc cutter heads for high compressive strength geology, closed face cutter heads for unstable ground or custom cutter heads options compliment the versatility of our TBMs to suit a variety of ground conditions.





TBM 600 with Belt Conveyor

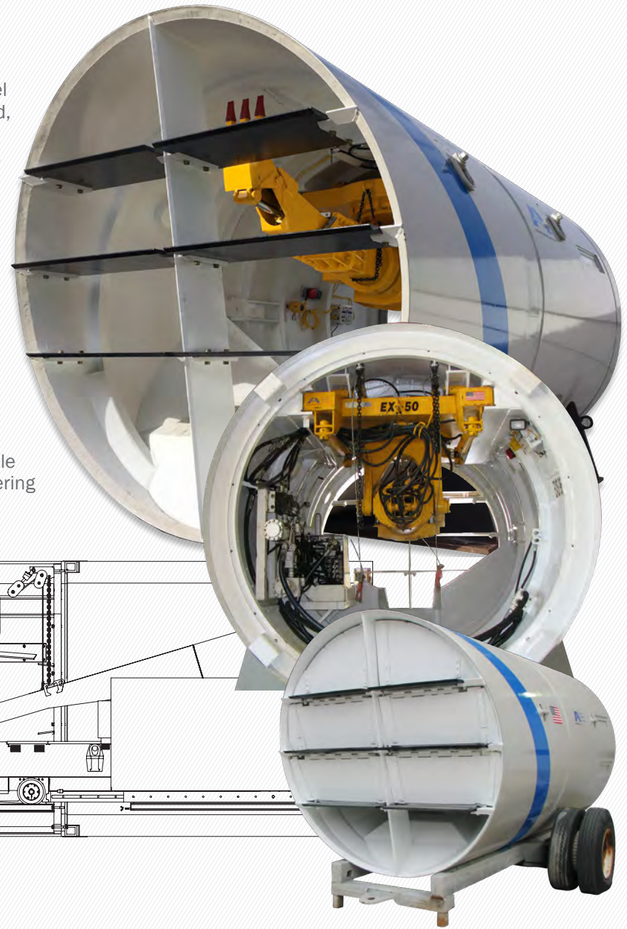
TBM	PIPE ID/ MACHINE OD	CUTTING DIAMETER	2-SPEED DRIVE MOTORS (30 CID)	TORQUE	CUTTING TORQUE @ 3,000 psi (207 bar)	CUTTING TORQUE @ 5,000 psi (345 bar)	CUTTING SPEED* CW & CCW STD./MAX. @ 3,000 psi (207 bar)	ELECTRICAL	WEIGHT**
TBM 48SC	n/a /48-in (1,219 mm)	49.5-in (1,257 mm)	4	Low High	20,000 ft-lbs (27,116 Nm) 30,000 ft-lbs (40,675 Nm)	33,000 ft-lbs (44,742 Nm) 50,000 ft-lbs (67,791 Nm)	0-29.3 rpm @ 90 gpm 0-19.5 rpm @ 90 gpm	Power Supply to Pump Unit = 480VAC 3-phase, 60 Hz, 400 Amp Power Supply from Pump Unit to TBM = 480 VAC, 3-phase, 60 Hz, 15 Amp Transformer = 24 VDC Tunnel Cable = 10 AWG/6C 90°C (On-Board Power Pack Available)	12,500 lbs (5,670 kg)
TBM 420	42/51-in (1,067/1,295 mm)	52.5-in (1,334 mm)	4	Low High	21,000 ft-lbs (28,472 Nm) 32,000 ft-lbs (43,386 Nm)	35,000 ft-lbs (47,454 Nm) 53,000 ft-lbs (71,858 Nm)	0-27.8 rpm @ 90 gpm 0-18.5 rpm @ 90 gpm		14,000 lbs (6,350 kg)
TBM 480	48/58-in (1,219/1,473 mm)	59.5-in (1,511 mm)	6	Low High	38,000 ft-lbs (51,521 Nm) 57,000 ft-lbs (77,282 Nm)	64,000 ft-lbs (86,772 Nm) 96,000 ft-lbs (130,159 Nm)	0-22.1 rpm @ 120 gpm 0-14.7 rpm @ 120 gpm		14,500 lbs (6,577 kg)
TBM 540	54/65-in (1,372/1,651 mm)	66.5-in (1,689 mm)	6	Low High	44,000 ft-lbs (59,656 Nm) 67,000 ft-lbs (90,840 Nm)	74,000 ft-lbs (100,331 Nm) 111,000 ft-lbs (150,496 Nm)	0-19 rpm @ 120 gpm 0-12.6 rpm @ 120 gpm		16,500 lbs (7,484 kg)
TBM 600	60/72-in (1,524/1,829 mm)	73.5-in (1,867 mm)	6	Low High	51,000 ft-lbs (69,147 Nm) 77,000 ft-lbs (104,398 Nm)	85,000 ft-lbs (115,245 Nm) 128,000 ft-lbs (173,545 Nm)	0-16.5 rpm @ 120 gpm 0-11 rpm @ 120 gpm		23,000 lbs (10,433 kg)
TBM 660	66/79-in (1,676/2,007 mm)	80.5-in (2,045 mm)	6	Low High	57,000 ft-lbs (77,281 Nm) 86,000 ft-lbs (116,601 Nm)	96,000 ft-lbs (130,159 Nm) 144,000 ft-lbs (195,238 Nm)	0-14.7 rpm @ 120 gpm 0-9.8 rpm @ 120 gpm		24,000 lbs (10,886 kg)
TBM 720	72/86-in (1,829/2,184 mm)	87.5-in (2,223 mm)	9	Low High	96,000 ft-lbs (130,159 Nm) 144,000 ft-lbs (195,238 Nm)	160,000 ft-lbs (216,931 Nm) 240,000 ft-lbs (325,397 Nm)	0-8.9 rpm @ 120 gpm 0-5.9 rpm @ 120 gpm		29,000 lbs (13,154 kg)
TBM 780	78/93-in (1,981/2,362 mm)	94.5-in (2,400 mm)	9	Low High	105,000 ft-lbs (142,361 Nm) 158,000 ft-lbs (214,220 Nm)	175,000 ft-lbs (237,269 Nm) 263,000 ft-lbs (356,581 Nm)	0-8.1 rpm @ 120 gpm 0-5.4 rpm @ 120 gpm		40,000 lbs (18,144 kg)
TBM 840	84/96-in (2,134/2,438 mm)	97.5-in (2,477 mm)	4	Low High	177,000 ft-lbs (239,980 Nm) 265,000 ft-lbs (359,292 Nm)	293,000 ft-lbs (397,255 Nm) 440,000 ft-lbs (596,561 Nm)	0-6.6 rpm @ 140 gpm 0-4.4 rpm @ 140 gpm		60,000 lbs (27,215 kg)

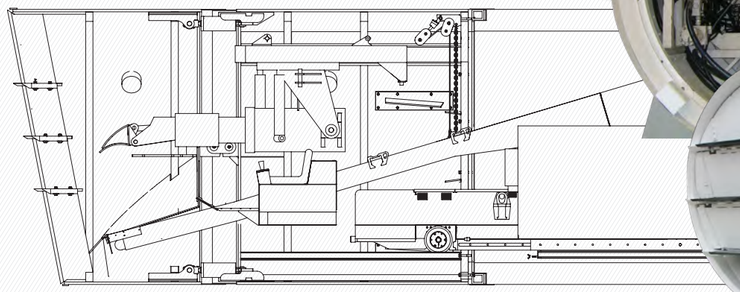
Note: Akkerman standard sizes can be customized to suit project needs. Akkerman reserves the right to improve its products without notice or obligation.
*When using the 5200 Pump Unit in the 5,000 psi selection mode, the pump unit supplies 70 gpm. Therefore, the listed cutter speeds will be reduced by approximately 60%.
**Actual weights may vary based on specific configuration.

PIPE JACKING & TUNNELING SYSTEMS EBSs

Excavator Boring Shields (EBSs) and **EX-50 Excavators** are used for 100-168-in. OD pipe jacking, liner plate, and ring-beam lagging tunnel building applications. EBSs perform best in sand, medium to stiff clay, dry or dewatered soil, and weathered rock in regions without ground water. The EX-50 Excavator is positioned in a slide mount on the interior top of the EBS and is interchangeable between EBS models.

The operator controls the EX-50 Excavator's backhoe claw with a joy stick and foot controls to excavate soil at the face of the bore. Soil is deposited onto the belt conveyor and transported with a 1548 Haul Unit for removal in the launch shaft. The EX-50's rotating boom has a full range of motion and can extend beyond the face of the bore to remove obstructions. EBSs come standard with sand shelves and can be equipped with closeable hydraulic doors to prevent subsidence from entering the interior.



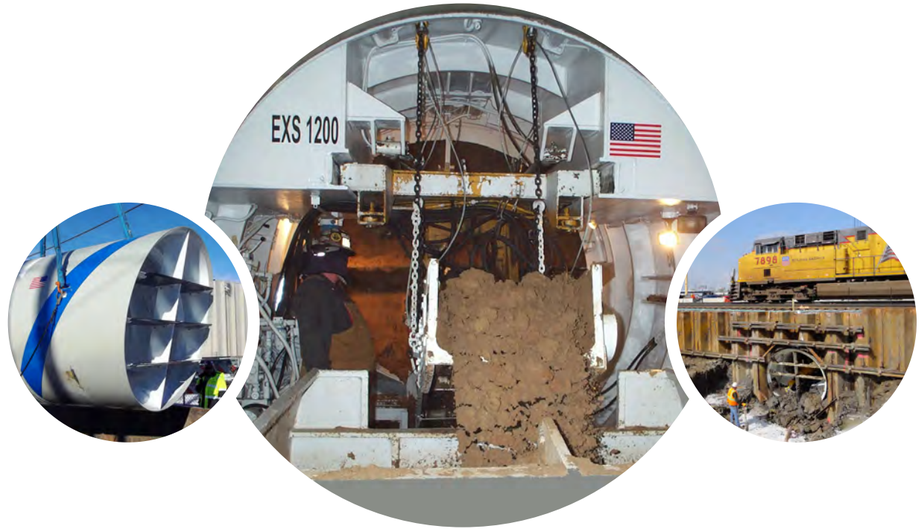


EBS 840 with Belt Conveyor and Haul Unit

BORING SHIELD	MACHINE OD	CUTTING DIAMETER	LENGTH	WEIGHT w/o EXCAVATOR*
EBS 840	100-in (2,540 mm)	101.5-in (2,578 mm)	18-ft (5.5 m)	33,400 lbs (15,150 kg)
EBS 960	114-in (2,896 mm)	115.5-in (2,934 mm)		36,600 lbs (16,601 kg)
EBS 1080	127-in (3,226 mm)	128.5-in (3,264 mm)		50,500 lbs (22,906 kg)
EBS 1200	144-in (3,658 mm)	145.5-in (3,696 mm)		53,000 lbs (24,040 kg)
EBS 1440	168-in (4,267 mm)	169.5-in (4,305 mm)		60,000 lbs (27,216 kg)

Note: Akkerman standard sizes can be customized to suit project needs. Akkerman reserves the right to improve its products without notice or obligation.
*Actual weights may vary based on specific configuration.

EXCAVATOR	HYDRAULICS	EXTENSION	RETRACTION	WEIGHT
EX-50	60 gpm @ 2,800 psi (227 L/min @ 1,724 kPa)	48,000 lbs (21,772 kg)	24,000 lbs (10,886 kg)	7,000 lbs (3,175 kg)



PIPE JACKING & TUNNELING SYSTEMS TUNNEL BORING SYSTEM

The **Tunnel Boring System** is a turnkey solution for 48-96-in. OD pipe jacking and comprises a pump unit positioned behind a thrust yoke that matches the diameter of the TBM and a skid base. Pipe jacking takes place when the operator on the pump unit's platform engages controls to extend jacking cylinders to advance the yoke, TBM and pipe along the skid base.

The **5200 Series Pump Unit** features independent hydraulic jacking and TBM supply functions with pressure compensated capabilities. Combinations of 30, 60, 90 and 120 gallons per minute are selected to match TBM and auxiliary requirements.

Thrust Yokes match the pipe diameter and provide a 360-degree surface to minimize point pressure on the pipe and transfer thrust from the pump unit to the pipe.

Skid Bases accommodate various pipe lengths and shaft configurations and are available in standard lengths of 2.5 through 22.5-ft.

PUMP UNIT	DIMENSIONS H x W x D	WEIGHT w/ OIL	THRUST	HYDRAULIC SUPPLY	RESERVOIR CAPACITY
5200 Series Pump Unit	90 x 102 x 62-in (2,286 x 2,591 x 1,575 mm)	17,200 lbs (7,802 kg)	(2) 200 ton (181 t) w/ 36-in (914 mm) Stroke Cylinders Total Thrust = 400 ton (363 t) @ 8,000 psi	(2) 100 HP (74 kW) Low Pressure Electric Motors for 30 or 60 gpm (114-227 L/min) Variable Displacement Piston Pump with Electric Flow Control @ 3,000 psi (207 bar) or 30 gpm (114 L/min) @ 5,000 psi (345 bar) with a Series II TBM 60 HP (45 kW) High Pressure Electric Motor for 0-12.5 gpm (0-45 L/min) Pressure Compensated @ 8,000 psi (552 bar)	TBM System and Jacking System 240 gal (908 L)

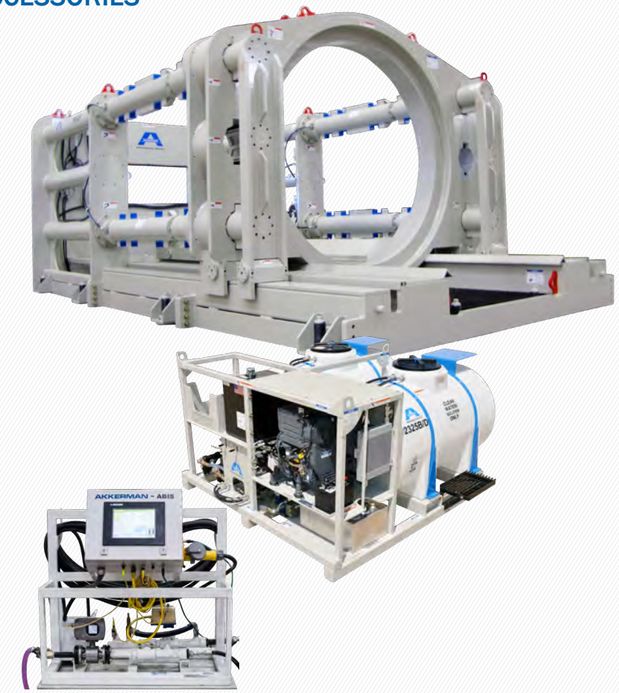
SKID/YOKE	DIMENSIONS L x W x H	WEIGHT
Skid 2.5-ft	30 x 91 x 25.5-in (762 x 2,311 x 648 mm)	1,500 lbs (680 kg)
Skid 7.5-ft	90 x 91 x 25.5-in (2,286 x 2,311 x 648 mm)	4,200 lbs (1,905 kg)
Skid 15-ft	180 x 91 x 25.5-in (4,572 x 2,311 x 648 mm)	8,400 lbs (3,810 kg)
Skid 22.5-ft	270 x 91 x 25.5-in (6,858 x 2,311 x 648 mm)	12,600 lbs (5,715 kg)
Yoke 360	91.5 x 72.75 x 44-in (2,324 x 1,848 x 1,118 mm)	3,075 lbs (1,395 kg)
Yoke 420	93.5 x 72.75 x 51-in (2,375 x 1,848 x 1,295 mm)	3,200 lbs (1,451 kg)
Yoke 480	93.5 x 72.75 x 58-in (2,375 x 1,848 x 1,473 mm)	3,320 lbs (1,506 kg)
Yoke 540, 540 Ext.	93.5 x 72.75 x 65-in (2,375 x 1,848 x 1,651 mm) 123.5 x 72.75 x 65-in (3,137 x 1,848 x 1,651 mm)	3,450 lbs (1,565 kg) 4,250 lbs (1,928 kg)
Yoke 600, 600 Ext.	93.5 x 77.5 x 72.5-in (2,381 x 1,969 x 1,842 mm) 123.5 x 77.5 x 72-in (3,137 x 1,969 x 1,829 mm)	3,575 lbs (1,622 kg) 4,500 lbs (2,041 kg)
Yoke 660	93.75 x 79 x 79-in (2,381 x 2,007 x 2,007 mm)	3,700 lbs (1,678 kg)
Yoke 720, 720 Ext.	93.75 x 86 x 86-in (2,381 x 2,184 x 2,184 mm) 123.75 x 86 x 86-in (3,143 x 2,184 x 2,184 mm)	5,000 lbs (2,268 kg) 6,500 lbs (2,948 kg)
Yoke 780 Ext.	123.75 x 93 x 93-in (3,143 x 2,362 x 2,362 mm)	7,400 lbs (3,357 kg)

PIPE JACKING & TUNNELING SYSTEMS ACCESSORIES

Keyhole Jacking Frames are a high capacity jacking frame to fit a minimum 28-32-ft. shaft. They feature 800-1,200 tons of thrust capacity to advance up to 114-in. OD pipe. As the Keyhole Jacking Frame's hydraulic cylinders extend, notches on the cylinders lock into place to ensure smooth continuous advancement. The hydraulic winch at the base of the reaction wall retracts the jacking frame thrust block. The pipe jacking keyhole jacking frames are configured with a dirt bucket bay.

2325B/D and **2325B/E Bentonite and Lubrication Pumps** offer operators independent flow control of pumping applications of water and water with polymer with a Marsh Funnel viscosity up to 50 seconds with 2,500 psi of pressure. The pumps feature independent or a combination of 6, 10 or 16 gpm fluid pressure output. In-tank hydraulically-driven agitators keep mixtures blended in the two 325 gallon tanks. Mixtures are supplied from one or both tanks with bypass valves to allow for mixing and pumping, or pump supply from both tanks.

The **Akkerman Bentonite Injection System (ABIS)** is used to reduce jacking forces on microtunneling and pipe jacking operations by delivering automated bentonite injection at exact intervals from a monitor touch screen. Remote Station Control Boxes each link three Automated Injection Ball Valve Assemblies for precise bentonite injection at the desired location within the tunnel. Intermediate Jacking Station functions are also controlled with the ABIS system.



KEYHOLE JACKING FRAME	DIMENSIONS L x W x H	PIPE CAPACITY MIN./MAX. OD*	THRUST CAPACITY	MIN. SHAFT SIZE**	NO. OF CYLINDERS/STROKE	HYDRAULIC FUNCTIONS	WEIGHT***
480JF	22.7 x 9 x 6.5-ft (6.9 x 2.7 x 2 m)	n/a /60-in (1,524 mm)	800 ton @ 8,500 psi (726 mt @ 586 bar)	28-ft (8.5 m)	4, 50-in (1,270 mm)	Extend, Retract, High Flow Return, Auxiliary Control	46,000 lbs (20,865 kg)
600JF	23 x 10.9 x 7.3-ft (7 x 3.3 x 2.2 m)	60-75-in (1,524-1,905 mm)					56,000 lbs (25,401 kg)
720JF	23.4 x 12.7 x 8.5-ft (7.1 x 3.9 x 2.6 m)	75-90-in (1,905-2,286 mm)					59,500 lbs (26,989 kg)
960JF	23.5 x 13 x 10.5-ft (7.2 x 4 x 3.2 m)	90-102-in (2,286-2,591 mm)	800 ton @ 8,500 psi (726 mt @ 586 bar)****	32-ft (9.8 m)	4 or 6, 50-in (1,270 mm)		74,000 lbs (33,566 kg)
1080JF	23.5 x 14 x 11.5-ft (7.2 x 4 x 3.5 m)	102-114-in (2,591-2,896 mm)					87,000 lbs (39,462 kg)

Note: Akkerman standard sizes can be customized to suit project needs. Akkerman reserves the right to improve its products without notice or obligation.
*Smaller sized pipe can be used in conjunction with a thrust adapter.
**Shaft size is dependent upon launch shaft seal and reaction block configuration.
***Actual weights may vary based on specific configuration.
****The thrust capacity on the 960JF and 1080JF models can be increased to 1,200 tons (1,090 t) with the addition of a cylinder kit.

PUMP	DIMENSIONS L x W x H	WEIGHT	POWER UNIT	TANK FLUID CAPACITIES	PUMPS
2325B/D Bentonite and Lubrication Pump	64 x 86.75 x 93-in (1,625 x 2,203 x 2,362 mm)	Empty 3,150 lbs (1,429 kg) Full 8,300 lbs (3,765 kg)	Diesel Engine 3,000 rpm, 30 HP (22.5 kW)	Fuel = 18 gal (68 L) (2) 325 gal (1,230 L) Tanks Hydraulic Reservoir = 25 gal (94.6 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump 1 = 6 gpm (22 L/min) Pump 2 = 10 gpm (38 L/min) Pumps 1 & 2 = 16 gpm (60 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator
2325B/E Bentonite and Lubrication Pump	64 x 86.75 x 93-in (1,625 x 2,203 x 2,362 mm)	Empty 3,150 lbs (1,429 kg) Full 8,300 lbs (3,765 kg)	Electric Motor 1,750 rpm, 30 HP (22.5 kW)	(2) 325 gal (1,230 L) Tanks Hydraulic Reservoir = 25 gal (94.6 L)	Pumps Water, Water with Polymer/Bentonite up to 50 Marsh Funnel Seconds Pump 1 = 6 gpm (22 L/min) Pump 2 = 10 gpm (38 L/min) Pumps 1 & 2 = 16 gpm (60 L/min) Max. Pressure = 2,500 psi (172.4 bar) In-Tank Hydraulic-Driven Agitator

ABIS	CONTROL SKID DIMENSIONS L x W x H	FLOW METER	REMOTE STATION CONTROL BOX DIMENSIONS L x W x H	SENSOR VALVE CONTROL ELECTRICAL BULKHEAD
Akkerman Bentonite Injection System	Dimensions 40 x 26 x 36-in (1,016 x 508 x 203 mm) Power In/Out 120 VAC, single-phase Communications - MODbus Resistive Touch Screen Monitor Box 16 x 20 x 8-in (406 x 508 x 203 mm)	Signal - 4-20 mA Pressure Transducer 0-300 psi Flow Rate - 0-30 gpm	Dimensions 12 x 12 x 6-in (305 x 205 x 152 mm) Power In/Out 120 VAC, single-phase Communications - MODbus Integrated Light & Remote Work Light	Bentonite & IJS Pressure Transducers Bentonite Circulation & Flow Meter Valves IJS Position & Control

Akkerman reserves the right to improve its products without notice or obligation.

PIPE JACKING & TUNNELING SYSTEMS ACCESSORIES

The electric **P6000E Power Pack** provides low and high pressure hydraulic power to supply oil to the TBM, conveyor and jacking frame cylinders. The P6000E features quite, three-phase electrical motors, compact and configurable power modules, and a 600 gallon hydraulic reservoir.

Belt and Screw Conveyors transport soil from the cutter head to the dirt bucket and are available in various widths and diameters based on TBM or EBS diameter.

Haul Units transport the dirt bucket along the tunnel track to the launch shaft for soil disposal. Haul units are electrically driven with a removable battery pack and equipped with disc brakes.

Dirt Buckets are sized to match the TBM or EBS and haul unit models to efficiently transport soil.

Intermediate Jacking Stations (IJSs) distribute thrust loads to facilitate longer drives and are encased in a non-recoverable steel housing. IJSs are constructed of multiples of five ram segments with a seven inch stroke that each exert 60-tons of thrust, and are positioned on the inside the steel housing.

The **Laser Stand** is positioned behind the pump unit and cradles the pipe laser at the correct height for sight down the tunnel onto the cutter head.

POWER PACK	DIMENSIONS L x W x H	OIL CAPACITY	ELECTRICAL	POWER MODULES	WEIGHT
P6000E	96 x 72.5 x 88-in (2,438 x 1,842 x 2,235 mm)	600 gal (2,271 L)	480VAC, 60 Hz 3-phase 275 kW/ 300 kVA	Low Pressure Motor = (2) 100 HP (74 kW) 60 gpm @ 3,000 psi (227 L/min @ 207 bar) High Pressure Motor = 100 HP (74 kW) 13.5 gpm @ 8,000 psi (51 L/min @ 552 bar)	16,000 lbs (7,257 kg) w/ Oil

HAUL UNIT	DIMENSIONS L x W x H	BATTERY PACK	SPEED	MIN. PIPE SIZE	MAX. GRADE	WEIGHT w/ BATTERY
524	128.5 x 31 x 15.6-in (3,264 x 787 x 396 mm)	Voltage = 24 VDC Weight = 250 lbs (113 kg)	500-ft/min (152 m/ min)	36-in (914 mm)	Unloaded = 5% Loaded = 2.5%	950 lbs (431 kg)
524 Ext.	158.8 x 31 x 15.6-in (4,033 x 787 x 396 mm)					1,100 lbs (499 kg)
1548	142.6 x 47.6 x 25.9-in (3,623 x 1,210 x 657 mm)	Voltage = 48 VDC Weight = 1,800 lbs (816.5 kg)	750-ft/min (228.6 m/ min)	60-in (1,524 mm)		4,800 lbs (2,177 kg)
1548 Ext.	172.6 x 47.6 x 25.9-in (4,385 x 1,210 x 657 mm)					5,200 lbs (2,359 kg)

HAUL UNIT TRACK	DIMENSIONS L x H	BASE	TRACK GAUGE
524	8-ft x 3.75-in (2.4m x 95 mm)	14.13-in (359 mm)	11.13-in (283 mm)
1548	8-ft x 3-in (2.4m x 76.2 mm)	22.75-in (578 mm)	20-in (508 mm)

CONVEYOR	BELT SIZE/ AUGER DIAMETER	LENGTH	TBM/EBS MODEL	WEIGHT
Belt 1015	10-in (254 mm)	15-ft (4.6 m)	48SC	720 lbs (327 kg)
Belt 1215	12-in (305 mm)		48SC, 420	780 lbs (354 kg)
Belt 1615	16-in (406 mm)		480, 540, 600	1,820 lbs (826 kg)
Belt 2415	24-in (610 mm)		660, 720, 780, 840	1,900 lbs (861 kg)
Belt 2418	24-in (610 mm)	18-ft (5.5 m)	660, 720, 780, 840	2,000 lbs (907 kg)
Belt 2421	24-in (610 mm)	21-ft (6.4 m)	660, 720, 780, 840, EBSs	2,100 lbs (952 kg)
Belt 2423	24-in (610 mm)	23-ft (7 m)	840 & EBSs	2,200 lbs (998 kg)
Screw 120	12-in (305 mm)	15-ft (4.6 m)	48SC, 420, 480, 540	620 lbs (281 kg)
Screw 140	14-in (356 mm)		540, 600, 660	820 lbs (372 kg)
Screw 160	16-in (406 mm)		720, 780, 840	1,420 lbs (644 kg)
Screw 160 HD	16-in (406 mm)	22-ft (6.7 m)	720, 780, 840	2,075 lbs (941 kg)

Akkerman reserves the right to improve its products without notice or obligation.

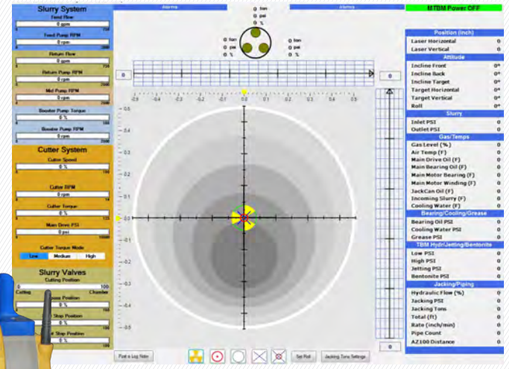
DIRT BUCKET	DIMENSIONS L x W x H	WEIGHT	CAPACITY
360	61 x 33 x 23-in (1,549 x 838 x 584 mm)	440 lbs (200 kg)	0.9-cu yd (0.7 m³)
360 Ext.	90 x 33 x 23-in (2,286 x 838 x 584 mm)	530 lbs (240 kg)	1.3-cu yd (1.0 m³)
48SC	61 x 38 x 28-in (1,549 x 965 x 711 mm)	460 lbs (209 kg)	1.1-cu yd (0.8 m³)
48SC Ext.	90 x 38 x 28-in (2,286 x 965 x 711 mm)	620 lbs (281 kg)	1.7-cu yd (1.3 m³)
420	61 x 38 x 28-in (1,549 x 965 x 711 mm)	480 lbs (218 kg)	1.1-cu yd (0.8 m³)
420 Ext.	90 x 38 x 28-in (2,286 x 965 x 711 mm)	630 lbs (286 kg)	1.7-cu yd (1.3 m³)
480	61 x 43 x 33-in (1,549 x 1,092 x 838 mm)	670 lbs (304 kg)	1.5-cu yd (1.1 m³)
480 Ext.	90 x 43 x 33-in (2,286 x 1,092 x 838 mm)	810 lbs (367 kg)	2.3-cu yd (1.8 m³)
540	61 x 48 x 39-in (1,549 x 1,219 x 991 mm)	1,000 lbs (454 kg)	1.9-cu yd (1.5 m³)
540 Ext.	90 x 48 x 39-in (2,286 x 1,219 x 991 mm)	1,180 lbs (535 kg)	2.9-cu yd (2.2 m³)
600	61 x 55 x 38-in (1,549 x 1,397 x 965 mm)	1,280 lbs (581 kg)	2.3-cu yd (1.8 m³)
600 Ext.	90 x 55 x 38-in (2,286 x 1,397 x 965 mm)	1,470 lbs (667 kg)	3.5-cu yd (2.7 m³)
660	61 x 60 x 44-in (1,549 x 1,524 x 1,118 mm)	1,500 lbs (680 kg)	2.9-cu yd (2.2 m³)
660 Ext.	90 x 60 x 44-in (2,286 x 1,524 x 1,118 mm)	1,700 lbs (771 kg)	4.4-cu yd (3.4 m³)
720	61 x 64 x 42-in (1,549 x 1,626 x 1,067 mm)	1,570 lbs (712 kg)	2.9-cu yd (2.2 m³)
720 Ext.	90 x 64 x 42-in (2,286 x 1,626 x 1,067 mm)	1,820 lbs (825 kg)	4.4-cu yd (3.4 m³)
780	61 x 70 x 48-in (1,549 x 1,778 x 1,219 mm)	2,100 lbs (952 kg)	3.6-cu yd (2.8 m³)
780 Ext.	90 x 70 x 48-in (2,286 x 1,778 x 1,219 mm)	2,400 lbs (1,089 kg)	5.4-cu yd (4.1 m³)

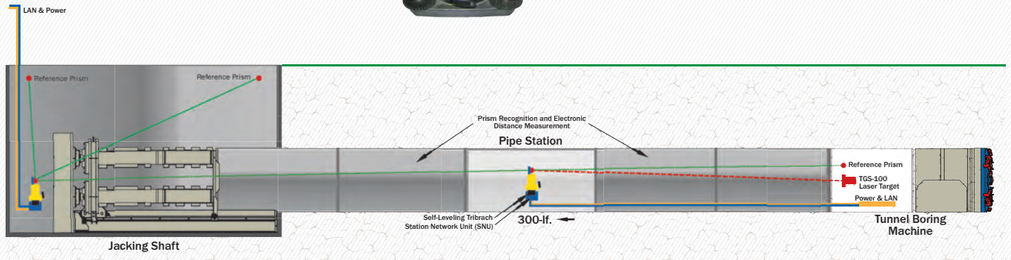
PIPE JACKING & TUNNELING SYSTEMS AZ100 TOTAL GUIDANCE SYSTEM

The **AZ100 Total Guidance System (TGS)** is an azimuth based tunneling navigation system for extended lengths and alignments with curves. The AZ100 TGS comprises individual, self-leveling station units that maintain a surveyed connection without the need for continuous, manual surveying.

The AZ100 Total Guidance System registers the position and angle of incidence of the red laser emitted from the guidance system. The first pipe station is positioned at 300-lf. and additional pipe stations are inserted as required along the alignment to maintain a line of sight between all stations.

An impressive range of distance between pipe stations can be achieved, on average 1,000-3,500-lf. dependent upon prism size, tunnel diameter and atmospherics.





AZ100 TGS Diagram Showing Shaft and Pipe Station #1

SLIPLINING SYSTEMS

Cost-Effective Rehabilitation in Live Sewers

The SLS 100 is a pipe jacking system used for the rehabilitation of live sewer lines that are 30-102-in. in outside diameter to eliminate the need for sewage bypass pumping during installation. Prior to sliplining operations, the contractor is responsible for removing the top half of the existing pipe and clearing the tunnel of debris. The modular sliplining frame accommodates up to 20-ft. pipe lengths and various pipe diameters with the addition of spacers and extensions. The right and left side hydraulically driven and linked pipe elevators for careful lowering and positioning of pipe segments. Using a wireless remote controller with LCD screen, the operator controls sliplining main drive, bidirectional travel, brakes, speed control, elevators, pipe clamp, winch, lights, and e-stop functions. Thrust force is produced by two-speed dual or quad motors, and chain-driven planetary gearboxes advance the pipe axially into position with electrical speed sensors for consistent travel. The SLS 100 features data logging capabilities through a web application.

SLIPLINING SYSTEMS

The **SLS 100 Sliplining System** is used for the rehabilitation of 30-102-inch OD live sewers to prolong the lifespan of failing infrastructure and eliminate the need for bypass pumping. The modular sliplining frame can accommodate up to 20-foot pipe joints for installation in either direction and features a retention winch and pipe clamp to assist with positioning and counterbalance flow force. Using a wireless remote controller with LCD screen, the operator controls the main drive, bidirectional travel, brakes, speed control, frame elevators, pipe clamp, winch, e-stop, and lighting. Two-speed dual or quad motors and chain driven planetary gearboxes generate thrust force to advance pipe into position assisted by speed sensors for synchronized travel. Sliplining operations are powered by an electric motor or diesel engine Power Pack.

Live remote access of system data, data logs, graphs and documentation are available through a web application.

The Akkerman Sliplining System includes a modular jacking frame and power pack.

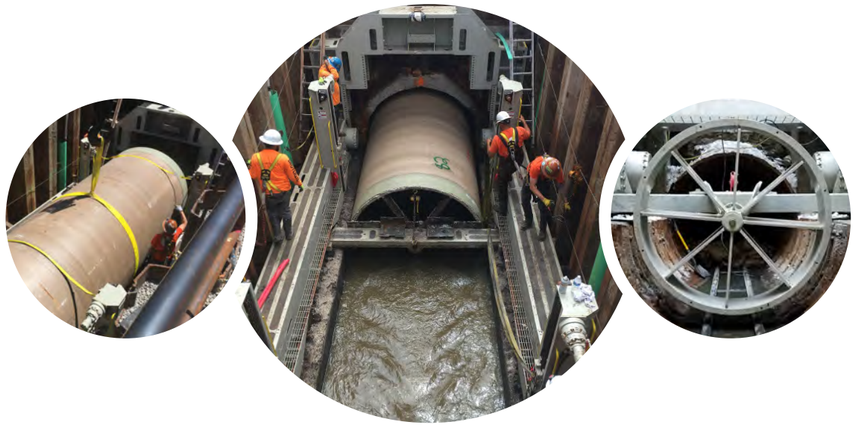
Pipe specific sliplining mandrels, provers, and pipe shield/savers are sold separately.

SLS 100 frame is shown with extensions for 20-ft. pipe

SLS 100 FRAME	DIMENSIONS	MAIN THRUST DRIVE	PIPE POSITIONING ELEVATORS	PIPE CLAMP	WINCH	WEIGHT*
SLS 100	Min. 20-ft (l) for 10-ft pipe joint (6.1/3 m) Max. 30-ft (l) for 20-ft pipe joint (9.1/6.1 m) 8.5-ft (h) (2.6 m) 8-ft (w) w/ 30-in OD (2.4 m/762 mm) 12-ft (w) w/ 78-in OD (3.7/1.98 m) 14-ft (w) w/ 102-in OD (4.3/2.6 m)	65-ton (54 mt) 0-27-ft/min (0-8.2 m/min) 130-ton (118 mt) 0-13-ft/min (0-3.9 m/min)	Vertical Travel 71-in (1,803 mm) Lifting Capacity 20,000 lbs (9,072 kg) Travel Rate 12.5-ft/min (3.8 m/min)	Axial Gripping Force 12,000 ft-lbs (5,443 Nm) Radial Force 10,000 ft-lbs (4,536 Nm)	Capacity 12,000 lbs (5,443 kg) Travel Rate - 0-20-ft/min (6.1 m/min)	42,000 lbs (19,050 kg)

Note: Akkerman standard sizes can be customized to suit project needs. Akkerman reserves the right to improve its products without notice or obligation.
*Actual weights may vary based on specific configuration.

POWER PACK	MOTOR/ENGINE	PUMPS	FUEL TANK CAPACITY	HYDRAULIC RESERVOIR	WEIGHT
SLS 100 Electric - Tricon Container	200 HP (148 kW)	(3) Variable Displacement Pumps (2) Hydrostatic 46 gpm @ 4,200 psi (174 L/min @ 290 bar) (1) Load Sense 21 gpm @ 2,000 psi (79 L/min @ 138 bar)	n/a	100 gal (379 L)	10,000 lbs (4,536 kg)
SLS 100 Diesel - Bicon Container	215 HP (160 kW) Tier IV		200 gal (757 L)		



EARTH PRESSURE BALANCE SYSTEMS

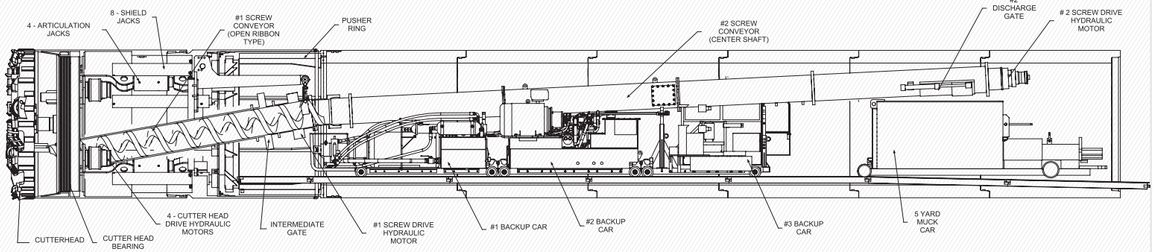
Supported, Precise Innovation

Earth Pressure Balance Machine (EPBMs) Systems are used for direct pipe jacking, concrete segments, liner plate and ring beam and lagging tunnel installations of 102-in. OD pipe and larger on runs generally exceeding 1,000-ft. in poor soil conditions. EPBMs excavate soil while balancing machine advancement and soil pressures to minimize ground settlement. Excavated soil from the EPBM cutter chamber is injected with foam and slurry to counterbalance the face pressure which is then removed through the screw conveyor and haul unit. The operator guides the EPBM and monitors targeting data, pressures, position, speed, torque and flows from a control console in a back-up car to pilot an accurate course and achieve maximum production rates. Back-up cars, each with a special function follow behind the EPBM. The power container distributes power to EPBM operations and the foam and slurry plants provide additives which aid in soil removal. The EPBM cutter head design and power source are custom configured to best meet project geological and performance requirements.

EARTH PRESSURE BALANCE SYSTEMS

Earth Pressure Balance Machine (EPBMs) Systems are used for direct pipe jacking, concrete segments, liner plate and ring beam and lagging tunnel installations of 102-in. OD pipe diameters and larger on runs generally exceeding 1,000-ft. in poor soil conditions. They install pipe by pipe jacking or segment erecting methods for straight and curved extended length alignments with extreme accuracy. EPBM systems are complex in design and performance and are custom built to suit project parameters.

EPBM systems are most suitable for saturated and flowing ground conditions, and foam bentonite slurry injection is used to stabilize and balance machine and soil pressures to minimize ground settlement and prevent subsidence. Ideal EPBM project ground conditions present good plastic deformation, soft consistency and low water permeability. Introducing foam bentonite slurry into the ground lowers the density of the soils, increases water impermeability to seal the tunnel face, and reduces friction and wear on the equipment. Because of the soil conditioning, EPBM operators are able to achieve consistent excavation and production rates.



102-in. Pipe Jacking EPBM

An EPBM is specified over a microtunneling system for its ability to balance soil conditions on projects presenting little groundwater. If the groundwater pressure is high, the tendency for ground collapse increases, therefore balancing the soil pressure with foam is not feasible and microtunneling is a more suitable option.

The pipe jacking EPBM and pipe sections are advanced by a hydraulic jacking frame in the launch shaft.

The segment erecting EPBM positions concrete segments to form a ring to build the tunnel. This EPBM advances itself off of the previously built ring with hydraulic cylinders which apply pressure to the segments and the thrust block.

Excavated soil from the EPBM cutting chamber is removed through a screw conveyor system to the haul unit's dirt bucket for removal from the pipeline.

Trailing back up cars follow behind the EPBM in the tunnel and contain the main hydraulic drive pumps, electric motors, conveyor lift, operator's control station, variable frequency drives, foam and slurry, transformers and tunnel ventilation equipment.

Above ground system components are the control and power containers and foam and slurry plant.

Accuracy is maintained on an EPBM alignment with the AZ100 Total Guidance System.

AKKERMAN

DRIVEN FOR CUSTOMER SUCCESS

Since 1973, Akkerman has developed, manufactured and supported quality underground construction solutions that accurately install a variety of pipe in an extensive range of ground conditions and project challenges. We are proud to be the only North American manufacturer of our range of equipment and a global competitor.

Symmetry with contractors has been the backbone of our business and a point of distinction above our competition. Before Akkerman the equipment manufacturer there was D. H. Akkerman Construction Company. To satisfy their need to accurately install pipe under crossings, the manufacturing branch of Akkerman was founded over forty five years ago.

Our business operates with the highest level of integrity and Akkerman employees have a personal investment in our customers' success. Our highly skilled sales team has a clear understanding of industry demands. Our in-house engineering department applies the most current standards and continually reviews, reassesses and enhances our equipment offerings.

We are committed to making every effort to position our equipment on your next project. As an added benefit, the purchase of a complete equipment system includes crew training and technical support. Akkerman systems are available for purchase, lease-to-purchase, or rent from our rental fleet. Select equipment will be considered for trade-in. Contact us to pair the best option with your requirements.

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