GLOBAL PRODUCT CATALOGUE

DELTATOOLS™

July 2009

BOART LONGYEAR™

www.boartlongyear.com

®

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ABOUT OUR PRODUCTS

BOART LONGYEAR® is the industry's only integrated drilling services and products provider, combining 24-hour engineering excellence, global manufacturing facilities and the most experienced drilling services group in the business. Our customers rely on our unique ability to develop, field test, and deliver any combination of drilling consumables, capital equipment, and expertise direct to any corner of the world.

Exploration Drilling Products

BOART LONGYEAR® is globally recognized as the leader in exploration drilling technology. From the rig to the drill string to the record-breaking Stage3 diamond coring bit at the bottom of the hole, our customers trust us to deliver the most innovative, advanced, and complete solution available.

DIAMOND PRODUCTS
- **Surface set bits**
- **Impregnated bits**
- **Reamers**
- **Casing shoes**
- **PCD bits**
- **Carbon bits**

WIRELINE COMPONENTS
- **Core barrel assemblies**
- **Water swivels and hoisting plugs**
- **Subs and adaptors**
- **Overshots and recovery tools**
- **Wrenches**

RODS AND CASING
- **Q® and Patented RQ® Drill Threads**
- **Coring Rod**
- **Casing**

RC CONSUMABLES
- **Rod**
- **Swivels**
- **Swivel Accessories**
- **Subs**

EXPLORATION DRILL RIGS
- **Surface core drills**
- **Underground core drills**
- **Multi-purpose drills**
- **Reverse circulation drills**

ABOUT OUR PRODUCTS

In addition to exploration drilling technology, BOART LONGYEAR® also engineers and manufactures world-class drill rigs and consumables for construction, overburden and percussive drilling.

Construction Drill Rigs

- DeltaBase® Site investigation and sampling drills
- DeltaBase® Multi-purpose drills
- DeltaBase® Foundation and construction drills

Construction Drilling Consumables

- DeltaTools™ rods and casing
- DeltaTools™ Bits and casing shoes
- DeltaTools™ Jet grouting tools
- DeltaTools™ Freezing rods

Percussive

- Production drill rigs
- Rock drills and breakers
- HRT consumables
  - Threaded bits, rods, couplings, and shank adaptors
  - Tapered bits and rods
  - Integral drill steel
  - Down the hole hammer bits

Aftermarket Support

- Genuine spare parts
- Spare parts kits
- First-aid drill repair boxes
- Maintenance programs

MANUFACTURING

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BOART LONGYEAR® began manufacturing DeltaTools™ overburden drilling products in 1989 at its Burghaun facility in Germany to serve the foundation construction market in Europe.

BOART LONGYEAR® overburden tools were quickly recognized by the industry as reliable and well-designed. From the start, our customers appreciated our use of high-quality steels, precise heat treating and thread gauging as well as the development of new tungsten carbides for the drill bit line. Our attention to detail has made the DeltaTools product line one of the most respected names in the industry.

Today, BOART LONGYEAR® manufactures a broad offering of DeltaTools at our 4200 m^2 (45000 ft^2) facility in Eiterfeld, Germany.

The modern ISO9002-certified facility hosts an array of advanced manufacturing capabilities which include CNC machining, friction-welding for our rod and casing products and computer controlled ovens and induction brazing equipment for assembly of tungsten carbide equipped bits and tools.

1985 | **1990** | **1995**

1989
BOART LONGYEAR® begins production of high quality overburden drilling products in Burghaun, Germany

1994
BOART LONGYEAR® released patented TwinDrive™ threaded products

1996
BOART LONGYEAR® introduced its Jet Grouting systems for high-pressure injection for foundation construction work

1997
BOART LONGYEAR® develops ribbed carbide injection nozzles for Jet Grouting tools

MANUFACTURING

INNOVATION

BOART LONGYEAR® has more than 120 years of experience in the drilling industry and we've been an innovator from the start. Shortly after launching the DeltaTools™ product line, we quickly focused on the development and design of new tungsten materials and geometries specifically suited for overburden drilling applications. These essential materials have enabled us to produce casing crowns, rotary bits and percussive bits which regularly exceed published service-life specifications.

In 1994, BOART LONGYEAR® developed its patented TwinDrive™ thread design for our rotary percussive tools which provided a safe and effective joint solution when using modern high-power hydraulic drifters. The TwinDrive thread offers drillers significantly lower make and break forces on rod joints and up to 40% improvement in casing and drill rod tooling life.

In 1996, we launched our jet grouting system to address the need for high-pressure grout-injection tools for foundation construction work. The system includes an innovative automatic-valve assembly for integral control of flow direction which accommodates either low pressure flushing media or high pressure grout. Additionally, BOART LONGYEAR® led the industry in the development of high quality lip seals to replace the conventional O-rings being used in these high pressure applications.

In 1997, BOART LONGYEAR® further improved the jet grouting system through the introduction of specialized carbide nozzle designs which provided a 'directed' grout stream and resulted in deeper penetration of the grout into the surrounding soil.

Protected by European Patent No. 1117897 in Austria, Germany, Italy, Switzerland, United Kingdom, Korea Patent No. 10-0556271, Japan Patent No. 3961769

2000 2005 2010

2000
BOART LONGYEAR® introduces TDN inner drill rods for double string drilling systems

2004
BOART LONGYEAR® begins providing ground freezing rods for specialty ground stabilization projects

2007
BOART LONGYEAR® releases patent-pending Interlocked DTH Shock Absorber

MANUFACTURING

In 2000, we introduced our TDN inner drill rods for dual-string drilling systems as an alternative to T38 and T45 extension drill steels. This provided drillers with a thread designed to handle strong percussive forces while reducing the annulus between casing and the inner rod. The smaller annulus resulted in better flushing from higher up-hole fluid velocities allowing for higher penetration rates.

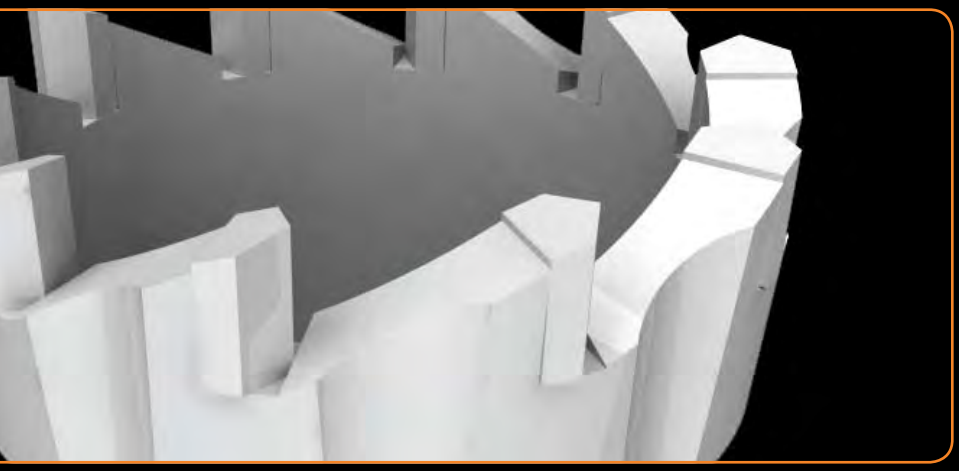
In 2004, BOART LONGYEAR® introduced its ground freezing rods for specialty ground stabilization projects. Using our core competencies in steel selection, thread design and seal design, we developed a line of products which dealt extremely well with the cold temperatures faced in ground freezing applications.

In 2007, we developed the patent-pending interlocked shock absorber for the protection of rotary heads during DTH drilling. BOART LONGYEAR® eliminated the common failure modes in shock absorbers by developing interlock members between the mating parts to absorb the rotary torque.

We continue to drive product innovation through our engineering team in Germany as well as our global engineering organization. Our internal efforts are enhanced by collaboration with universities, raw material suppliers and a variety of technical experts. Our long history of innovation, attention to detail and our focus on advancing overburden drilling technology enables us to deliver the most effective and efficient tools in the industry.

CUSTOM SYSTEMS AND COMPONENTS

CUSTOM SYSTEMS AND COMPONENTS

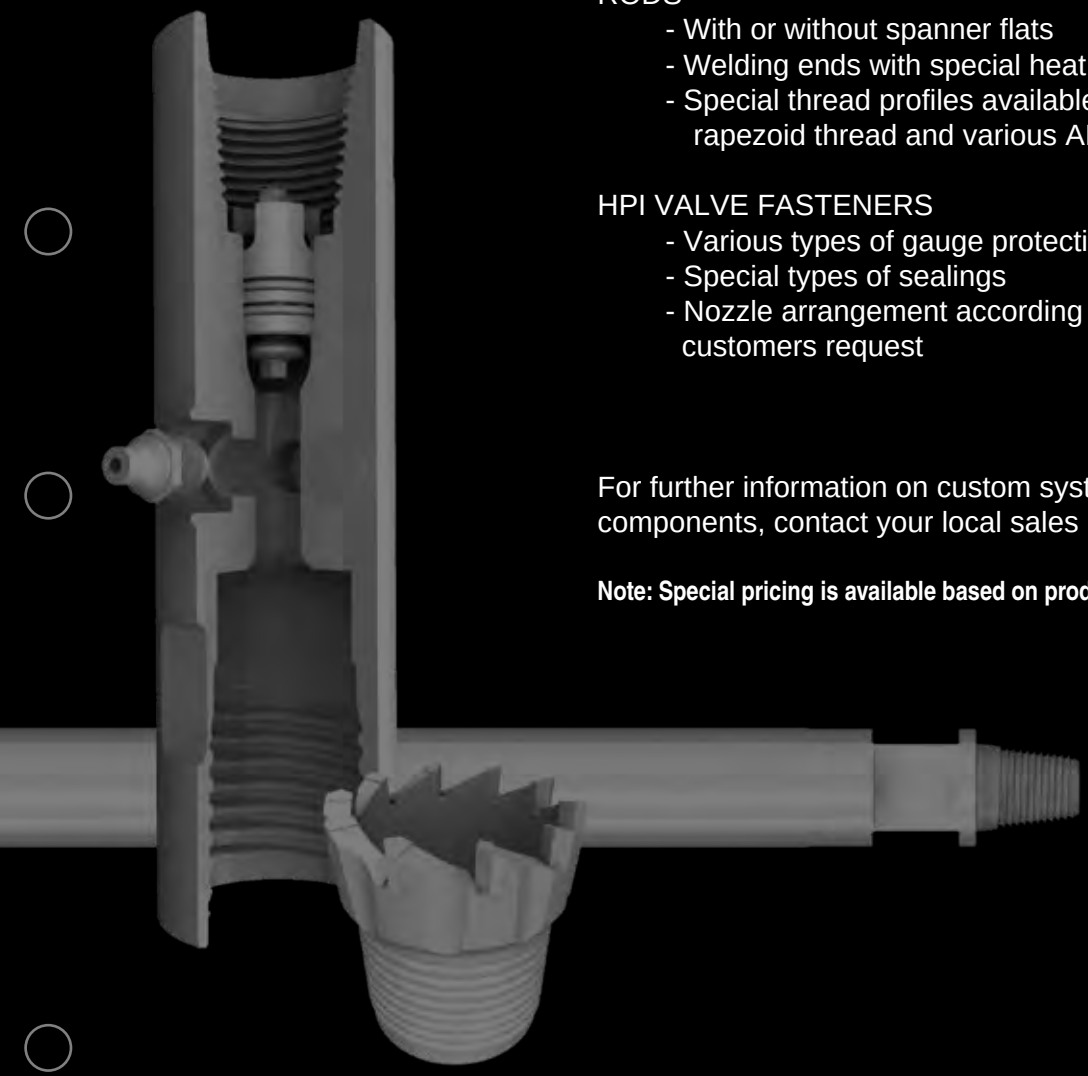


CUSTOM SYSTEMS AND COMPONENTS

OVERVIEW

Each drilling application has its own distinctive challenges which make the tooling requirements unique. We have the capacity to manufacture tools that are considered non-standard by other manufacturers.

Below is a sample of what we can do for your unique drilling needs.



CASINGS
- With or without spanner flats
- Welding ends with special heat treatment
- Special thread profiles available
  flat thread and buttress thread

RODS
- With or without spanner flats
- Welding ends with special heat treatment
- Special thread profiles available
  rapezoid thread and various API types

HPI VALVE FASTENERS
- Various types of gauge protection
- Special types of sealings
- Nozzle arrangement according to
  customers request

For further information on custom systems and components, contact your local sales representative.

Note: Special pricing is available based on production volume.

SAFETY

SAFETY IDENTIFICATION AND SAFEGUARDS

SAFETY

SAFETY IDENTIFICATION AND SAFEGUARDS

Hazard Signal Words
Hazard signal words are used throughout this catalogue. They appear in the narrow left-hand column of numerous pages and, with their additional text description, are intended to alert the reader to the existence and relative degree of hazard.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury and death.

DANGER indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury, or property damage.

SAFETY

SAFETY IDENTIFICATION AND SAFEGUARDS

⚠ WARNING

Read and understand all safety instructions carefully before operating equipment. Failure to follow these instructions may result in serious personal injury or death.

- Keep guards installed and maintained in good working order on all drilling equipment.
- Always keep the work area clean.
- Avoid dangerous working environments.
- Do not operate equipment while under the influence of drugs, alcohol or medication.
- Keep visitors a safe distance away from the work area.
- Wear personal protective equipment such as a hard hat, safety glasses and steel toed work boots.
- Read and understand the operations manual and labels affixed to drilling equipment.
- Use only qualified service technicians. Failure to do so could cause severe damage to the machine or the operator, and may void your warranty.
- Ensure that the drill and accessories fully comply with applicable local safety and health regulations.
- Do not exceed rated capacity of any piece of equipment.
- Before operating any controls, be certain you know what function they control and the ramifications of that function.
- Before operating any hoist, ensure the rope is free and clear to travel.
- When loading dual drill strings the inner string must be engaged first. During this process ensure that outer casing is secure from falling down on inner drill string joint.
- Use extreme caution when breaking rod joint and flushing with compressed air. Pressurized air and cuttings can exit the rod joints at very high velocities.
- Never stand below or in front of drilling bits for inspection or removal. Bits can fall from drill string and trapped pressure in drill string can force debris from flushing holes and drill string at high velocities.
- Use caution when moving inner and outer rods together. Inner rod must be secured within outer rods or it can slide from outer rods causing severe injury.
- When utilizing jet grouting equipment, ensure flushing head plugs are secure.





OVERBURDEN CASED DRILLING SYSTEMS

QUICK SYSTEM OVERVIEW

DRIVE DRILLING SYSTEM *

Drill head:	Single hydraulic drifter
Flushing:	None or external to casing
Casing:	Rotary/percussive, nipple or friction welded
Bit:	Lost bit left in hole
Typical thread direction:	Left

GROUND CONDITIONS
Gravels, soils, sands, limited boulders, and other easily-displaced ground formations.

SYSTEM FEATURES
- Single casing system.
- Bit options with non-return valves for use in high water areas.

* For further information on the Drive Drilling System, please refer to page 26-30.

DUPLEX DRILLING SYSTEM *

Drill head:	Single hydraulic drifter
Flushing:	Air or water mostly within casing
Casing:	Rotary/percussive, nipple or friction welded
Inner drill rod:	Friction welded rod or percussive drill steel
Casing crown:	Tungsten carbide ring bit
Inner bit:	Full face percussive, DTH
Typical thread direction:	Left (percussive), right (DTH)

GROUND CONDITIONS
Gravels, sands, silts, some slate, limestones, limited boulders.

SYSTEM FEATURES
- Dual string drilling system with internal flushing.
- Casing can be stopped at any depth while drilling continues with inner rod.
- Can be configured for single rotary head with DTH, rotary drag bit, or tri-cone.
- Flexible system for a wide range of ground conditions.

* For further information on the Duplex Drilling System, please refer to page 32-36.

QUICK SYSTEM OVERVIEW

DOUBLE HEAD DRILLING SYSTEM ROTARY / ROTARY *

Drill head:	Dual rotary heads
Flushing:	Air, water, mud within casing
Casing:	Rotary, friction welded
Inner drill rod:	API drill rods, auger or casing with TDN
Casing crown:	Tungsten carbide ring bit
Inner bit:	DTH, rotary drag bit, tri-cone
Typical thread direction:	Left (casing), right (inner rod)

GROUND CONDITIONS
All ground conditions.

SYSTEM FEATURES
- Dual-string drilling system with internal flushing.
- Independent control of casing and inner string.
- Control of inner bit relative to casing crown.
- Low hole direction deviation compared to other drilling methods.
- Excellent choice for deeper drilling requirements.
- Highly flexible drilling system for varied ground conditions.
- Can be sealed against pressurized water.

* For further information on the Double Head Drilling System Rotary / Rotary, please refer to page 38-42.

DOUBLE HEAD DRILLING SYSTEM ROTARY / PERCUSSIVE *

Drill head:	Rotary head (casing) & hydraulic drifter (inner string)
Flushing:	Air, water, mud within casing
Casing:	Rotary, friction welded
Inner drill rod:	Friction welded rod or percussive drill steel
Casing crown:	Tungsten carbide ring bit
Inner bit:	Full face percussive or cross blades
Typical thread direction:	Right (casing), left (inner rod)

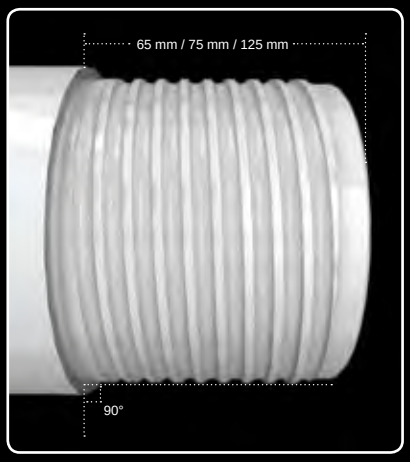
GROUND CONDITIONS
All ground conditions to a drilling depth of approx. 35 m.

SYSTEM FEATURES
- Dual string drilling system with internal flushing.
- Independent control of casing and inner string.
- Control of inner bit relative to casing crown.
- Low hole direction deviation compared to other drilling methods.
- Highly flexible drilling system for varied ground conditions.
- Can be sealed against pressurized water.
- Faster than rotary/rotary drilling up to 35 m.

* For further information on the Double Head Drilling System Rotary / Percussive, please refer to page 44-48.

THREAD OVERVIEW

BOART LONGYEAR® offers a variety of thread types designed for specific drilling applications:

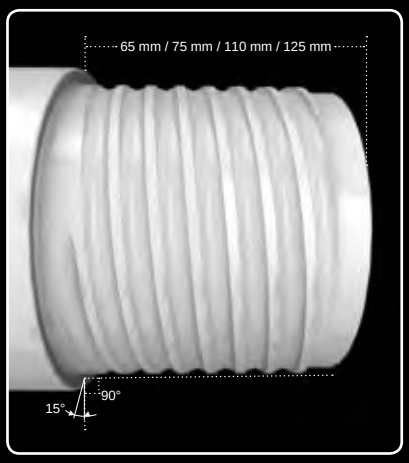


CYLINDRICAL

Cylindrical threads are characterized by a parallel wall design which means that the casing or rod must be completely unscrewed prior to separating the joint.

Cylindrical threads are the most common threads utilized for reusable overburden rotary-percussive casing and inner rods. For rotary-percussive casing, all cylindrical threads are single-start up to 88.9 mm and triple-start for larger diameters.

All standard rotary overburden casing is manufactured by BOART LONGYEAR® with a double-start cylindrical thread.



CONICAL

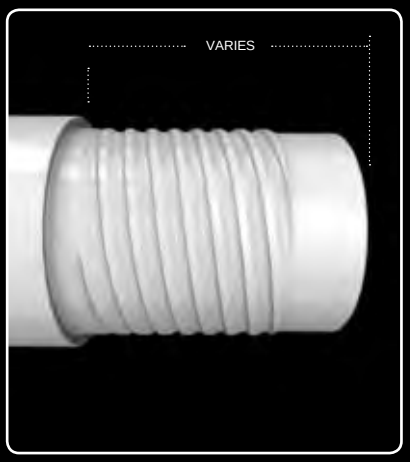
Conical threads are similar in thread form and appearance to cylindrical threads except that there is a 0.5° - 1.0° angle in the thread form giving the thread ends a slight conical shape. It will require less turns to open and separate a conical thread joint due to its conical shape. Conical threads are available only on rotary-percussive casing.

					CYLINDRICAL THREAD			CONICAL THREAD		
CASING Ø	DRILLING METHOD	PROFILE	PITCH		ANGLE	LENGTH	SHOULDER ANGLE	ANGLE	LENGTH	SHOULDER ANGLE
51 mm	Rotary-Percussive	R4	10, 16	Single-Start	0°	65	90°	1°	65	15°
63.5 mm					0°	65		1°	65	
76.1 mm					0°	75		1°	75	
88.9 mm					0°	75		1°	75	
114.3 mm	Rotary	R4	20, 32	Double-Start	0°	110				
133 mm					0°	110				
152.4 mm					0°	110				
101.6 mm	Rotary-Percussive	R5	33, 867	Triple-Start	0°	125		1°	100	15°
114.3 mm					0°	125		1°	100	
133 mm					0°	125		0.5°	100	
152.4 mm					0°	125		0.5°	100	

THREAD OVERVIEW

TWINDRIVE™

Our patented TwinDrive™ threads have been developed for rotary-percussive casings and inner rods to handle the increased percussive power of hydraulic drifters. A typical cylindrical or conical thread form has a concentration of the clamping stresses at the base of the male thread. The TwinDrive™ thread form distributes the clamping load of the rod joint along the full length of the thread resulting in lower stresses at any given point in the thread. This means that it takes much less torque to make and break the rod joint and provides up to 40% additional tooling life in hard ground conditions.

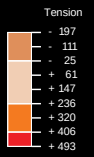


TwinDrive threads are available on all rotary percussive casing and rods. BOART LONGYEAR® uses the TwinDrive thread on all critical threading applications including modular flushing heads, TDN inner rod systems and non-percussive applications such as geothermal and jet grouting tools.

FEATURES: Reduced stresses, easier to uncouple, higher loading capacity, more resistance against leakage of flushing substances, and reduced susceptibility to corrosion.

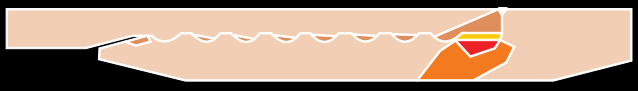
CONNECTION TYPE WITH STANDARD THREAD

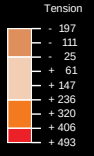
Shock wave through a drilling rod connector with standard thread at a certain point of time t = t1s.



CONNECTION TYPE WITH TWINDRIVE THREAD

Shock wave through a drilling rod connector with TwinDrive thread at a certain point of time t = t1s.





This comparison shows a significantly lower average tension in the drilling rod connector with the patented TwinDrive thread. Average maximum connection stress behind external and internal threads of the drilling rod connectors equipped with the new TwinDrive thread is considerably lower than that of the standard version. Also, the ratio of transmitted energy in connection with the percussion frequency to the field limit (highest tension and compression stress) is much lower.

THREAD OVERVIEW

THREAD DIRECTION

Casing and inner drill rods are offered in both left and right hand threads. The direction of rotation required is determined by the drill system and drilling heads being utilized.

TYPICAL DIRECTIONS OF ROTATION

DRILLING SYSTEM	OUTER CASING	INNER ROD
Drive Drilling	Left Hand	
Duplex Drilling	Left Hand	Left Hand
Double Head Rotary/Rotary	Left Hand	Right Hand
Double Head Rotary/Percussive	Right Hand	Left Hand
Jet Grouting	Right Hand	

THREAD STARTS

The number of thread starts on a given thread varies by the size of the tooling, the application of the tooling and the type of thread utilized.

THREAD STARTS – ROTARY PERCUSSIVE ROD/CASING

CASING DIAMETER	THREAD TYPE	INNER ROD
51 mm - 88.9 mm	Conical/Cylindrical	Single-Start
51 mm - 88.9 mm	TwinDrive™	Multi-Start
101.6 mm - 177.8 mm	Conical/Cylindrical	Triple-Start
101.6 mm - 177.8 mm	TwinDrive™	Multi-Start

THREAD STARTS – ROTARY CASING

CASING DIAMETER	THREAD TYPE	# OF STARTS
114 mm - 177.8 mm	Cylindrical	Double-Start

THREAD LENGTH

The thread length of overburden casing varies by casing diameter and thread type.

	THREAD LENGTH			
CASING DIAMETER	ROTARY PERCUSSIVE CONICAL	ROTARY PERCUSSIVE CYLINDRICAL	ROTARY CYLINDRICAL	TwinDrive™
51 mm - 63.5 mm	65 mm	65 mm		Varies
76.1 mm - 88.9 mm	75 mm	75 mm		
101.6 mm - 152.4 mm	100 mm	125 mm	110 mm	
177.8 mm	140 mm	180 mm	140 mm	

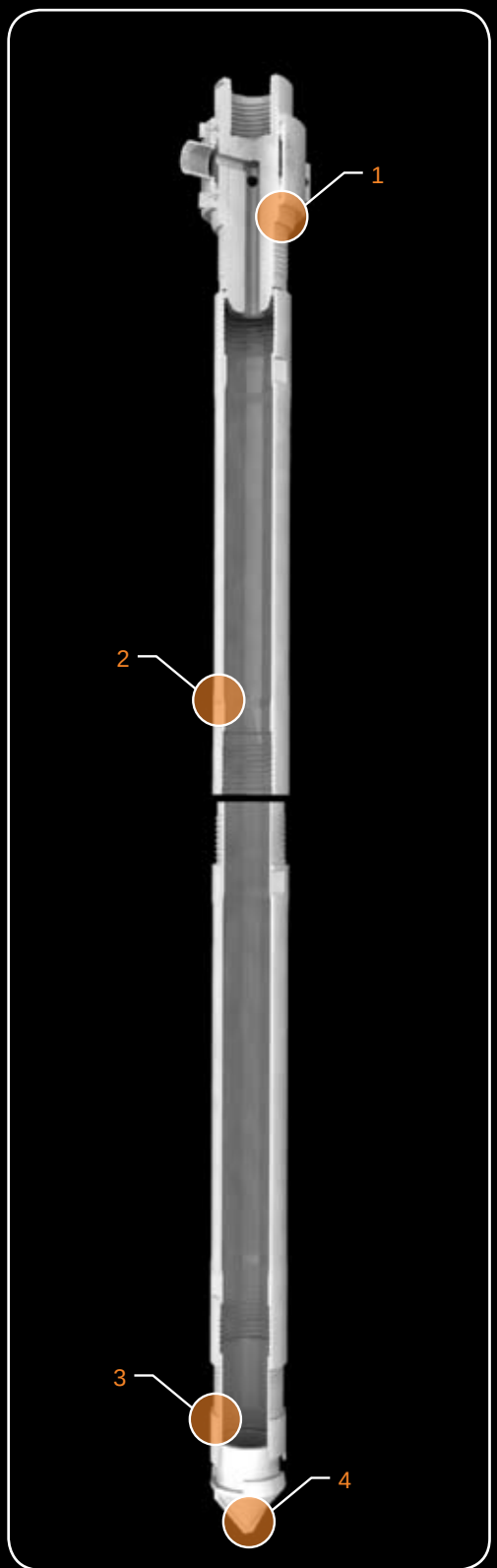
API STYLE THREADS

Industry standard API style threads are available from BOART LONGYEAR® as part of our DTH rod offering. This tapered thread form is utilized as the inner rod for rotary and DTH drilling applications.

OVERBURDEN CASED DRILLING SYSTEMS

SYSTEM OVERVIEW

DRIVE DRILLING SYSTEM



FLUSHING HEAD (1)

Drive drilling flushing heads allow for the introduction of flushing media into the drive drilling string. Flushing heads are selected to match the shank on the hydraulic drifter as well as the casing diameter and casing thread being utilized.

CASING (2)

Drive drilling systems utilize rotary percussive casing. Casing is either friction welded male/female construction or female/female casing with nipple connections.

DRIVE SHOE (3)

Drive drilling shoes mount onto the first string of casing and hold the drive drilling bit. They are offered with a variety of methods to engage with the drive drilling bit.

DRIVE BIT (4)

Drive drilling bits are designed to be lost bits which are left in the hole once the drilling depth is reached. They are available with flushing holes, one-way valves, and tungsten carbide inserts.

SYSTEM OVERVIEW

DRIVE DRILLING SYSTEM

APPLICATION

Drive drilling, also called rotary percussion drilling is noted for the simplicity of the drilling method.

Drive drilling is well suited for use in ground conditions where the material can be displaced without the use of flushing or where flushing can be used without the risk of creating cavities in the bore hole. Examples of these types of ground conditions include: soft rock, medium dense gravel, sands, and formations with limited boulders.

A single hydraulic drifter, also called a top hammer, is used to drive the drill string to the desired depth by using percussive force and minimal rotation.

The drill string consists of rotary percussive casing only without the use of an inner drill string. The most common bit used on the end of the casing is called a “lost bit” or “lost crown bit”. This type of bit is detached from the casing left down the hole after the hole is grouted and casing is removed. A full face re-usable casing bit is also available for drilling conditions in which the bore hole will remain stable when retrieving the drill string with bit.

It is possible to connect a flushing head between the drifter and top of the drill string to allow flushing through the casing and drill bit. The flushing medium returns to the surface via the annular space between the formation and casing.

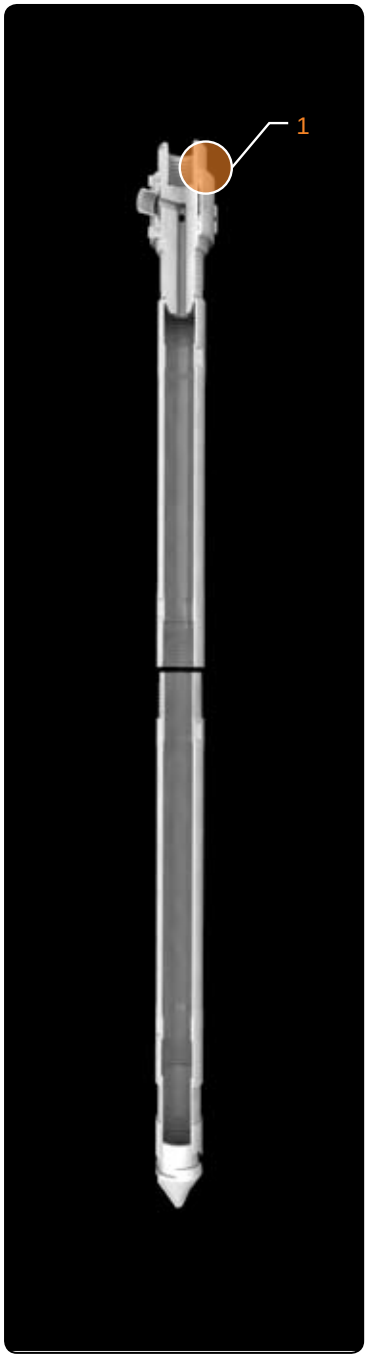
DIAMETER OFFERING

HOLE Ø (METRIC)	HOLE Ø (IMPERIAL)
88.9 mm	3.5”
101.6 mm	4.0”
114.3 mm	4.5”
133 mm	5.23”
152.4 mm	6.0”

DRIVE DRILLING SYSTEM SELECTION

FLUSHING HEAD COMPLETE

ID	THREAD TYPE	ROCK DRILL SHANK THREAD	ROCK DRILL SHAFT DIAMETER	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
1	Cylindrical	H55	100 mm	23020028	23020024	23020025	23020026	23020195
	Conical	H55	100 mm	23020087	23020144	23020163	23020178	23020057
	TwinDrive™	H55	100 mm	23020137	23020058	23020077	23020179	23020196
	Cylindrical	BW64	120 mm	23020125	23020145	23020011	23020012	23020090
	Conical	BW64	120 mm	23020126	23020146	23020075	23020089	23020091
	TwinDrive™	BW64	120 mm	23020138	23020147	23020164	23020180	23020197
	Cylindrical	C64	120 mm	23020127	23020148	23020052	23020111	23020198
	Conical	C64	120 mm	23020128	23020149	23020165	23020181	23020199
	TwinDrive™	C64	120 mm	23020139	23020150	23020166	23020182	23020200
	Cylindrical	H90	140 mm	23020129	23020151	23020167	23020183	23020201
	Conical	H90	140 mm	23020130	23020152	23020168	23020184	23020202
	TwinDrive™	H90	140 mm	23020140	23020153	23020169	23020185	23020203
	Cylindrical	C90	140 mm	23020131	23020154	23020170	23020186	23020204
	Conical	C90	140 mm	23020132	23020155	23020171	23020187	23020205
	TwinDrive™	C90	140 mm	23020141	23020156	23020172	23020188	23020206
	Cylindrical	H112	170 mm	23020133	23020157	23020106	23020189	23020207
	Conical	H112	170 mm	23020134	23020158	23020173	23020190	23020208
	TwinDrive™	H112	170 mm	23020142	23020159	23020174	23020191	23020209
	Cylindrical	C112	170 mm	23020135	23020160	23020175	23020192	23020210
	Conical	C112	170 mm	23020136	23020161	23020176	23020193	23020211
	TwinDrive™	C112	170 mm	23020143	23020162	23020177	23020194	23020212



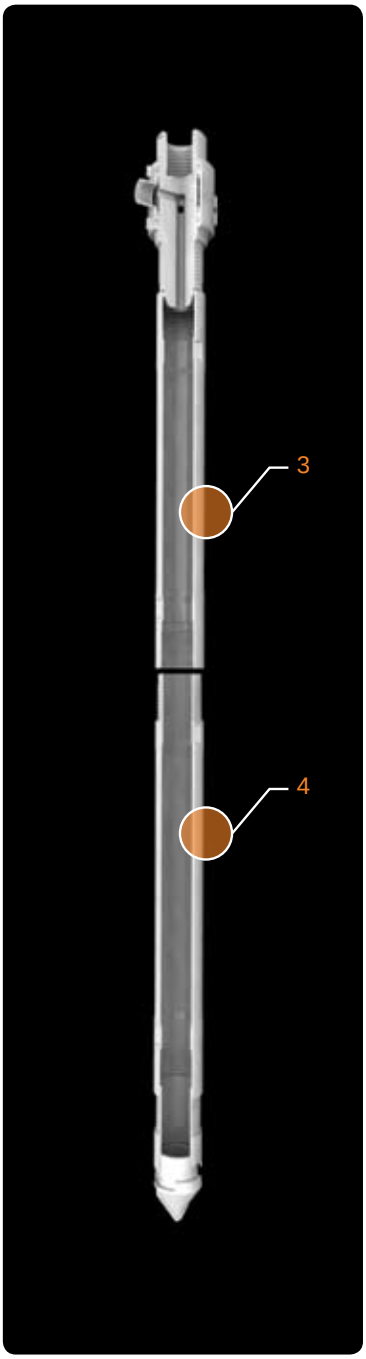
ROCK DRILL CONNECTOR FOR FLUSHING HEAD (NOT SHOWN)

ID	DESCRIPTION
2	Dependent on rock drill manufacturer and type. Specify at time of order.

DRIVE DRILLING SYSTEM SELECTION

STARTER CASING FRICTION WELDED

ID	THREAD TYPE	THREAD DIRECTION	LENGTH	OUTER CASING DIAMETER 88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
3	Cylindrical	Left Hand Female/Female	500 mm	21010209	21010004	21010353	21010077	21010135
	Conical		500 mm	21010370	21011278	21010369	21011285	21011290
	TwinDrive™		500 mm	21010933	21011279	21011281	21011286	21011291
	Cylindrical		1000 mm	21010210	21010006	21010308	21010100	21010469
	Conical		1000 mm	21010457	21010283	21010321	21010109	21010475
	TwinDrive™		1000 mm	21010379	21011133	21011140	21011141	21010840
	Cylindrical		1500 mm	21010213	21010458	21010039	21010464	21010470
	Conical		1500 mm	21010456	21010459	21010462	21010466	21010474
	TwinDrive™		1500 mm	21010870	21011132	21011139	21011142	21011136
	Cylindrical		2000 mm	21010412	21010015	21010042	21010465	21010502
	Conical		2000 mm	21010455	21010460	21010382	21010467	21010473
	TwinDrive™		2000 mm	21010384	21011131	21011138	21011143	21011134
	Cylindrical		3000 mm	21010453	21010020	21010333	21010390	21010471
	Conical		3000 mm	21010454	21010461	21010463	21010468	21010472
	TwinDrive™		3000 mm	21011130	21010289	21011137	21011144	21011135
	Cylindrical		3050 mm	21010445	21010022	21011282	21011287	21011292
	Conical		3050 mm	21010446	21011280	21011283	21011288	21011293
	TwinDrive™		3050 mm	21010883	21010875	21011284	21011289	21011294



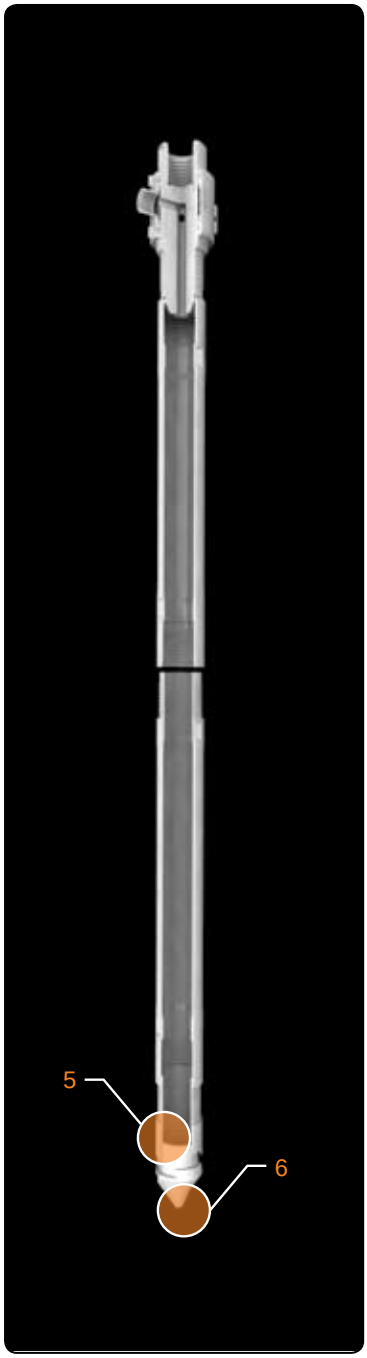
CASING FRICTION WELDED

ID	THREAD TYPE	THREAD DIRECTION	LENGTH	OUTER CASING DIAMETER 88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
4	Cylindrical	Left Hand Male/Female	1000 mm	21010211	21010010	21010038	21010001	21010137
	Conical		1000 mm	21010240	21010025	21010282	21010110	21010163
	TwinDrive™		1000 mm	21010237	21010859	21010669	21010392	21010385
	Cylindrical		1500 mm	21010214	21010012	21010040	21010081	21010140
	Conical		1500 mm	21010241	21010277	21010319	21010112	21010285
	TwinDrive™		1500 mm	21010388	21010858	21010667	21010509	21010731
	Cylindrical		2000 mm	21010220	21010018	21010044	21010085	21010142
	Conical		2000 mm	21010242	21010026	21010062	21010114	21010164
	TwinDrive™		2000 mm	21010238	21010670	21010712	21010383	21010380
	Cylindrical		3000 mm	21010222	21010021	21010046	21010086	21010143
	Conical		3000 mm	21010243	21010403	21010306	21010302	21010280
	TwinDrive™		3000 mm	21010389	21010290	21010713	21010722	21010728
	Cylindrical		3050 mm	21010445	21010023	21010448	21010291	21010451
	Conical		3050 mm	21010446	21010447	21010449	21010322	21010452
	TwinDrive™		3050 mm	21010883	21010875	21010869	21010860	21010823

DRIVE DRILLING SYSTEM SELECTION

CASING NIPPLE CONNECTION (NOT SHOWN)

ID	THREAD TYPE	THREAD DIRECTION	LENGTH	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
4.1	Cylindrical	Left Hand	900 mm		21020021	21020384	21020214	
	Conical		900 mm	21020169		21020053	21020086	21020118
	Cylindrical		950 mm	21020162		21020045	21020076	21020109
	Conical		950 mm	21020172	21020008	21020054		
	Cylindrical		1400 mm		21020024		21020213	21020111
	Conical		1400 mm	21020174		21020055	21020088	21020121
	Cylindrical		1450 mm	21020289		21020047	21020077	21020112
	Conical		1450 mm		21020011			
	Cylindrical		1900 mm		21020025		21020078	
	Conical		1900 mm	21020177		21020056	21020090	21020122
	Cylindrical		1950 mm	21020165		21020049	21020079	21020113
	Conical		1950 mm	21020179	21020014	21020208	21020199	
	Cylindrical		2900 mm		21020368			
	Conical		2900 mm	21020302		21020303	21020304	21020306
	Cylindrical		2950 mm	21020301		21020050	21020081	21020305
	Conical		2950 mm	21020181	21020017		21020322	



CONNECTION NIPPLE (NOT SHOWN)

ID	THREAD TYPE	THREAD DIRECTION	LENGTH	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
4.1 A	Cylindrical	Left Hand	50 mm	21020191	21020027	21020061	21020095	21020123
	Conical		50 mm	21020193	21020031		21020198	
	Cylindrical		100 mm		21020029		21020098	21020124
	Conical		100 mm	21020195	21020032	21020066	21020099	21020125

DRIVE SHOE

ID	THREAD TYPE	THREAD DIRECTION	TYPE	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
5	Cylindrical	Left Hand Male	Flat Collar	22530034	22530049	22530062	22530079	22530063
	Conical			22530059	22530060	22530061	22530030	22530064
	TwinDrive™			22530150	22530026	22530105	22530115	22530151
	Cylindrical	Left Hand Male	Rotation Lock	22530006	22530011	22530001	22530021	22530065
	Conical			22530007	22530023	22530002	22530031	22530066
	TwinDrive™			22530033	22530022	22530100	22530051	22530152

DRIVE BIT

ID	INTERFACE	FLUSHING	CUTTING BLADE	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
6	Flat Collar	No	No	62080021	62080011	62080023	62080025	62080027
	Rotation Lock	No	No	62080022	62080004	62080024	62080026	62080027
	Rotation Lock	Yes	Yes	62080006	62080012	62080029	62080030	62080031
	Rotation Lock	Yes	No	62080017	62080007	62080008	62080018	62080032

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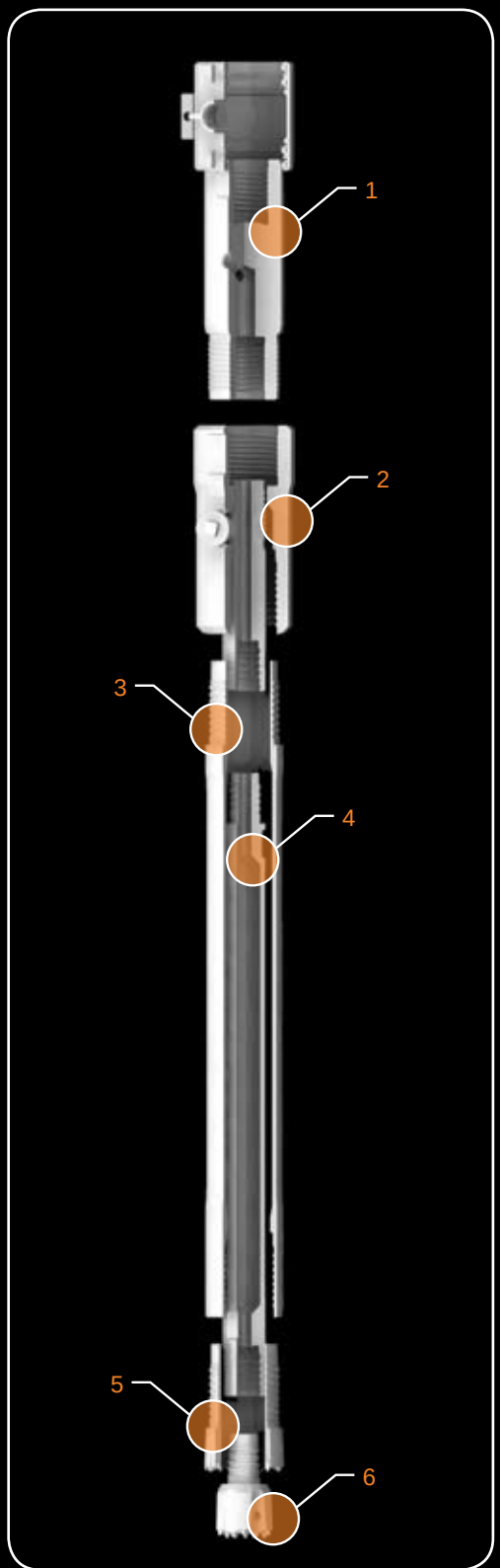
SYSTEM OVERVIEW

DUPLEX DRILLING SYSTEM



FLUSHING HEAD (1)
Duplex drilling flushing heads allow for the introduction of flushing media into the duplex drilling string as well as an exit point through the ejection bell. Flushing heads are selected to match the shank on the hydraulic drifter, the casing diameter and thread, and the type of inner drill rod being utilized.

EJECTION BELL (2)
The ejection bell is part of the flushing head assembly. Casing is threaded into the bottom of the ejection bell. The ejection bell is threaded onto the flushing body. The ejection ports on the ejection bell are threaded so they can be plugged if required to direct flushing fluids to the outside of the casing.

CASING (3)
Duplex drilling systems utilize rotary percussive casing. Casing is either friction welded male/female construction or female/female with nipple connections.

INNER DRILL ROD (4)
The inner drill string of duplex drill systems are either friction welded rotary percussive rods or percussive T38 or T45 drill steel. These systems also can utilize TDN inner drill rods.

CASING BIT (5)
Casing bits for duplex systems are ring bits with tungsten carbide inserts. The type of carbide insert is dependent on the ground conditions being drilled.

INNER STRING BIT (5)
The inner drill string bit of duplex drilling systems typically utilizes a full face percussive bit with tungsten carbide inserts. Duplex drilling systems can also use rotary bits or down the hole hammers (DTH).

SYSTEM OVERVIEW

DUPLEX DRILLING SYSTEM

APPLICATION

Duplex drilling utilizes either a single drifter (top hammer) or a single rotary head to drive a drill string consisting of both an outer casing and an inner drill string simultaneously.

Duplex drilling is a potential solution for drilling in harder ground conditions which can not easily be displaced and require containment of the flushing media within the drill string. Common conditions where Duplex drilling is used are gravels and hard rock formations as well as situations where the ground conditions are unknown or conditions where there is a risk of creating cavities in the ground due to uncontrolled flushing.

A Duplex drill system can be driven by a single hydraulic drifter and utilizes rotary percussive casing as well as rotary percussive inner rods. These systems are run with carbide casing crowns and percussive drill bits for overburden drilling.

A Duplex system can also be driven by a single rotary head in combination with a down the hole hammer (DTH), Tri-cone bit or drag bit on the inner drill string. In this arrangement the internal drill string is typically made up of API drill rods.

Duplex drilling is a controlled flushing method to prevent contact of the flushing medium with the bore hole wall. The flushing media enters the drill string through a flushing head and travels down the drill string within the inner drill rod. The flushing media exits the drill bit on the inner drill string and carries the cuttings up the drill string in the annular area between the outside of the inner rod and the inside of the casing. The cuttings and flushing media exit the drill string through the ejection bell attached to the casing.

Duplex systems offer the driller the flexibility to deal with many different drilling conditions. This includes the ability to stop driving the casing and continue on drilling to depth with only the inner string.

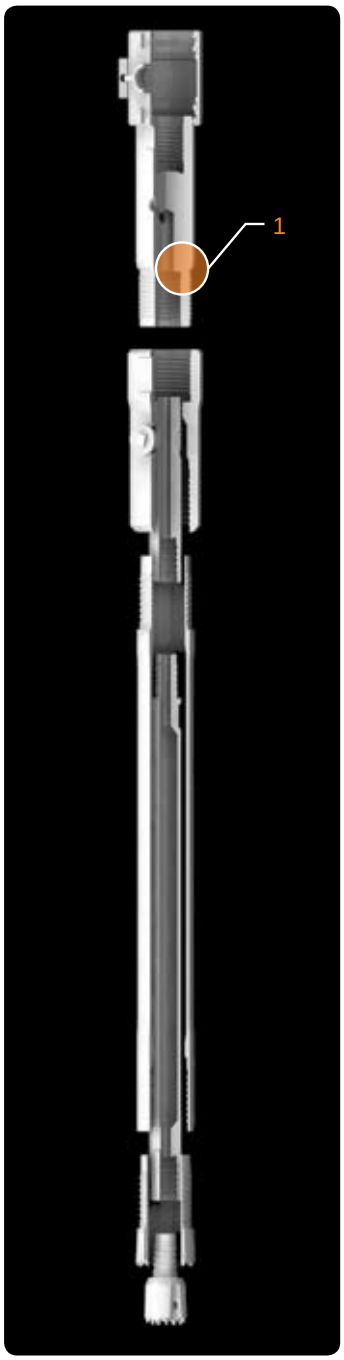
DIAMETER OFFERING

CASING Ø	INTERNAL ROD Ø	
88.9 mm	51 mm	1 1/2” T38
101.6 mm	63.5 mm	1 1/2” T38
114.3 mm	76.1 mm	1 3/4” T45
133 mm	88.9 mm	1 3/4” T45
152.4 mm	101.6 mm	1 3/4” T45

DUPLEX DRILLING SYSTEM SELECTION

COMPLETE FLUSHING HEAD USING FRICTION WELDED INNER RODS (INCLUDES EJECTION BELL, FLUSHING RING AND BALANCE ROD)

				OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
				INNER ROD - FRICTION WELDED				
ID	THREAD TYPE	ROCK DRILL SHANK THREAD	ROCK DRILL SHAFT DIAMETER	51 Ø	63.5 Ø	76.1 Ø	88.9 Ø	101.6 Ø
1	Cylindrical	H55	100 mm	23010183	23010318	23010315	23010256	23010277
	Conical			23010431	23010317	23010316	23010032	23010278
	TwinDrive™			23010432	23010411	23010390	23010362	23010347
	TDN				23010418	23010397	23010376	23010369
	Cylindrical	BW64	120 mm	23010160	23010319	23010165	23010156	23010023
	Conical			23010161	23010150	23010153	23010157	23010081
	TwinDrive™			23010427	23010412	23010391	23010363	23010345
	TDN				23010419	23010398	23010377	23010370
	Cylindrical	C64	120 mm	23010425	23010320	23010296	23010257	23010046
	Conical			23010426	23010321	23010314	23010258	23010276
	TwinDrive™			23010429	23010413	23010392	23010364	23010346
	TDN				23010420	23010399	23010378	23010371
	Cylindrical	H90	140 mm	23010434	23010334	23010310	23010264	23010279
	Conical			23010435	23010336	23010312	23010266	23010281
	TwinDrive™			23010436	23010414	23010393	23010365	23010343
	TDN				23010421	23010400	23010379	23010372
	Cylindrical	C90	140 mm	23010438	23010335	23010311	23010265	23010280
	Conical			23010439	23010337	23010313	23010267	23010282
	TwinDrive™			23010440	23010415	23010396	23010368	23010344
	TDN				23010422	23010401	23010380	23010373
	Cylindrical	H112	170 mm	23010442	23010338	23010306	23010268	23010178
	Conical			23010443	23010340	23010308	23010269	23010283
	TwinDrive™			23010444	23010416	23010394	23010366	23010225
	TDN				23010423	23010402	23010381	23010374
	Cylindrical	C112	170 mm	23010446	23010339	23010307	23010270	23010284
	Conical			23010447	23010341	23010309	23010271	23010285
	TwinDrive™			23010448	23010417	23010395	23010367	23010342
	TDN				23010424	23010403	23010382	23010375



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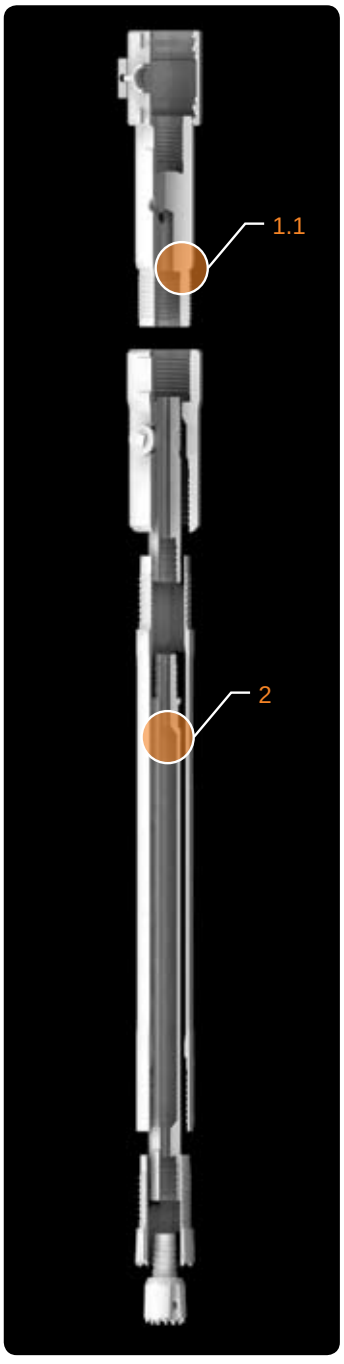
DUPLEX DRILLING SYSTEM SELECTION

COMPLETE FLUSHING HEADS USING EXTENSION DRILL ROD INNER STRING (INCLUDES EJECTION BELL AND BALANCE ROD)

				OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
				INNER ROD				
ID	THREAD TYPE	ROCK DRILL SHANK THREAD	ROCK DRILL SHAFT DIAMETER	T38	T38	T45	T45	T45
1.1	Cylindrical	H55	100 mm	23010056	23010001	23010012	23010025	23010042
	Conical			23010450	23010322	23010014	23010123	23010255
	TwinDrive™			23010451	23010404	23010383	23010355	23010348
	Cylindrical	BW64	120 mm	23010159	23010323	23010020	23010038	23010066
	Conical			23010068	23010191	23010154	23010155	23010158
	TwinDrive™			23010452	23010405	23010384	23010356	23010349
	Cylindrical	C64	120 mm	23010453	23010324	23010017	23010259	23010286
	Conical			23010454	23010325	23010297	23010260	23010287
	TwinDrive™			23010455	23010406	23010385	23010357	23010350
	Cylindrical	H90	140 mm	23010456	23010326	23010298	23010195	23010288
	Conical			23010457	23010328	23010300	23010261	23010290
	TwinDrive™			23010458	23010407	23010386	23010358	23010351
	Cylindrical	C90	140 mm	23010459	23010327	23010299	23010262	23010289
	Conical			23010460	23010329	23010301	23010263	23010291
	TwinDrive™			23010461	23010408	23010387	23010359	23010352
	Cylindrical	H112	170 mm	23010462	23010330	23010302	23010272	23010292
	Conical			23010463	23010331	23010304	23010273	23010294
	TwinDrive™			23010464	23010409	23010388	23010360	23010353
	Cylindrical	C112	170 mm	23010465	23010332	23010303	23010274	23010293
	Conical			23010466	23010333	23010305	23010275	23010295
	TwinDrive™			23010467	23010410	23010389	23010361	23010354



INNER ROD FRICTION WELDED

				OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
				INNER ROD - FRICTION WELDED				
ID	THREAD TYPE	THREAD DIRECTION	LENGTH	51 Ø	63.5 Ø	76.1 Ø	88.9 Ø	101.6 Ø
2	Cylindrical	Left Hand Male/Female	1000 mm	21010124	21010172	21010184	21010211	21010010
	Conical		1000 mm	21010498	21010483	21010485	21010240	21010025
	TwinDrive™		1000 mm	21010887	21010881	21010874	21010237	21010859
	TDN		1000 mm		21010814	21010718	21010723	21010729
	Cylindrical		1500 mm	21010476	21010478	21010484	21010214	21010012
	Conical		1500 mm	21010499	21010482	21010194	21010241	21010277
	TwinDrive™		1500 mm	21010886	21010880	21010873	21010388	21010858
	TDN		1500 mm		21010882	21010719	21010724	21010732
	Cylindrical		2000 mm	21010126	21010175	21010188	21010220	21010018
	Conical		2000 mm	21010500	21010481	21010195	21010242	21010026
	TwinDrive™		2000 mm	21010885	21010879	21010872	21010238	21010670
	TDN		2000 mm		21010815	21010720	21010725	21010733
	Cylindrical		3000 mm	21010477	21010479	21010190	21010222	21010021
	Conical		3000 mm	21010501	21010480	21010486	21010243	21010403
	TwinDrive™		3000 mm	21010884	21010878	21010871	21010389	21010290
	TDN		3000 mm		21010816	21010721	21010726	21010730

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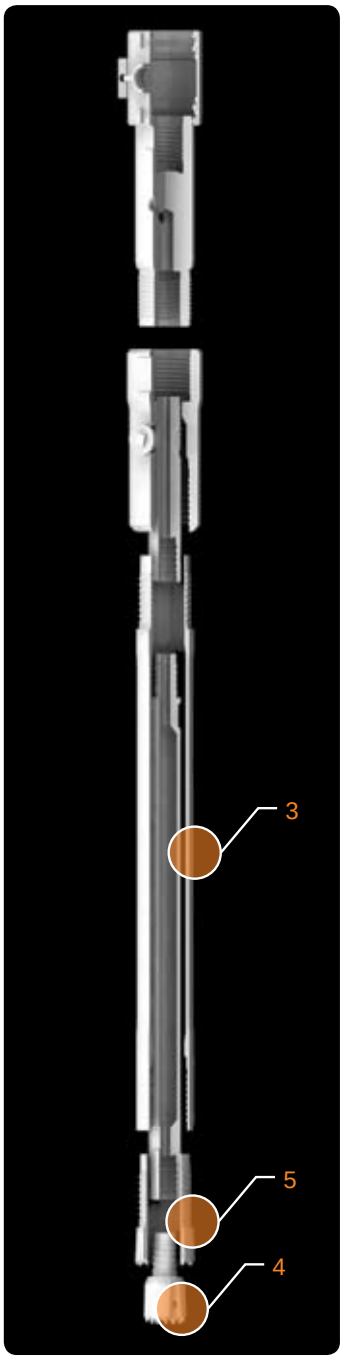
DUPLEX DRILLING SYSTEM SELECTION

INNER ROD EXTENSION WITH COUPLING (NOT SHOWN)

ID	THREAD TYPE	THREAD DIRECTION	LENGTH	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
2.1	ø1 1/2" T38	Left Hand Male/Male	1000 mm	61050029				
			1500 mm	61050174				
			2000 mm	61050036				
			3050 mm	61050038				
	ø1 3/4" T45	Left Hand Male/Male	1000 mm			61050044		
			1500 mm			61050045		
			2000 mm			61050047		
			3050 mm			61050048		

ID	THREAD TYPE	THREAD DIRECTION	LENGTH	OUTER CASING DIAMETER				
				88.9 Ø	101.6 Ø	114.3 Ø	133 Ø	152.4 Ø
2.1 A	ø1 1/2" T38	Left Hand Male/Male	Coupling	61080004				
	ø1 3/4" T45		Coupling			61080006		



CASING

ID	DESCRIPTION
3	See components section for casing selection options. (See pages: 58 - 71)

INNER PERCUSSIVE BITS

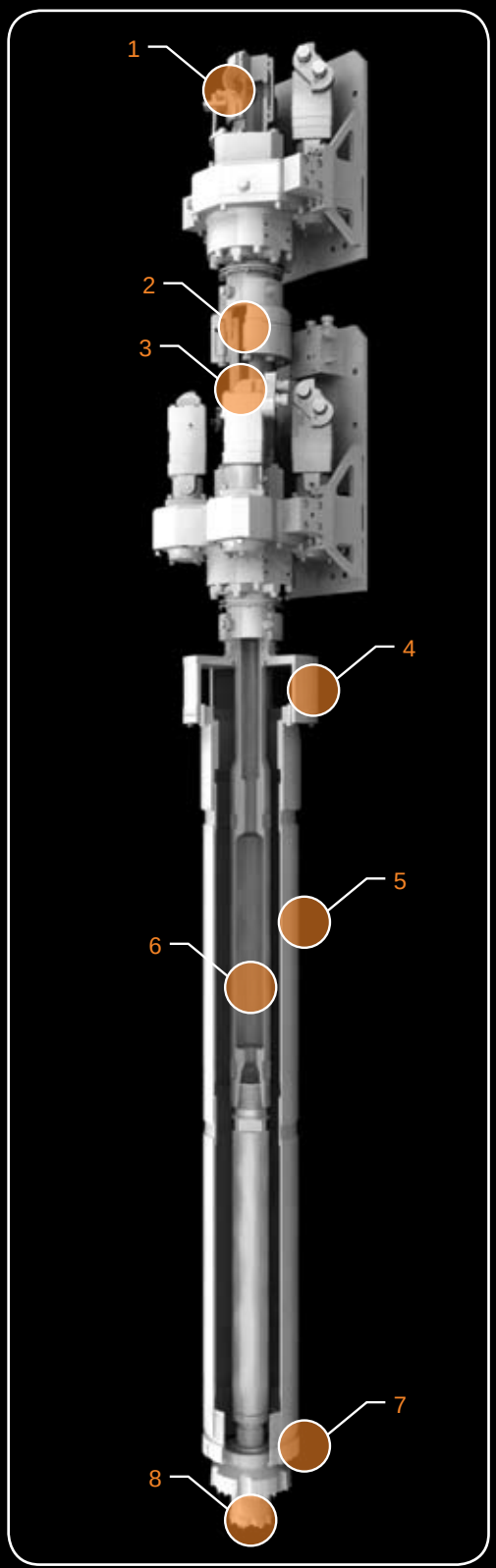
ID	DESCRIPTION
4	See components section for inner percussive bit selection options. (See pages: 84 - 88)

CASING BITS

ID	DESCRIPTION
5	See components section for casing bit selection options. (See pages: 74-83)

SYSTEM OVERVIEW

DOUBLE HEAD ROTARY-ROTARY SYSTEM



FLUSHING HEAD (1)
The flushing head in Rotary-Rotary drilling systems is mounted above the upper drilling head. It is designed to fit the specific drill head in the system.

SHOCK ABSORBER (2)
The shock absorber in a double head rotary system mounts below the top rotary head and is connected to the inner drill string. The shock absorber protects the rotary head from damage due to vibrations from a DTH used with the inner drill string.

BALANCE ROD (3)
The balance rod provides the link between the top drill head and the inner drill string. Balance rods are made to the exact length required by the installed drilling head system.

CASING FLANGE AND EJECTION BELL (4)
The casing flange connects the casing to the lower rotary head and provides an exit point for the flushing medium through the ejection bell.

CASING (5)
Dual rotary drilling systems utilize male/female friction welded double-start rotary percussive casing. Rotary percussive single and triple-start casing can also be used.

INNER DRILL ROD (6)
The inner drill string on dual rotary drill systems are mostly API drill rods.

CASING BIT (7)
Casing bits for dual rotary systems are ring bits with tungsten carbide inserts. The type of carbide insert is dependent on the ground conditions being drilled but is typically a scraping type button form.

INNER STRING BIT (8)
Typically a down the hole hammer is used on the inner drill string of dual rotary systems. These systems can also utilize various types of rotary bits including tri-cone and drag bits.

SYSTEM OVERVIEW

DOUBLE HEAD ROTARY-ROTARY SYSTEM

APPLICATION

The double head Rotary-Rotary drilling system utilizes two independent rotary heads to separately drive the outer casing and the inner drill string. This system uses a lower drill head to turn rotary casing equipped with a carbide casing crown. An upper rotary drill head turns the inner drill rod equipped with a down the hole hammer (DTH), drag bit, tri-cone, or an auger drill string.

Double head Rotary-Rotary systems are a preferred method for drilling straight deep holes. These systems offer the driller a high level of flexibility and control to deal with varying ground conditions. In combination with a DTH system on the inner drill string, a Rotary-Rotary system is able to achieve deeper depths compared to drifter (top hammer) based systems.

The two rotary heads are typically mounted on separate sleds which can be adjusted together or separately to allow for ideal positioning of the inner drill string bit in relation to the casing crown. This means that the inner bit can be advanced in front of the casing bit to act as a pilot bit for the drill string or it can be retracted inside the casing crown to better contain flushing inside the casing.

When drilling with DTH hammers on the inner string it is important to include a shock absorber. The shock absorber is mounted below the upper rotary head for the inner string and protects this rotary head from the percussive energy of the DTH hammer. The elastometric elements in the shock absorber dampen the DTH vibrations protecting the internal gearing of the rotary head.

DIAMETER OFFERING

EXTERNAL TUBE Ø	INTERNAL TUBE Ø	
108 mm, LH	76.1 mm	API 2 3/8” REG, RH
114.3 mm, LH	76.1 mm	API 2 3/8” REG, RH
133 mm, LH	88.9 mm	API 2 3/8” REG, RH
152.4 mm, LH	101.6 mm	API 3 1/2” REG, RH
177.8 mm, LH	114.3 mm	API 3 1/2” REG, RH

DOUBLE HEAD ROTARY-ROTARY

FLUSHING HEAD

ID	HEAD MANUFACTURER	HEAD MODEL	ROTATION DIRECTION	FLUSH CONNECTION	PART #
1	Eurodrill	RH800/900	Right and Left Hand	G2"	23390072
	Eurodrill	RH1000/RH1400/RH1700		G2"	23390073
	Krupp	HR40		G2"	23390070
	Klemm	KH9/KH13		G2"	23390074

SHOCK ABSORBER

ID	HEAD MANUFACTURER	HEAD MODEL	ROTATION DIRECTION	OUTPUT THREAD	PART #
2	Eurodrill	RH800	Right Hand	KW76 Male	24100198
	Eurodrill	RH1000			24100161
	Krupp	HR40			24100193
	Klemm	KH9			24100198

BALANCE ROD

ID	DOUBLE HEAD DRILL SYSTEM TYPE	THREAD	THREAD DIRECTION	DIAMETER	LENGTH	PART #
3	Rotary Percussive	Male KW76 X	Left Hand	80 mm	Specify	TBD*
	Rotary Rotary	Male KW76	Right Hand	80 mm		

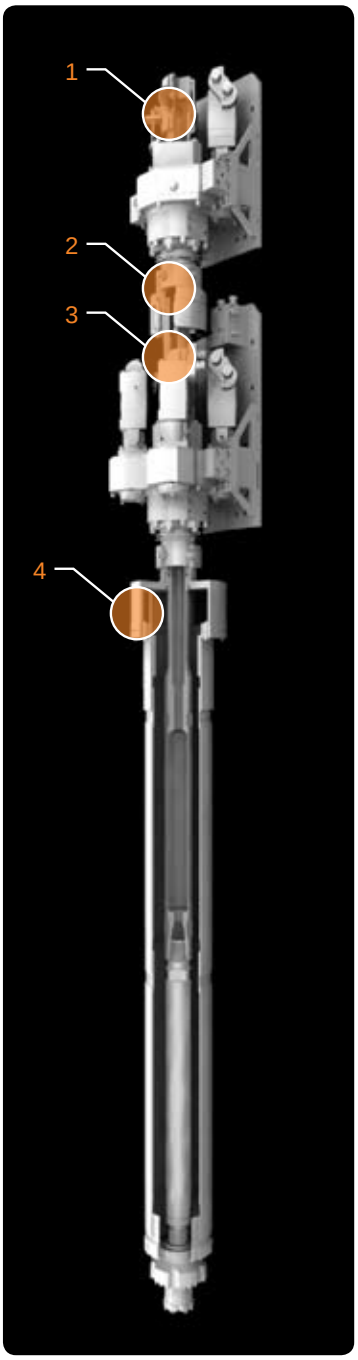
* length and part number dependent on double head installation. Specify at time of order.

EJECTION BELL

ID	HEAD MANUFACTURER	ROTARY HEAD MODEL	SHAFT DIAMETER	PART #
4	Eurodrill	RH1000/RH1400	80 mm	24100158
	Krupp	HR50/HR60	80 mm	24100243
	Klemm	KH13 (HDK800-ZS3)	80 mm	24100106
	Klemm	KH16	80 mm	24100159

SPRAY PROTECTION (NOT SHOWN)

ID	HEAD MANUFACTURER	ROTARY HEAD MODEL	PART #
5	Eurodrill	RH1000/RH1400	24100150
	Krupp	HR50/HR60	24100155
	Klemm	KH13 (HDK800-ZS3)	24100121
	Klemm	KH16	24100245



DOUBLE HEAD ROTARY-ROTARY

CASING FLANGE

ID	THREAD DIRECTION	CASING THREAD TYPE	OUTER CASING DIAMETER			
			114.3 Ø	133 Ø	152.4 Ø	177.8 Ø
6	Left Hand	Cylindrical Double-Start	24030134	24030070	24030326	24030380

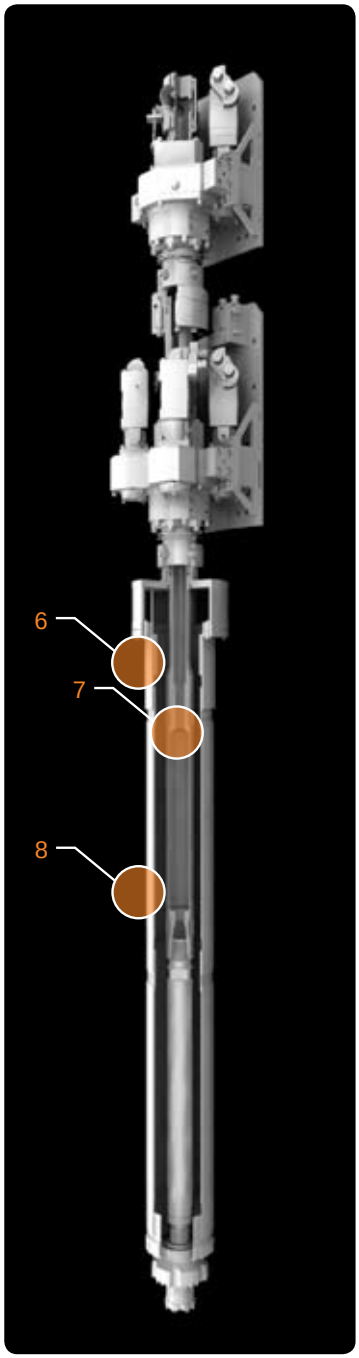
CASING FLANGES INCLUDE:	PART #
Hex bolt for flange (8 pcs)	55010327

BALANCE ROD ADAPTER

ID	DOUBLE HEAD DRILL SYSTEM TYPE	THREAD (1)	THREAD (2)		THREAD DIRECTION	Part No.
7	Rotary-Rotary	KW76 - Female	2 3/8" API Reg	Female	Right Hand	24020806
			3 1/2" API Reg			24021178

ROTARY CASING

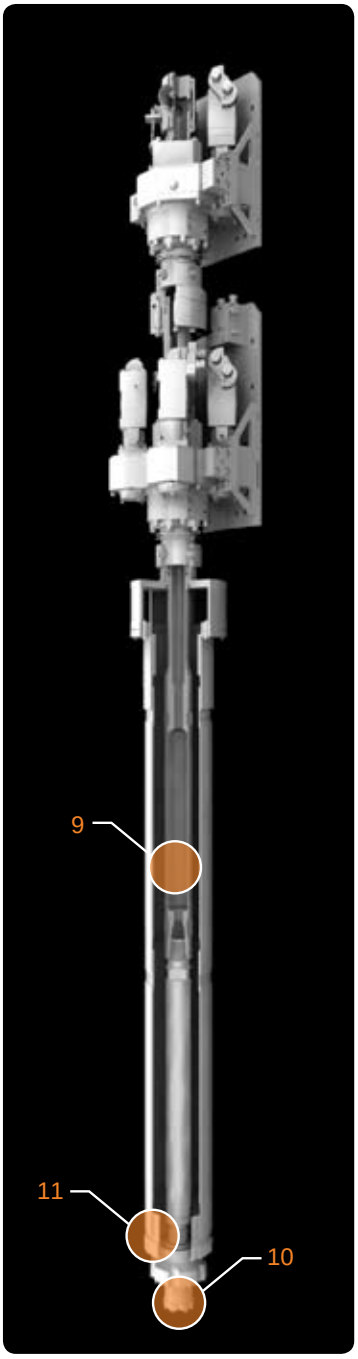
ID	THREAD TYPE	THREAD END CONSTRUCTION	LENGTH	CASING DIAMETER			
				114.3 Ø	133 Ø	152.4 Ø	177.8 Ø
8	Cylindrical Double-Start Left Hand	Friction Weld	500 mm	21011058	21010268	21010565	
			1000 mm	21010049	21010090	21010146	
			1500 mm	21010497	21010091	21010148	
			2000 mm	21010052	21010092	21010293	
		Manual Weld	500 mm				21011307
			1000 mm				21010196
			1500 mm				21010197
			2000 mm				21010496
		Direct Thread	500 mm		21020543	21020544	21020545
			1000 mm		21020383	21020408	21020514
			1500 mm		21020382	21020401	21020427
			2000 mm		21020418	21020416	21020407



DOUBLE HEAD ROTARY-ROTARY

INNER API DRILL ROD MALE

ID	THREAD TYPE	DIAMETER	WALL THICKNESS	THREAD DIRECTION	CASING DIAMETER			
					114.3 Ø	133 Ø	152.4 Ø	177.8 Ø
9	2 3/8" API Reg Male/Female Friction Welded	76.1 mm (3")	6.3 mm	Right Hand	21030422			
					21030078			
					21030080			
					21030083			
	2 3/8" API Reg Male/Female Friction Welded	76.1 mm (3")	8.8 mm	Right Hand	21030232			
					21030204			
					21030208			
					21030203			
	2 3/8" API Reg Male/Female Friction Welded	88.9 mm (3.5")	6.3 mm	Right Hand		21030249		
						21030263		
						21030131		
						21030133		
	2 3/8" API Reg Male/Female Friction Welded	88.9 mm (3.5")	8.8 mm	Right Hand		21030440		
						21030130		
						21030265		
						21030134		
	3 1/2" Reg Male/Female Friction Welded	101.6 mm (4")	6.3 mm	Right Hand			21030646	
							21030385	
							21030384	
							21030383	
	3 1/2" Reg Male/Female Friction Welded	101.6 mm (4")	8.8 mm	Right Hand			21030647	
							21030609	
							21030610	
							21030611	
	3 1/2" Reg Male/Female Friction Welded	114.3 mm (4.5")	6.3 mm	Right Hand				21030537
								21030008
								21030010
								21030012
	3 1/2" Reg Male/Female Friction Welded	114.3 mm (4.5")	8.8 mm	Right Hand				21030499
								21030009
								21030488
								21030275



INNER ROTARY BITS

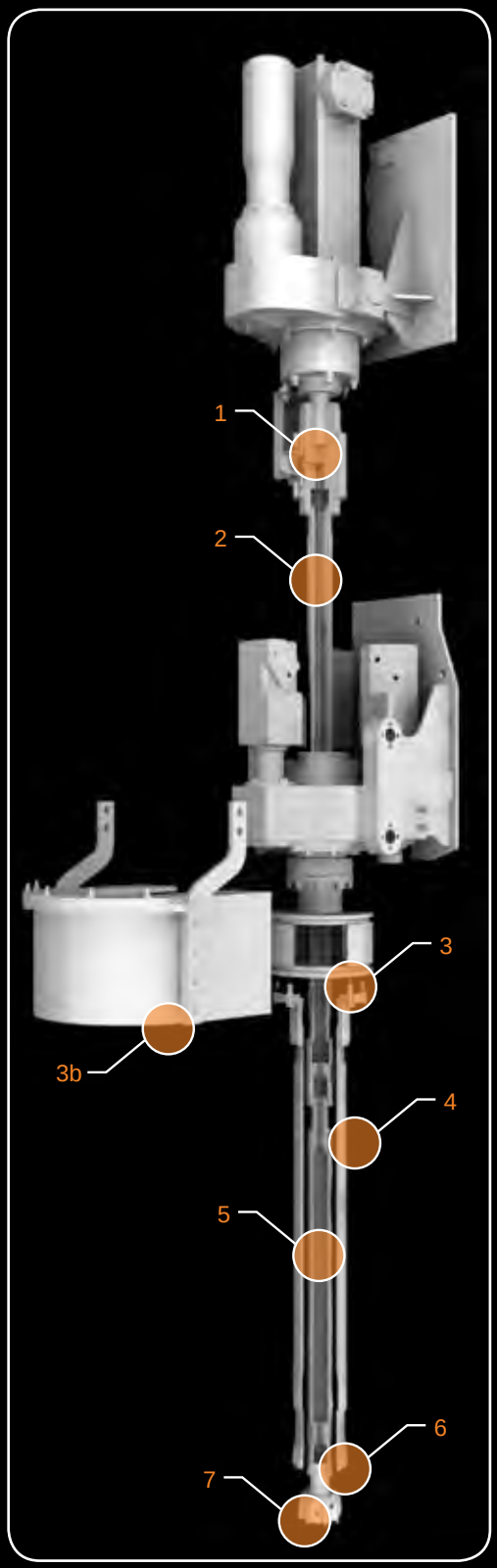
ID	DESCRIPTION
10	See components section for inner bit selection options. (See pages: 84 - 88)

CASING BITS

ID	DESCRIPTION
11	See components section for casing bit selection options. (See pages: 74 - 83)

SYSTEM OVERVIEW

DOUBLE HEAD ROTARY-PERCUSSIVE SYSTEM



FLUSHING HEAD (1)
The flushing head in rotary percussive systems is mounted below the hydraulic drifter. They are designed to fit the shank thread of the specific drifter.

BALANCE ROD (2)
The balance rod provides the link between the drifter with flushing head and the inner drill string. Balance rods are made to the exact length determined by the installed drilling head system in use.

CASING FLANGE AND EJECTION BELL (3)
The casing flange connects the casing to the lower rotary head and provides an exit point for the flushing medium through the ejection bell. Spray protection is available as an optional accessory.

CASING (4)
Dual Rotary drilling systems utilize male/female friction welded double-start rotary percussive casing. Rotary percussive single and triple-start casing can also be used.

INNER DRILL ROD (5)
The inner drill string on rotary percussive drill systems are either friction welded rotary percussive rods or percussive T38 or T45 drill steel. These systems also can utilize TDN inner drill rods.

CASING BIT (6)
Casing bits for rotary percussive drill systems are ring bits with tungsten carbide inserts. The type of carbide insert is dependent on the ground conditions being drilled but is typically a scraping type button form.

INNER STRING BIT (7)
The inner drill string bit of rotary percussive drilling systems typically utilizes a full face percussive bit with tungsten carbide inserts.

SYSTEM OVERVIEW

DOUBLE HEAD ROTARY-PERCUSSIVE SYSTEM

APPLICATION

Double head Rotary-Percussive drilling utilizes a rotary head to drive the outer casing and a hydraulic drifter (top hammer) to driver the inner drill string.

Double head rotary-percussive drill systems use a lower rotary drill head to turn rotary casing equipped with a tungsten carbide casing crown. An upper hydraulic drifter drives the inner rotary percussive drill rod equipped with a percussive drill bit.

Double head rotary-percussive systems are an excellent method for drilling straight holes. These systems offer the driller a high level of flexibility and control to deal with varying ground conditions.

The two drill heads are typically mounted on separate sleds which can be adjusted together or separately to allow for ideal positioning of the inner drill string bit in relation to the casing crown. This means that the inner bit can be advanced in front of the casing bit to act as a pilot bit for the drill string or it can be retracted inside the casing crown to better contain flushing inside the casing.

In addition to casing, inner rods and bits, double head rotary-percussive systems require a balance rod between the two drill heads, rotary head flange connections, flushing head matched to the hydraulic drifter and a flushing ejection bell which are all designed to work with the specific drill heads on the rig.

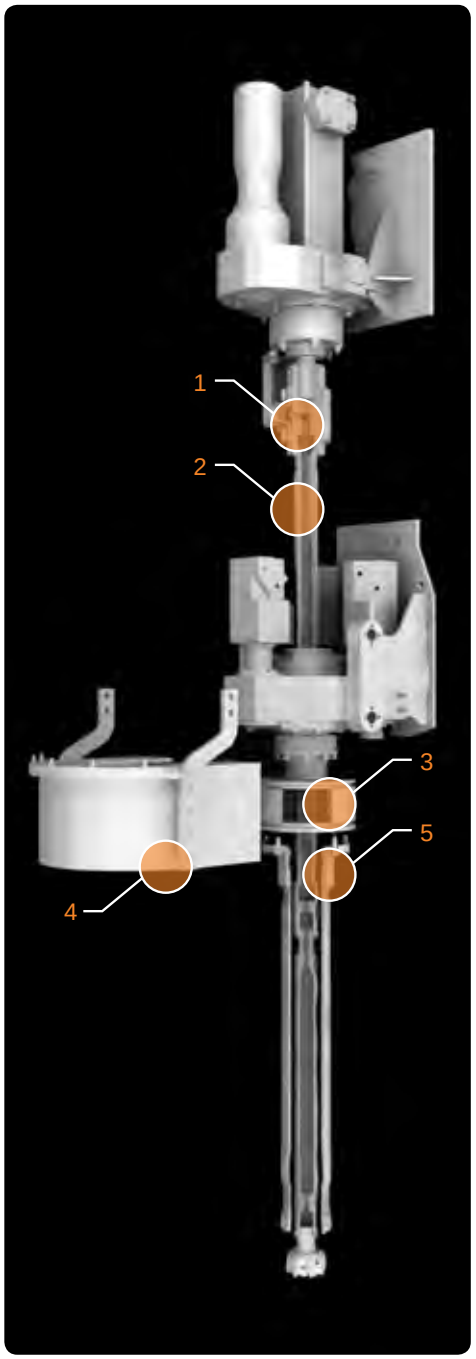
DIAMETER OFFERING

EXTERNAL TUBE Ø	INTERNAL TUBE Ø
114.3 mm, RH	1 3/4” T45, LH
133 mm, RH	1 3/4” T45, LH
152.4 mm, RH	101.6 mm, LH or 51 mm
177.8 mm, RH	114.3 mm, LH

DOUBLE HEAD ROTARY-PERCUSSIVE

FLUSHING HEAD

ID	DRIFTER MANUFACTURER	DRIFTER MODEL	DRIFTER SHANK THREAD	SPINDLE THREAD	THREAD DIRECTION	SHAFT DIAMETER	PART #
1	Eurodrill	HD4008/HD4010	BW55	KW76	Left Hand	100 mm	23010515
	Eurodrill	HD4008	BW64			120 mm	23010516
	Eurodrill	HD5012	H90			140 mm	23010517
	Eurodrill	HD5012	H92			140 mm	23010518
	Krupp	HB45A	BW55			100 mm	23010519
	Krupp	HB45A	C64			120 mm	23010520
	Klemm	KD1011	BW55			100 mm	23010515
	Klemm	KD1215R	RT70			120 mm	23010521



BALANCE ROD

ID	DOUBLE HEAD DRILL SYSTEM TYPE	THREAD	THREAD DIRECTION	DIAMETER	LENGTH	PART #
2	Rotary-Percussive	Male KW76 X	Left	80 mm	Specify	TBD*
	Rotary-Rotary	Male KW76	Right	80 mm		

* length and part number dependent on double head installation. Specify at time of order.

EJECTION BELL

ID	HEAD MANUFACTURER	ROTARY HEAD MODEL	SHAFT DIAMETER	PART #
3	Eurodrill	RH1000/RH1400	80 mm	24100158
	Krupp	HR50/HR60	80 mm	24100243
	Klemm	KH13 (HDK800-ZS3)	80 mm	24100106
	Klemm	KH16	80 mm	24100159

SPRAY PROTECTION

ID	HEAD MANUFACTURER	ROTARY HEAD MODEL	PART #
4	Eurodrill	RH1000/RH1400	24100150
	Krupp	HR50/HR60	24100155
	Klemm	KH13 (HDK800-ZS3)	24100121
	Klemm	KH16	24100245

CASING FLANGE

ID	THREAD DIRECTION	CASING THREAD TYPE	OUTER CASING DIAMETER			
			1143. Ø	133 Ø	152.4 Ø	177.8 Ø
5	Right Hand	Cylindrical Double-Start	24030398	24030029	24030125	24030126

CASING FLANGES INCLUDE:	PART #
Hex bolt for flange (6 pcs)	55010274
Spring ring for flange (6 pcs)	55010038

DOUBLE HEAD ROTARY-PERCUSSIVE

ADAPTER BALANCE ROD TO INNER ROD

ID	DOUBLE HEAD DRILL SYSTEM TYPE	THREAD (1)	THREAD (2)		THREAD DIRECTION	Part No.
6	Rotary-Percussive	KW76 - Female	1 3/4" T45	Female	Left hand	24021219
			ø 51 mm TDN			24020220
			ø 76.1mm Cylindrical			24021225
			ø 76.1 mm TDN			24021227
			ø 114.3 mm Cylindrical			24021222
			ø 101 mm TDN			24021221

ROTARY CASING

ID	THREAD TYPE	THREAD END CONSTRUCTION	LENGTH	CASING DIAMETER 114.3 Ø	133 Ø	152.4 Ø	177.8 Ø
7	Cylindrical Double-Start Right Hand	Friction Welded	500 mm	21011208	21011305	21010150	
			1000 mm	21010053	21010096	21010152	
			1500 mm	21010054	21010098	21010154	
			2000 mm	21010056	21010099	21010157	
		Welded	500 mm				21011306
			1000 mm				21010495
			1500 mm				21010201
			2000 mm				21010202
		Direct Thread	500 mm		21020436	21020115	21020410
			1000 mm		21020402	21020406	21020411
			1500 mm		21020403	21020489	21020412
			2000 mm		21020433	21020423	21020413

DOUBLE HEAD ROTARY-PERCUSSIVE

INNER ROD EXTENSION MALE/MALE WITH COUPLING

ID	THREAD TYPE	DIAMETER	THREAD DIRECTION	LENGTH	CASING DIAMETER 114.3 Ø	133 Ø	152.4 Ø	177.8 Ø
8	T45 Male/Male	1 3/4"	Left Hand	500 mm				
				1000 mm	61050044	61050044		
				1500 mm	61050045	61050045		
				2000 mm	61050047	61050047		
	T45	1 3/4"		Coupling	61080006			
	T45	1 3/4" with 90 mm OD guides		Coupling	24020507			
	T45	1 3/4" with 110 mm OD guides		Coupling		24020508		
	TDN Male/Female Friction Welded	51 mm	Left Hand	500 mm				
				1000 mm		21011122		
				1500 mm		21011128		
				2000 mm		21011123		
	Cylindrical Male/Female Friction Welded	76.1 mm	Left Hand	500 mm				
				1000 mm			21010184	
				1500 mm			21010484	
				2000 mm			21010188	
	TDN Male/Female Friction Welded	76.1 mm	Left Hand	500 mm				
				1000 mm			21010718	
				1500 mm			21010719	
				2000 mm			21010720	
	Cylindrical Male/Female Friction Welded	114.3 mm	Left Hand	500 mm				
				1000 mm				21010038
				1500 mm				21010040
				2000 mm				21010044
	TDN Male/Female Friction Welded	101.6 mm	Left Hand	500 mm				
				1000 mm				21010729
				1500 mm				21010732
				2000 mm				21010733

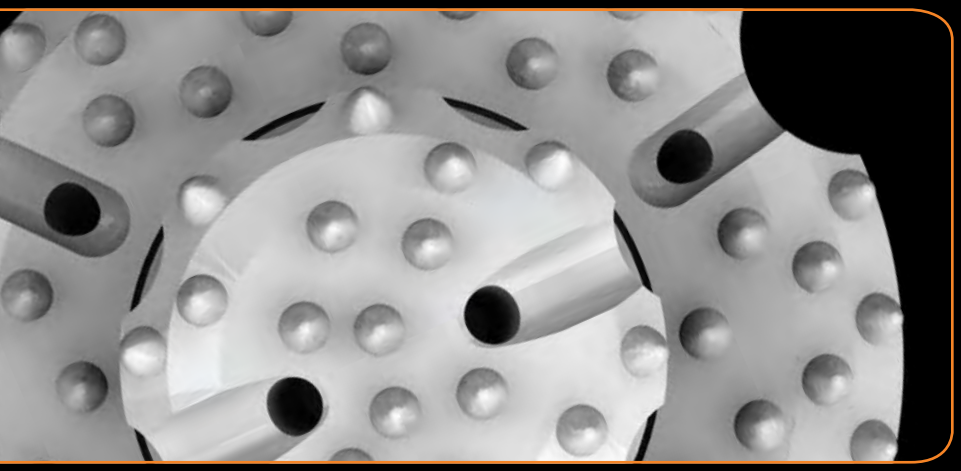
INNER PERCUSSIVE BITS

ID	DESCRIPTION
9	See components section for inner bit selection options. (See pages: 84 - 88)

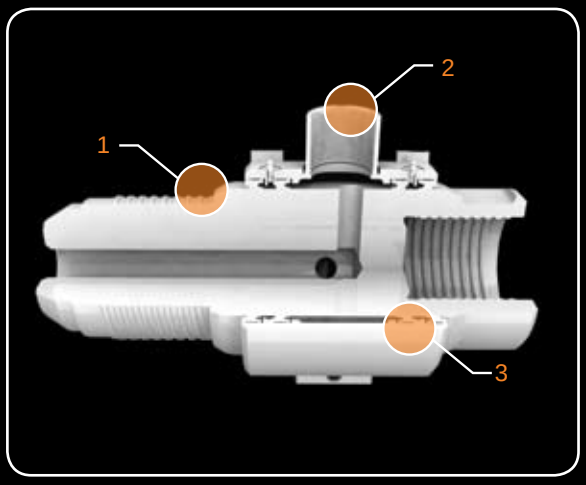
CASING CROWNS

ID	DESCRIPTION
10	See components section for casing bit selection options. (See pages: 74 - 83)

COMPONENTS



FLUSHING HEADS: DRIVE DRILLING



DRIVE DRILLING FLUSHING HEAD

Drive drilling flushing heads allow for the introduction of flushing media into the drive drilling string. Flushing heads are selected to match the shank on the hydraulic drifter as well as the casing diameter and casing thread being utilized.

Drive drilling flushing heads for alternate casing sizes and hydraulic drifter shanks are available upon request.

FLUSHING BODY (1)

The flushing body has a female thread to match with the hydraulic drifter shank and a male thread to match the casing in use.

CASING Ø	ROCK DRILL SHANK THREAD	ROCK DRILL SHAFT Ø	THREAD TYPE		
			CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	H55	100 mm	23040056	23040061	23040422
	BW64	120 mm	23040410	23040411	23040423
	C64	120 mm	23040412	23040413	23040424
	H90	140 mm	23040414	23040415	23040425
	C90	140 mm	23040416	23040417	23040315
	H112	170 mm	23040418	23040419	23040426
	C112	170 mm	23040420	23040421	23040427
101.6 mm	H55	100 mm	23040044	23040058	23040108
	BW64	120 mm	23040430	23040431	23040432
	C64	120 mm	23040433	23040434	23040435
	H90	140 mm	23040436	23040437	23040438
	C90	140 mm	23040439	23040440	23040441
	H112	170 mm	23040185	23040442	23040443
	C112	170 mm	23040444	23040445	23040446
114.3 mm	H55	100 mm	23040046	23040461	23040159
	BW64	120 mm	23040028	23040154	23040447
	C64	120 mm	23040093	23040448	23040449
	H90	140 mm	23040450	23040451	23040452
	C90	140 mm	23040453	23040454	23040455
	H112	170 mm	23040184	23040456	23040457
	C112	170 mm	23040458	23040459	23040460
133 mm	H55	100 mm	23040047	23040462	23040463
	BW64	120 mm	23040029	23040200	23040464
	C64	120 mm	23040145	23040465	23040466
	H90	140 mm	23040467	23040468	23040469
	C90	140 mm	23040470	23040471	23040472
	H112	170 mm	23040244	23040473	23040474
	C112	170 mm	23040475	23040476	23040477
152.4 mm	H55	100 mm	23040051	23040107	23040478
	BW64	120 mm	23040201	23040202	23040479
	C64	120 mm	23040480	23040481	23040482
	H90	140 mm	23040483	23040484	23040485
	C90	140 mm	23040486	23040487	23040488
	H112	170 mm	23040489	23040490	23040491
	C112	170 mm	23040492	23040493	23040494

FLUSHING HEADS: DRIVE DRILLING

FLUSHING RING AND SEALS

The flushing ring is held stationary by the mounting bracket fixed to the drifter while the flushing body rotates. The flushing ring is the connection point for the flushing hose and has upper and lower lip seals to contain the flushing media.

FLUSHING RING (2)

FLUSHING HOSE CONNECTION	ROCK DRILL SHAFT Ø	PART NUMBER
G1 1/4"	100 mm	23070033
G1 1/4"	120 mm	23070035
G1 1/2"	140 mm	23070037
G2"	170 mm	23070012

FLUSHING RING SEALS (3)

ROCK DRILL SHAFT Ø	PART NUMBER (Qty. 4)
100 mm	55030018
120 mm	55030019
140 mm	55030062
170 mm	55030174

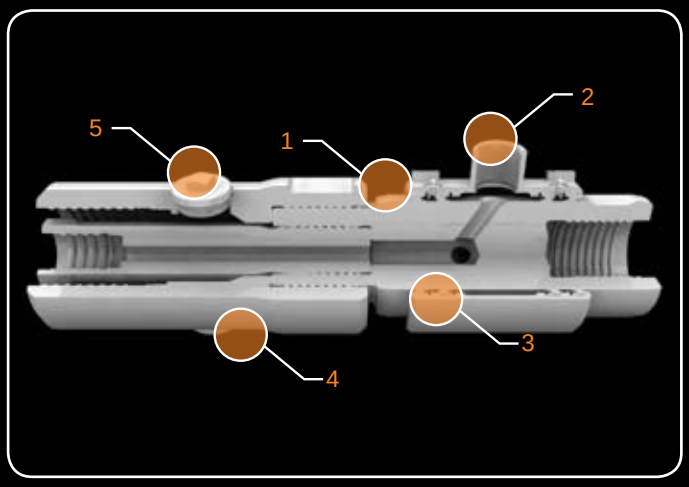
MOUNTING BRACKET (4)

The mounting bracket, which is matched to the hydraulic drifter, keeps the flushing ring stationary on the flushing body.

DRIFTER	SHAFT Ø	PART NUMBER
HD4008	100 mm	23080091
HD4008	120 mm	23080048
HD5012	140 mm	23080066
HB45A	100 mm	23080086
HB45A	120 mm	23080096
KD1011	100 mm	23080097
KD1215R	120 mm	23080098

ALL CONNECTORS INCLUDE:	PART NUMBER
Hex bolt, for Connector	55010001
Nut, for Connector	55010002

FLUSHING HEADS: DUPLEX DRILLING



DUPLEX DRILLING FLUSHING HEAD

Duplex drilling flushing heads allow for the introduction of flushing media into the drill string as well as an exit point through the flushing bell. Flushing heads are selected to match the shank on the hydraulic drifter, the casing diameter and thread, and the type of inner drill rod being utilized.

Duplex flushing heads are modular in design, enabling you to keep the same flushing body and flushing ring but allowing you to change the balance rod and ejection bell for different sizes of casing and inner rods being utilized. Duplex drilling flushing heads for alternate casing sizes, inner rod types and hydraulic drifter shanks are available upon request.

FLUSHING BODY (1)

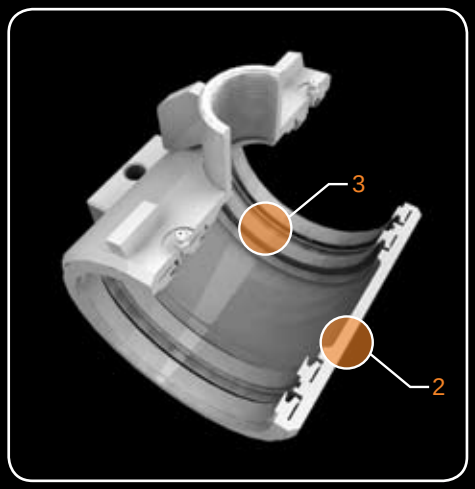
One end of the flushing body has a female thread to match with the hydraulic drifter shank on the drill. The other end of the flushing body has a female thread to match the balance rod as well as a male thread to match the flushing bell.

The patented TwinDrive™ thread is used for both the balance rod and flushing bell. The TwinDrive thread makes it easier to unscrew the balance rod or flushing bell and is better at withstanding the percussive forces from the hydraulic drifter.

ROCK DRILL SHANK THREAD	ROCK DRILL SHAFT Ø	FLUSHING BELL THREAD	BALANCE ROD THREAD	PART NUMBER
H55	100 mm	Standard Rope Thread Male	Standard Rope Thread Male	23040124
BW64	120 mm			23040026
C64	120 mm			23040174
H90	140 mm	TwinDrive™ Male	TwinDrive™ Male	23040195
C90	140 mm			23040314
H112	170 mm			23040206
C112	170 mm			23040243

NOTE: Additional configurations are available.
Please contact your sales representative for further details.

FLUSHING HEADS: DUPLEX DRILLING



FLUSHING RING AND SEALS

The flushing ring is held stationary by the mounting bracket fixed to the drifter while the flushing body rotates. The flushing ring is the connection point for the flushing hose and has upper and lower lip seals to contain the flushing media.

FLUSHING RING (2)

FLUSHING HOSE CONNECTION	ROCK DRILL SHAFT Ø	PART NUMBER
G1 1/4"	100 mm	23070033
G1 1/4"	120 mm	23070035
G1 1/2"	140 mm	23070037
G2"	170 mm	23070012

FLUSHING RING SEALS (3)

FLUSHING HEAD SHAFT Ø	PART NUMBER (Qty. 4)
100 mm	55030018
120 mm	55030019
140 mm	55030062
170 mm	55030174

FLUSHING BELL (4)

The flushing bell has either a female TwinDrive™ thread or a female rope thread to mate with the flushing body and a female thread to match the casing being used in the drill string. Flushing media exits the drill string through the flushing bell.

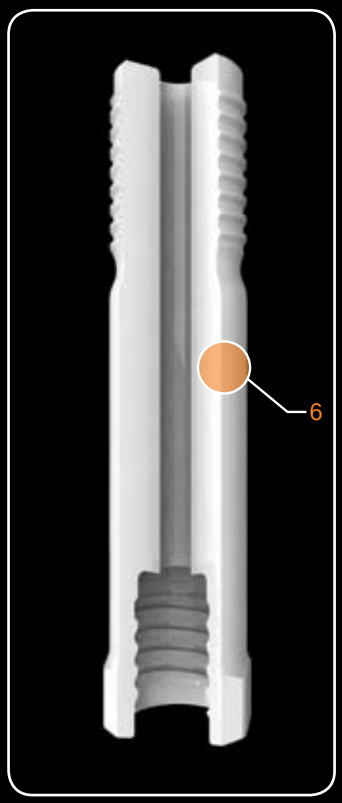
A threaded plug is provided with the flushing bell to block off the return flushing flow and force circulation via the outside of the casing through the annulus to the surface.

				CASING THREAD TYPE		
OUTER CASING Ø	ROCK DRILL SHAFT Ø	FLUSHING BODY THREAD		CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	100 mm	Female Left Hand	Rope	23050037	23050058	23050146
	120 mm			23050044	23050076	23050147
	140 mm		TwinDrive™	23050148	23050150	23050152
	170 mm			23050149	23050151	23050153
101.6 mm	100 mm	Female Left Hand	Rope	23050002	23050006	23050142
	120 mm			23050046	23050077	23050143
	140 mm		TwinDrive™	23050129	23050054	23050144
	170 mm			23050130	23050096	23050145
114.3 mm	100 mm	Female Left Hand	Rope	23050009	23050011	23050138
	120 mm			23050010	23050067	23050139
	140 mm		TwinDrive™	23050079	23050053	23050140
	170 mm			23050127	23050128	23050141
133 mm	100 mm	Female Left Hand	Rope	23050015	23050021	23050134
	120 mm			23050019	23050022	23050135
	140 mm		TwinDrive™	23050078	23050071	23050136
	170 mm			23050126	23050109	23050137
152.4 mm	100 mm	Female Left Hand	Rope	23050025	23050029	23050133
	120 mm			23050026	23050030	23050132
	140 mm		TwinDrive™	23050084	23050080	23050131
	170 mm			23050082	23050095	23050114

FLUSHING PLUG (5)

PART NUMBER (Qty. 2)
55390017

FLUSHING HEADS: DUPLEX DRILLING



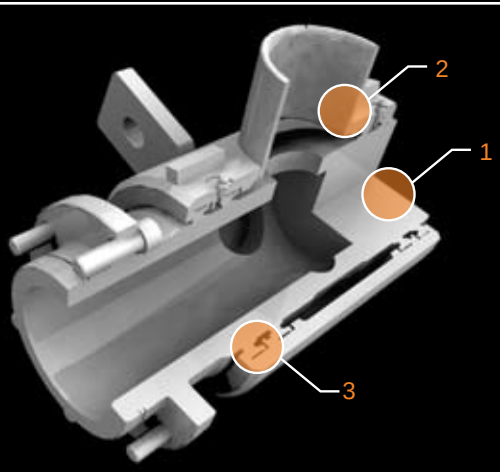
BALANCE ROD (6)

The balance rod provides the connection between the flushing body and the inner drill string. The male end of the balance rod uses the TwinDrive™ thread form to match with the flushing body. The female end is matched to the inner drill string being utilized.

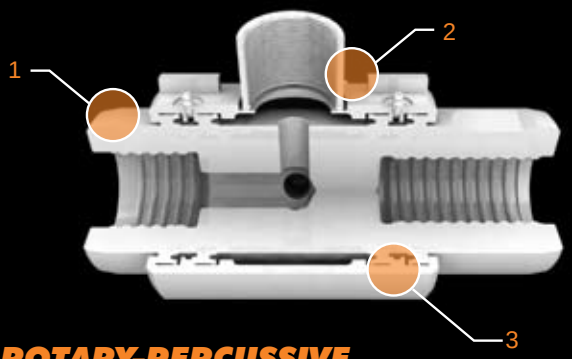
BOART LONGYEAR®, on request, can make balance rods to match other manufacturers flushing heads.

				THREAD TYPE			
OUTER CASING Ø	INNER ROD Ø	ROCK DRILL SHAFT Ø	FLUSHING BODY THREAD	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
88.9 mm	51 mm	100 mm	TwinDrive™ Male Left Hand	23060077	23060078	23060210	
		120 mm		23060077	23060078	23060210	
		140 mm		23060206	23060207	23060211	
		170 mm		23060208	23060209	23060212	
101.6 mm	63.5 mm	100 mm	TwinDrive™ Male Left Hand	23060175	23060176	23060200	23060203
		120 mm		23060175	23060176	23060200	23060203
		140 mm		23060180	23060181	23060201	23060204
		170 mm		23060178	23060179	23060202	23060205
114.3 mm	76.1 mm	100 mm	TwinDrive™ Male Left Hand	23060168	23060035	23060197	23060194
		120 mm		23060168	23060035	23060197	23060194
		140 mm		23060169	23060170	23060198	23060195
		170 mm		23060171	23060172	23060199	23060196
133 mm	88.9 mm	100 mm	TwinDrive™ Male Left Hand	23060017	23060157	23060185	23060191
		120 mm		23060017	23060157	23060185	23060191
		140 mm		23060160	23060161	23060187	23060192
		170 mm		23060158	23060162	23060186	23060193
152.4 mm	101.6 mm	100 mm	TwinDrive™ Male Left Hand	23060163	23060164	23060182	23060188
		120 mm		23060163	23060164	23060182	23060188
		140 mm		23060166	23060167	23060183	23060189
		170 mm		23060088	23060156	23060184	23060244

FLUSHING HEADS: DOUBLE HEAD DRILLING



ROTARY-ROTARY



ROTARY-PERCUSSIVE

DOUBLE HEAD DRILLING FLUSHING HEAD

Double head drilling systems have a flushing system to introduce flushing media into the inner drill string at the upper rotary head or drifter. Flushing media exits the drilling system at the ejection bell mounted below the lower rotary head. These flushing heads are uniquely designed for the specific double-head drilling system, the head mounting, and the sizes of the tools being used for the job.

FLUSHING BODY

The flushing body of the of the flushing head on a dual head drilling system mounts either on the top rotary head (on a rotary-rotary system) or below the drifter (on a rotary-percussive system). In both cases the flushing body is matched to the specific rotary head or drifter of the drilling system.

ROTARY/ROTARY (1)

HEAD MANUFACTURER	HEAD MODEL	PART NUMBER
Eurodrill	RH800	23390075
Eurodrill	RH1000/RH1400	23390076
Krupp	HR40	23390071
Klemm	KH9	23390077

ROTARY/PERCUSSIVE (1)

DRIFTER SHANK THREAD	SPINDLE THREAD	ROCK DRILL SHAFT Ø	THREAD DIRECTION	ROCK DRILL MODEL	PART NUMBER
H55	KW76	100 mm	Left Hand	HD4008	23040135
H64		120 mm		HD4008	23040399
H90		140 mm		HD5012	23040395
H92		140 mm		HD5012	23040406
H55		100 mm		HB45A	23040407
C64		120 mm		HB45A	23040408
H55		100 mm		KD1011	23040135
RT70		120 mm		KD1215R	23040409

FLUSHING HEADS: DOUBLE HEAD DRILLING

FLUSHING RING AND SEALS

The flushing ring is held stationary by the mounting bracket fixed to the drifter while the flushing body rotates. The flushing ring is the connection point for the flushing hose and has upper and lower lip seals to contain the flushing media.

The TwinDrive™ thread is used for both the balance rod and flushing bell. The TwinDrive thread makes it easier to unscrew the balance rod or flushing bell and is better at withstanding the percussive forces from the hydraulic drifter.

FLUSHING RING (2)

HEAD MANUFACTURER	HEAD MODEL	PART NUMBER
Eurodrill	RH800	23070071
Eurodrill	RH1000	
Krupp	HR40	
Klemm	KH9	

FLUSHING RING SEALS (3)

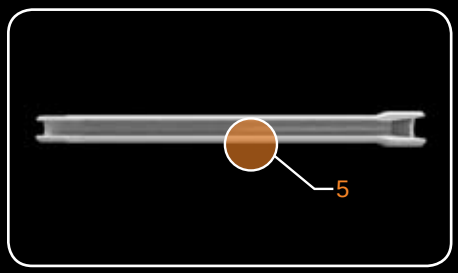
HEAD MANUFACTURER	HEAD MODEL	PART NUMBER (Qty. 4)
Eurodrill	RH800	55030011
Eurodrill	RH1000	
Krupp	HR40	
Klemm	KH9	

MOUNTING BRACKET (4)

The mounting bracket, which is matched to the hydraulic drifter, keeps the flushing ring stationary on the flushing body.

HEAD MANUFACTURER	HEAD MODEL	PART NUMBER
Eurodrill	RH800	23080099
Eurodrill	RH1000	23080100
Krupp	HR40	23080095
Klemm	KH9	23080101

ALL CONNECTORS INCLUDE:	PART NUMBER
Hex bolt, for Connector	55010001
Nut, for Connector	55010002



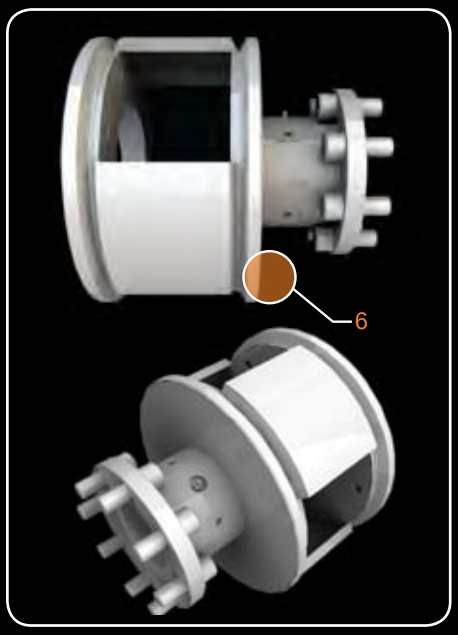
BALANCE ROD (5)

The balance rod in a double-head drilling system is used to connect the inner drill string of the system to the upper rotary head or drifter. The length and thread on the rod is specific to the drilling system being used. Length of the balance rod must be specified at the time of order.

DOUBLE HEAD DRILL SYSTEM TYPE	THREAD	THREAD DIRECTION	Ø	LENGTH	PART NUMBER
Rotary Percussive	KW76 X	Left Hand Male	80 mm	Specify	TBD*
Rotary Rotary	KW76	Right Hand Male			

* length and part number dependent on double head installation. Specify at time of order.

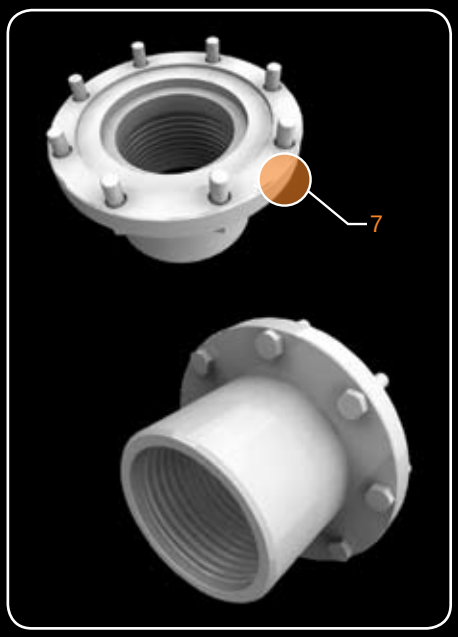
FLUSHING HEADS: DOUBLE HEAD DRILLING



EJECTION BELL (6)

The ejection bell in dual head drill systems is mounted directly under the lower rotary head. The ejection bell design is unique to the rotary head it is used on. Flushing media and cuttings exit the drilling system through the large opening in the ejection bell.

HEAD MANUFACTURER	ROTARY HEAD MODEL	SHAFT Ø	PART NUMBER
Eurodrill	RH1000/RH1400	80 mm	24100158
Krupp	HR50/HR60		24100243
Klemm	KH13 (HDK800-ZS3)		24100106
Klemm	KH16		24100159



CASING FLANGE (7)

The casing flange is the connection point for the outer casing used in the drilling system. It is mounted directly to the ejection bell and has a thread to match the casing being used.

		THREAD TYPE
OUTER CASING Ø	THREAD DIRECTION	CYLINDRICAL DOUBLE-START
114.3 mm	Left Hand	24030134
133 mm	Left Hand	24030070
152.4 mm	Left Hand	24030326
177.8 mm	Left Hand	24030380

CASING FLANGES INCLUDE:	PART NUMBER
Hex bolt for flange (8 pcs)	55010327

		THREAD TYPE
OUTER CASING Ø	THREAD DIRECTION	CYLINDRICAL DOUBLE-START
114.3 mm	Right Hand	24030398
133 mm	Right Hand	24030029
152.4 mm	Right Hand	24030125
177.8 mm	Right Hand	24030126

CASING FLANGES INCLUDE:	PART NUMBER
Hex bolt for flange (6 pcs)	55010274
Spring ring for flange (6 pcs)	55010038

RODS AND CASING

FEATURES

- Only a single joint between each casing when compared to nipple connection casing.
- Quench and tempered high grade pin and box threaded connections provide numerous make and break cycles without damage or galling of threads.
- Friction welding provides a superior welded connection between threaded joints and mid-body.

ROTARY PERCUSSIVE CASING FRICTION WELDED

Rotary percussive casing is designed for use in drive drilling and duplex drilling systems. This casing is specifically engineered to withstand the percussive forces from hydraulic drifters.

As a standard offering, friction welded rotary percussive casing is available in standard sizes up to 152.4 mm with left hand threads and spanner flats. Additional sizes as well as right hand threads are available upon request.

FRICTION WELDED RODS AND CASING CONSTRUCTION

Friction welded casing has quenched and tempered pin and box ends constructed of high tensile strength steel. The threaded ends are friction welded onto a mid-body manufactured from an annealed mid-grade steel.

TWINDRIVE™ THREAD

The patented TwinDrive thread form was designed for use in rotary-percussive applications to handle the stronger percussive forces when drilling in harder ground formations and from larger drifters. By distributing the percussive forces along the entire length of the thread, the TwinDrive thread offers the user up to 40% longer life and a significant reduction in the forces required for making and breaking rod joints.

BENEFITS

- Reinforced wall thickness at thread ends to handle heavy percussive drilling.
- Superior percussive power transmission due to TwinDrive threads.
- Highest quality quench and tempered thread ends.

RODS AND CASING

ROTARY PERCUSSIVE CASING FRICTION WELDED

CASING Ø	SPANNER FLAT	LENGTH	THREAD DIRECTION	THREAD TYPE		
				CYLINDRICAL SINGLE-START	CONICAL SINGLE-START	TWINDRIVE™
51 mm ID 26 mm	SF46	500 mm	Left Hand	21010832	21011332	21011334
		1000 mm		21010124	21010498	21010887
		1500 mm		21010476	21010499	21010886
		2000 mm		21010126	21010500	21010885
		3000 mm		21010477	21010501	21010884
		3050 mm		21011331	21011333	21011335
63.5 mm ID 38 mm	SF55	500 mm	Left Hand	21011154	21011327	21011328
		1000 mm		21010172	21010483	21010881
		1500 mm		21010478	21010482	21010880
		2000 mm		21010175	21010481	21010879
		3000 mm		21010479	21010480	21010878
		3050 mm		21011325	21011326	21011329
76.1 mm ID 50 mm	SF70	500 mm	Left Hand	21010181	21011320	21011323
		1000 mm		21010184	21010485	21010874
		1500 mm		21010484	21010194	21010873
		2000 mm		21010188	21010195	21010872
		3000 mm		21010190	21010486	21010871
		3050 mm		21011319	21011321	21011324
88.9 mm ID 64 mm	SF80	500 mm	Left Hand	21011007	21011318	21011317
		1000 mm		21010211	21010240	21010237
		1500 mm		21010214	21010241	21010388
		2000 mm		21010220	21010242	21010238
		3000 mm		21010222	21010243	21010389
		3050 mm		21010445	21010446	21010883
101.6 mm ID 75 mm	SF90	500 mm	Left Hand	21010334	21011278	21011279
		1000 mm		21010010	21010025	21010859
		1500 mm		21010012	21010277	21010858
		2000 mm		21010018	21010026	21010670
		3000 mm		21010021	21010403	21010290
		3050 mm		21010023	21010447	21010875
133 mm ID 108 mm	SF120	500 mm	Left Hand	21010409	21010106	21010530
		1000 mm		21010001	21010110	21010392
		1500 mm		21010081	21010112	21010509
		2000 mm		21010085	21010114	21010383
		3000 mm		21010086	21010302	21010722
		3050 mm		21010291	21010322	21010860

RODS AND CASING

ROTARY PERCUSSIVE CASING FRICTION WELDED (con'd)

CASING Ø	SPANNER FLAT	LENGTH	THREAD DIRECTION	THREAD TYPE		
				CYLINDRICAL SINGLE-START	CONICAL SINGLE-START	TWINDRIVE™
114.3 mm ID 88 mm	SF105	500 mm	Left Hand	21010701	21011024	21011281
		1000 mm		21010038	21010282	21010669
		1500 mm		21010040	21010319	21010667
		2000 mm		21010044	21010062	21010712
		3000 mm		21010046	21010306	21010713
		3050 mm		21010448	21010449	21010869
152.4 mm ID 128 mm	SF140	500 mm	Left Hand	21010286	21010686	21011291
		1000 mm		21010137	21010163	21010385
		1500 mm		21010140	21010285	21010731
		2000 mm		21010142	21010164	21010380
		3000 mm		21010143	21010280	21010728
		3050 mm		21010451	21010452	21010823

RODS AND CASING

FEATURES

- TDN rods are built with the patented TwinDrive thread to withstand percussion drilling forces in hard overburden soils.
- TDN rods have two percussion surfaces compared to the single surface typically found on standard percussive drill rods.
- Large ID provides efficient flushing path compared to T38 and T45 rods.

ROTARY PERCUSSIVE RODS FRICTION WELDED - TDN

TDN drill rods are designed for use on the inner drill string of Duplex and rotary-percussive drilling systems. TDN rods are an alternate to the T38 and T45 extension rods used in these systems. Up-hole flushing velocity may be reduced when using T38 and T45 rods due to the large annulus. TDN systems are designed to minimize the area between the inner rod and casing so that up-hole flushing velocity is optimized. The bigger inner diameter of the inner rod allows a higher medium flow without creating back-pressure. In addition to improved flushing, TDN systems also utilize the patented TwinDrive rotary percussive thread and the highest grade thread steel to provide longer rod life.

FRICTION WELDED ROD CONSTRUCTION

Friction welded rods have quenched and tempered pin and box ends constructed of high tensile strength steel. The threaded ends are friction welded onto a mid-body manufactured from an annealed mid-grade steel.

TWINDRIVE™ THREAD

The patented TwinDrive thread form was designed for use in rotary-percussive applications to handle the stronger percussive forces when drilling in harder ground formations and from larger drifters. By distributing the percussive forces along the entire length of the thread, the TwinDrive thread offers the user up to 40% longer life and a significant reduction in the forces required for making and breaking rod joints.

BENEFITS

- TDN rods increase flushing capacity both by reducing the annulus space between the inner diameter (ID) of the casing and by increasing the ID of the drill rods. TDN drill rods (depending on size) can have a ID up to 100% larger than the standard percussive T45 and T51 drill rods. T45 & T51 rods have a 19 mm ID and TDN 101.6 mm rods have a 40 mm ID.
- TDN drill rods are comprised of special grade hardened / nitrated alloy steel and special steel mid-bodies. They are friction welded to utilize the strongest construction method.
- TDN rods have two percussion surfaces compared to the single surface typically found on standard percussive drill rods. These percussion surfaces are found on the tube collar which is typically known as the shoulder and then also found on the end of the thread. This dual percussive surface area transmits the percussion force through the drill rod at an optimum rate while increasing the strength of the drill rod. When percussive force is transmitted via only one surface you typically tend to encounter breakage due to the stress on the single location.
- TDN rods are custom made to order based on the ID of casing being utilized.
- TDN rods are built to match the optimum annulus between the ID of the casing and the TDN drill rod.

Protected by European Patent No. 1117897 in Austria, Germany, Italy, Switzerland, United Kingdom, Korea Patent No. 10-0556271, Japan Patent No. 3961769

RODS AND CASING

ROTARY PERCUSSIVE RODS FRICTION WELDED - TDN

ROD Ø	TOOL JOINT Ø	CASING Ø	SPANNER FLAT	LENGTH	THREAD DIRECTION	THREAD TYPE TWINDRIVE™
51 mm ID 18 mm	52.5 mm	51 mm ID 26 mm	SF40	500 mm	Left Hand	21011314
				1000 mm		21011122
				1500 mm		21011128
				2000 mm		21011123
				3000 mm		21011124
				3050 mm		21011336
63.5 mm ID 22 mm	64 mm	63.5 mm ID 38 mm	SF55	500 mm	Left Hand	21011154
				1000 mm		21010814
				1500 mm		21010882
				2000 mm		21010815
				3000 mm		21010816
				3050 mm		21011330
76.1 mm ID 25 mm	77 mm	76.1 mm ID 50 mm	SF65	500 mm	Left Hand	21011222
				1000 mm		21010718
				1500 mm		21010719
				2000 mm		21010720
				3000 mm		21010721
				3050 mm		21011322
88.9 mm ID 35 mm	90 mm	88.9 mm ID 64 mm	SF80	500 mm	Left Hand	21011316
				1000 mm		21010723
				1500 mm		21010724
				2000 mm		21010725
				3000 mm		21010726
				3050 mm		21011315
101.6 mm ID 40 mm	103 mm	101.6 mm ID 75 mm	SF90	500 mm	Left Hand	21010774
				1000 mm		21010729
				1500 mm		21010732
				2000 mm		21010733
				3000 mm		21010730
				3050 mm		21010877

RODS AND CASING

CASING

NIPPLE

ROTARY PERCUSSIVE CASING NIPPLE CONNECTION

Rotary percussive nipple connection casing is designed for use in Drive drilling and Duplex drilling systems. This casing is specifically engineered to withstand the percussive forces from hydraulic drifters.

Rotary percussive casing nipples are constructed from quenched and tempered high tensile strength steel. The casing lengths are manufactured from an annealed mid-grade steel.

Additional sizes as well as right hand threads are available upon request.

BENEFITS

- Quench and tempered high grade nipple threaded connections provide numerous make and break cycles without damage or galling of threads.
- Annealed steel casing provides superior tensile strength and resistance to abrasive damage.

RODS AND CASING

ROTARY PERCUSSIVE CASING

CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE	
			CYLINDRICAL SINGLE-START	CONICAL SINGLE-START
88.9 mm	900 mm	Left Hand		21020169
	950 mm		21020162	21020172
	1400 mm			21020174
	1450 mm		21020289	
	1900 mm			21020177
	1950 mm		21020165	21020179
	2900 mm			21020302
	2950 mm		21020301	21020181
114.3 mm	900 mm	Left Hand	21020384	21020053
	950 mm		21020045	21020054
	1400 mm			21020055
	1450 mm		21020047	
	1900 mm			21020056
	1950 mm		21020049	21020208
	2900 mm			21020303
	2950 mm		21020050	
152.4 mm	900 mm	Left Hand		21020118
	950 mm		21020109	
	1400 mm		21020111	21020121
	1450 mm		21020112	
	1900 mm			21020122
	1950 mm		21020113	
	2900 mm			21020306
	2950 mm		21020305	

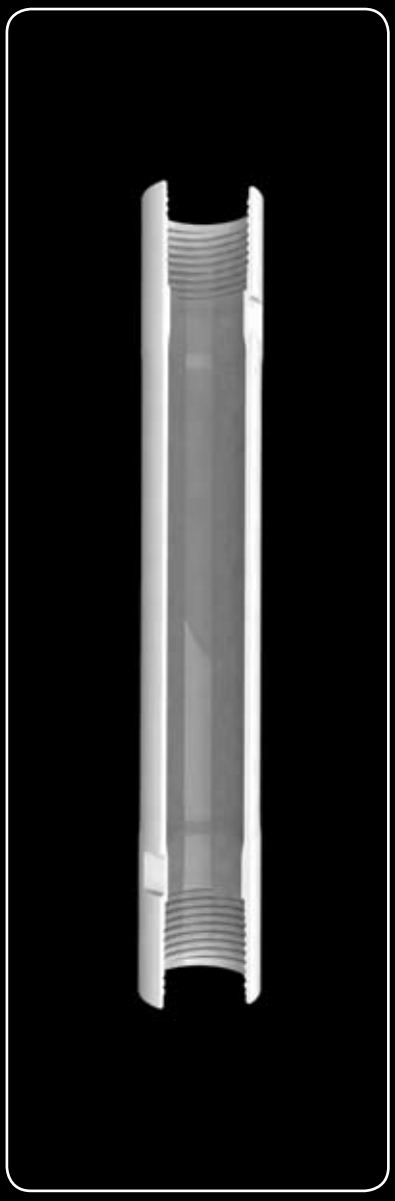
CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE	
			CYLINDRICAL TRIPLE-START	CONICAL TRIPLE-START
101.6 mm	900 mm	Left Hand	21020021	
	950 mm			21020008
	1400 mm		21020024	
	1450 mm			21020011
	1900 mm		21020025	
	1950 mm			21020014
	2900 mm		21020368	
	2950 mm			21020017
133 mm	900 mm	Left Hand	21020214	21020086
	950 mm		21020076	
	1400 mm		21020213	21020088
	1450 mm		21020077	
	1900 mm		21020078	21020090
	1950 mm		21020079	21020199
	2900 mm			21020304
	2950 mm		21020081	21020322
177.8 mm	900 mm	Left Hand	21020151	21020154
	950 mm			
	1400 mm		21020339	21020389
	1450 mm			
	1900 mm		21020153	21020285
	1950 mm		21020409	
	2900 mm		21020337	21020390
	2950 mm		21020332	

NIPPLE

CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE	
			CYLINDRICAL SINGLE-START	CONICAL SINGLE-START
88.9 mm	50 mm	Left Hand	21020191	21020193
	100 mm			21020195
133 mm	50 mm	Left Hand	21020095	21020198
	100 mm		21020098	21020099
152.4 mm	50 mm	Left Hand	21020123	
	100 mm		21020124	21020125

CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE	
			CYLINDRICAL SINGLE-START	CONICAL SINGLE-START
101.6 mm	50 mm	Left Hand	21020027	21020031
	100 mm		21020029	21020032
114.3 mm	50 mm	Left Hand	21020061	
	100 mm			21020066
177.8 mm	50 mm	Left Hand	21020279	
	100 mm		21020155	21020157

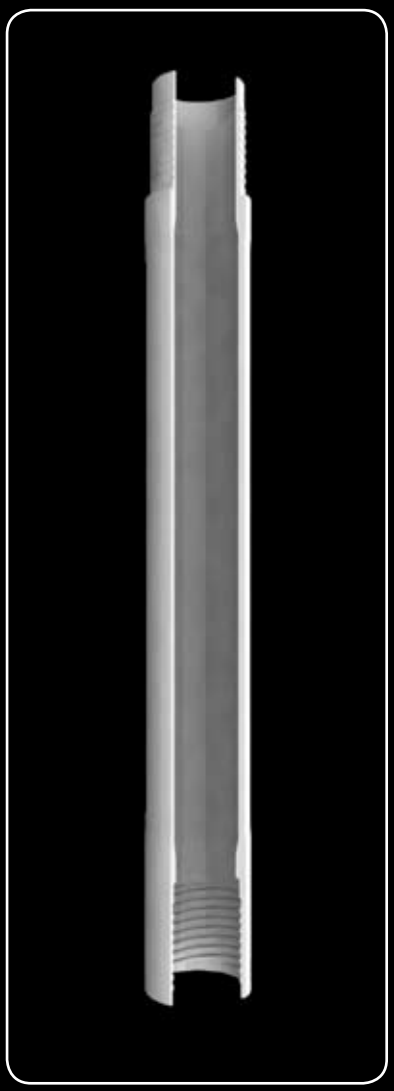
RODS AND CASING



STARTER CASING ROTARY PERCUSSIVE

CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE		
			CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	500 mm	Left Hand	21010209	21010370	21010933
	1000 mm		21010210	21010457	21010379
	1500 mm		21010213	21010456	21010870
	2000 mm		21010412	21010455	21010384
	3000 mm		21010453	21010454	21011130
	3050 mm		21010445	21010446	21010883
101.6 mm	500 mm	Left Hand	21010004	21011278	21011279
	1000 mm		21010006	21010283	21011133
	1500 mm		21010458	21010459	21011132
	2000 mm		21010015	21010460	21011131
	3000 mm		21010020	21010461	21010289
	3050 mm		21010022	21011280	21010875
114.3 mm	500 mm	Left Hand	21010353	21010369	21011281
	1000 mm		21010308	21010321	21011140
	1500 mm		21010039	21010462	21011139
	2000 mm		21010042	21010382	21011138
	3000 mm		21010333	21010463	21011137
	3050 mm		21011282	21011283	21011284
133 mm	500 mm	Left Hand	21010077	21011285	21011286
	1000 mm		21010100	21010109	21011141
	1500 mm		21010464	21010466	21011142
	2000 mm		21010465	21010467	21011143
	3000 mm		21010390	21010468	21011144
	3050 mm		21011287	21011288	21011289
152.4 mm	500 mm	Left Hand	21010135	21011290	21011291
	1000 mm		21010469	21010475	21010840
	1500 mm		21010470	21010474	21011136
	2000 mm		21010502	21010473	21011134
	3000 mm		21010471	21010472	21011135
	3050 mm		21011292	21011293	21011294

RODS AND CASING



ROTARY CASING

All BOART LONGYEAR® rotary casing is intended for re-usable casing applications where casing is removed after grouting. Rotary casing is designed for rotational drilling without percussion.

All sizes are available with both right hand and left hand thread configurations. Rotary casings have a continuous flush ID throughout the entire length of the casing.

Rotary casing is also available with the TwinDrive™ thread. BOART LONGYEAR® can provide rotary casing up to 406 mm diameter, available upon request.

FRICTION WELDED ROTARY CASING

Friction welded casing has quenched and tempered pin and box ends constructed of high tensile strength steel. The threaded ends are friction welded onto a mid-body manufactured from an economical mid-grade steel. Casings are friction welded up to 152.4 mm. Larger casings are manually welded.

BENEFITS

- Economical choice for re-usable casing.
- Quench and tempered high grade rod ends provide numerous make and break cycles without damage or galling of threads.
- Friction welding provides a superior welded connection between threaded joints and mid-body.

DIRECT THREAD ROTARY CASING

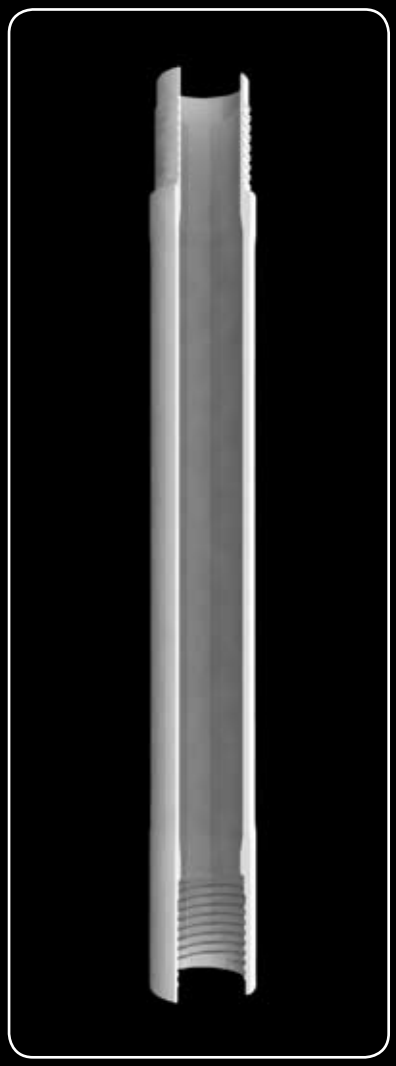
Direct thread casing has the pin and box threads machined directly into an annealed mid-grade steel.

BENEFITS

- Annealed steel construction provides superior tensile strength and resistance to abrasive wear during use.

RODS AND CASING

ROTARY CASING



CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE CYLINDRICAL DOUBLE-START
114.3 mm ID 94 mm	500 mm	Left Hand Friction Welded	21011058
	1000 mm		21010049
	1500 mm		21010497
	2000 mm		21010052
	3000 mm		21010415
	3050 mm		21011337
133 mm ID 113 mm	500 mm	Left Hand Friction Welded	21011058
	1000 mm		21010049
	1500 mm		21010497
	2000 mm		21010052
	3000 mm		21010415
	3050 mm		21011337
	500 mm	Left Hand Direct Thread	21011208
	1000 mm		21010053
	1500 mm		21010054
	2000 mm		21010056
	3000 mm		21010650
	3050 mm		21011338
152.4 mm ID 132 mm	500 mm	Left Hand Friction Welded	21010565
	1000 mm		21010146
	1500 mm		21010148
	2000 mm		21010293
	3000 mm		21010149
	3050 mm		21011339
	500 mm	Left Hand Direct Thread	21020544
	1000 mm		21020408
	1500 mm		21020401
	2000 mm		21020416
	3000 mm		21010484
	3050 mm		21020556
177.8 mm ID 158 mm	500 mm	Left Hand Friction Welded	21011307
	1000 mm		21010196
	1500 mm		21010197
	2000 mm		21010496
	3000 mm		21010200
	3050 mm		21011341
	500 mm	Left Hand Direct Thread	21020545
	1000 mm		21020514
	1500 mm		21020427
	2000 mm		21020407
	3000 mm		21020558
	3050 mm		21020559

CASING Ø	LENGTH	THREAD DIRECTION	THREAD TYPE CYLINDRICAL DOUBLE-START
114.3 mm ID 94 mm	500 mm	Right Hand Friction Welded	21011208
	1000 mm		21010053
	1500 mm		21010054
	2000 mm		21010056
	3000 mm		21010650
	3050 mm		21011338
133 mm ID 113 mm	500 mm	Right Hand Friction Welded	21011305
	1000 mm		21010096
	1500 mm		21010098
	2000 mm		21010099
	3000 mm		21010363
	3050 mm		21011311
	500 mm	Right Hand Direct Thread	21020436
	1000 mm		21020402
	1500 mm		21020403
	2000 mm		21020433
	3000 mm		21020463
	3050 mm		21020422
152.4 mm ID 132 mm	500 mm	Right Hand Friction Welded	21010150
	1000 mm		21010152
	1500 mm		21010154
	2000 mm		21010157
	3000 mm		21010159
	3050 mm		21011340
	500 mm	Right Hand Direct Thread	21020115
	1000 mm		21020406
	1500 mm		21020489
	2000 mm		21020423
	3000 mm		21020505
	3050 mm		21020557
177.8 mm ID 158 mm	500 mm	Right Hand Friction Welded	21011306
	1000 mm		21010495
	1500 mm		21010201
	2000 mm		21010202
	3000 mm		21011342
	3050 mm		21011343
	500 mm	Right Hand Direct Thread	21020410
	1000 mm		21020411
	1500 mm		21020412
	2000 mm		21020413
	3000 mm		21020560
	3050 mm		21020561

RODS AND CASING

PRODUCT FEATURES

- Long life thread designs utilizing high strength steel.
- Friction welding provides a superior welded connection between threaded joints and mid-body.
- Customized length and flats as required

API DRILL RODS

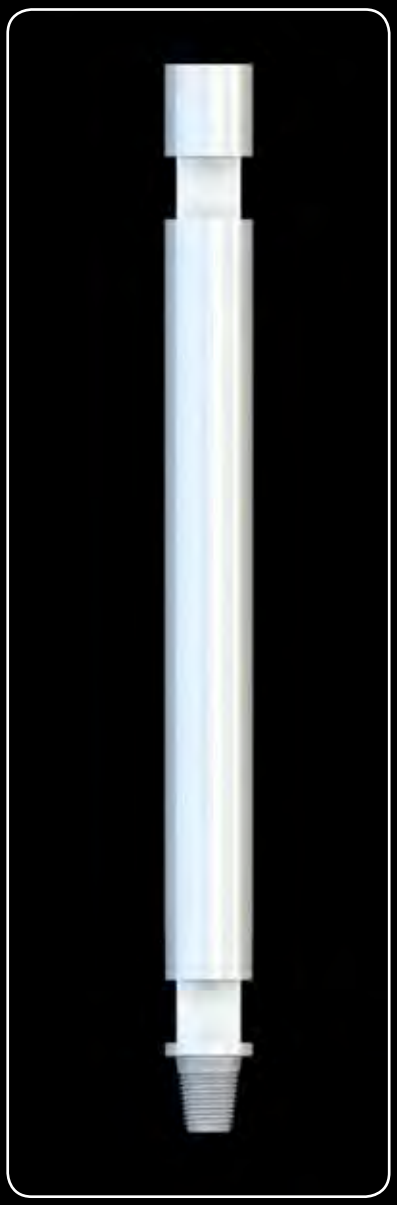
API DTH drill rods are designed for use in rotary and rotary DTH applications. These are commonly used as single rotary rods or as the inner drill string on double head rotary-rotary applications.

The rod ends of our API rods are constructed of high tensile strength quench and tempered steel. The rod ends are gas nitrated to provide additional life to the drill string. Rod ends are friction welded onto mid grade mid-body material.

API rods are manufactured in a variety of lengths and wall thickness and include IF designs for additional flushing capacity. BOART LONGYEAR® can manufacture alternative rod lengths and spanner flats upon request.

	Ø 76.1 mm (3")					
THREAD	WALL THICKNESS (Wth.) mm (in.)	MINIMUM ID mm (in.)	SQUARE FLATS mm (in.)	WEIGHT kg (lbs.) approx.	LENGTH mm (ft.)	PART NUMBER
2 3/8" API Reg	4.5	30 (1.18)	60 (2.36)	17 (37.5)	1000 (3.28)	21030314
				13 (28.7)	1500 (4.9)	21030079
				25 (55.1)	2000 (6.56)	21030240
				33 (72.8)	3000 (9.84)	21030085
				41 (90.4)	4000 (13.12)	21030315
2 3/8" API Reg	6.3	30 (1.18)	60 (2.36)		500 (1.64)	21030422
				20 (44.1)	1000 (3.28)	21030078
				25 (55.1)	1500 (4.9)	21030080
				31 (68.3)	2000 (6.56)	21030083
				42 (92.6)	3000 (9.84)	21030090
				53 (116.8)	4000 (13.12)	21030316
2 3/8" API Reg	8.8	30 (1.18)	60 (2.36)		500 (1.64)	21030232
				24 (52.9)	1000 (3.28)	21030204
				31 (68.3)	1500 (4.9)	21030208
				38 (83.8)	2000 (6.56)	21030203
				53 (116.8)	3000 (9.84)	21030317
				67 (147.7)	4000 (13.12)	21030094

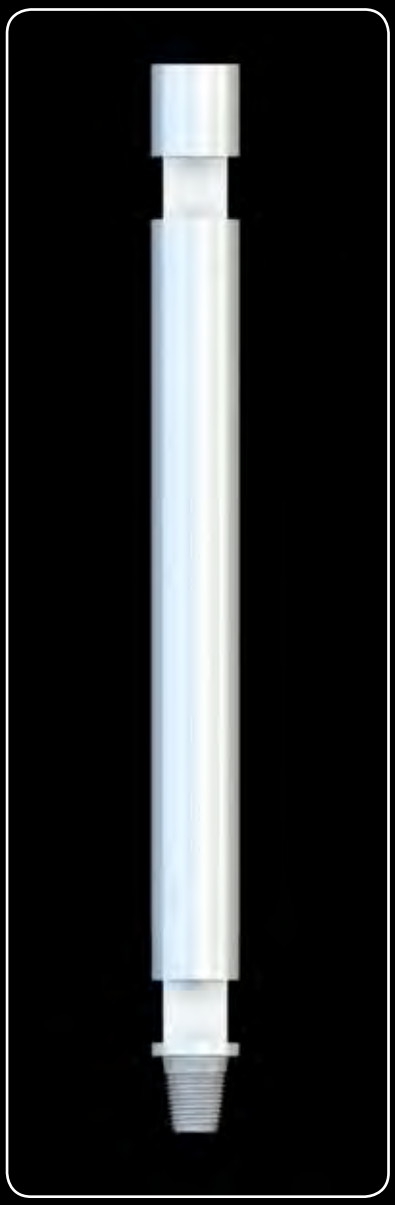
RODS AND CASING



API DRILL RODS

	Ø 88.9 mm (3.5")					
THREAD	WALL THICKNESS (Wth.) mm (in.)	MINIMUM ID mm (in.)	SQUARE FLATS mm (in.)	WEIGHT kg (lbs.) approx.	LENGTH mm (ft.)	PART NUMBER
2 3/8" API Reg	4.5	30 (1.18)	65 (2.56)	20 (44.1)	1000 (3.28)	21030318
				25 (55.1)	1500 (4.9)	21030636
				30 (66.1)	2000 (6.56)	21030319
				39 (86)	3000 (9.84)	21030135
				48 (105.8)	4000 (13.12)	21030320
2 3/8" API Reg	6.3	30 (1.18)	65 (2.56)		500 (1.64)	21030249
				23 (50.7)	1000 (3.28)	21030263
				30 (66.1)	1500 (4.9)	21030131
				36 (79.4)	2000 (6.56)	21030133
				49 (108)	3000 (9.84)	21030136
				62 (136.7)	4000 (13.12)	21030321
2 3/8" API Reg	8.8	30 (1.18)	65 (2.56)		500 (1.64)	21030440
				28 (61.7)	1000 (3.28)	21030130
				37 (81.6)	1500 (4.9)	21030265
				45 (99.2)	2000 (6.56)	21030134
				63 (138.9)	3000 (9.84)	21030137
				80 (176.4)	4000 (13.12)	21030139
2 3/8" API IF	6.3	44 (1.73)	65 (2.56)	22 (48.5)	1000 (3.28)	21030593
				28 (61.7)	1500 (4.9)	21030601
				34.5 (76.1)	2000 (6.56)	21030401
				47 (103.6)	3000 (9.84)	21030402
				60 (132.3)	4000 (13.12)	21030637
2 3/8" API IF	8.8	44 (1.73)	65 (2.56)	26 (57.3)	1000 (3.28)	21030146
				17.5 (38.6)	1500 (4.9)	21030450
				44 (97)	2000 (6.56)	21030147
				61 (134.5)	3000 (9.84)	21030451
				78.5 (173.1)	4000 (13.12)	21030638
2 7/8" API Reg	4.5	32 (1.26)	65 (2.56)	21 (46.3)	1000 (3.28)	21030322
				22.5 (49.6)	1500 (4.9)	21030639
				30 (66.1)	2000 (6.56)	21030323
				30 (66.1)	2000 (6.56)	21030323
				40 (88.2)	3000 (9.84)	21030324
				50 (110.2)	4000 (13.12)	21030325
2 7/8" API Reg	6.3	32 (1.26)	65 (2.56)	24 (52.9)	1000 (3.28)	21030326
				30.5 (67.2)	1500 (4.9)	21030500
				37 (81.6)	2000 (6.56)	21030327
				50 (110.2)	3000 (9.84)	21030328
				63 (138.9)	4000 (13.12)	21030329
2 7/8" API Reg	8.8	32 (1.26)	65 (2.56)	29 (63.9)	1000 (3.28)	21030330
					1500 (4.9)	21030640
				46 (101.4)	2000 (6.56)	21030331
				64 (141.1)	3000 (9.84)	21030332
				81 (178.6)	4000 (13.12)	21030333

RODS AND CASING

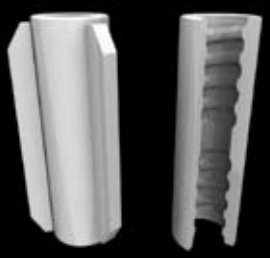


API DRILL RODS

THREAD	WALL THICKNESS (Wth.) mm (in.)	MINIMUM ID mm (in.)	SQUARE FLATS mm (in.)	WEIGHT kg (lbs.) approx.	LENGTH mm (ft.)	PART NUMBER
Ø 101.9 mm (4.0")						
3 1/2" API Reg	6.3	38 (1.5)			500 (1.64)	21030646
					1000 (3.28)	21030385
					1500 (4.9)	21030384
					2000 (6.56)	21030383
					3000 (9.84)	
					4000 (13.12)	
3 1/2" API Reg	8.8	38 (1.5)			500 (1.64)	21030647
					1000 (3.28)	21030609
					1500 (4.9)	21030610
					2000 (6.56)	21030611
					3000 (9.84)	
					4000 (13.12)	
Ø 114.3 mm (4.5")						
3 1/2" API Reg	6.3	38 (1.5)	95 (3.74)		500 (1.64)	21030537
				36.5 (80.5)	1000 (3.28)	21030008
				45 (99.2)	1500 (4.9)	21030010
				53 (116.8)	2000 (6.56)	21030012
				69.5 (153.2)	3000 (9.84)	21030013
				86 (189.6)	4000 (13.12)	21030337
3 1/2" API Reg	8.8	38 (1.5)	95 (3.74)		500 (1.64)	21030499
				42.5 (93.7)	1000 (3.28)	21030009
				54 (119)	1500 (4.9)	21030488
				65.4 (144.2)	2000 (6.56)	21030275
				88.3 (194.7)	3000 (9.84)	21030014
				111.2 (245.2)	4000 (13.12)	21030016
Ø 139.7 mm (5.5")						
4 1/2" API Reg	6.3	45 (1.77)	120 (4.72)	51 (112.4)	1000 (3.28)	21030026
				61.5 (135.6)	1500 (4.9)	21030560
				72 (158.7)	2000 (6.56)	21030027
				92.5 (203.9)	3000 (9.84)	21030028
				113 (249.1)	4000 (13.12)	21030342
4 1/2" API Reg	8.8	45 (1.77)	120 (4.72)	58.5 (129)	1000 (3.28)	21030343
				73 (160.9)	1500 (4.9)	21030490
				87 (191.8)	2000 (6.56)	21030344
				115.5 (254.6)	3000 (9.84)	21030345
				144 (317.5)	4000 (13.12)	21030346

RODS AND CASING

EXTENSION ROD



COUPLING

EXTENSION RODS T38/T45

T38 and T45 extension drill rods are designed for use as the inner drill rod extension for double head rotary percussive drilling systems. The extension drill rod is designed with male threads on both ends with a coupling connection between them.

The T38 and T45 thread profiles are specially designed to withstand the percussive forces exerted on the inner drill string by the hydraulic drifter.

The outer diameter of the extension drill steel is relatively small compared to the inner diameter of the casing. This can cause the inner drill string to have movement within the casing. To reduce this movement, BOART LONGYEAR® also offers couplings with centralizing guides to keep the rods on center in the casing.

TDN drill rods are an alternative for T38 and T45 drill steel and feature improved flushing capacities.

BENEFITS

- Threads designed for long life when used with heavy percussive forces.
- Couplings with centralizing guides to reduce inner drill string movement.

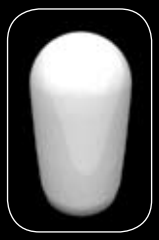
EXTENSION RODS

		THREAD TYPE	
LENGTH	THREAD DIRECTION	ø1 1/2"T38	ø1 3/4"T45
500 mm	Left Hand	61050029	24040031
1000 mm			61050044
1500 mm		61050174	61050045
2000 mm		61050036	61050047
3050 mm		61050038	61050048

COUPLINGS

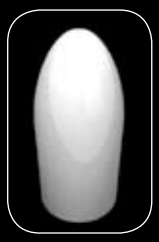
		THREAD TYPE	
OUTER Ø	THREAD DIRECTION	ø1 1/2"T38	ø1 3/4"T45
	Left Hand	61080004	61080006
90 mm with guides			24020507
110 mm with guides			24020508

BITS: INSERTS



Hemispherical Button

- Applicable for hard rock
- Best suited for rotary-percussive drilling
- Low abrasive wear
- 25,000 to 45,000 PSI (170 to 300 MPa)



Ballistic Button

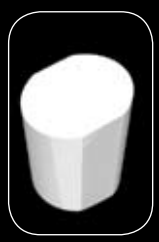
- Applicable for medium hard rock (mudstone, marl, sandstone), as well as loose rock
- Best suited for rotary-percussive drilling
- 10,000 to 20,000 PSI (70 to 140 MPa)

Two Step Button

- Applicable for medium hard rock (mudstone, marl, sandstone), as well as loose rock
- Best suited for rotary-percussive drilling

Scraping Button

- Applicable for loose rock as well as soft geological formations (mudstone, marl)
- Best suited for rotary drilling with temporary percussion



Scalping Button

- Applicable for concrete, conditional, loose rock, and soft geological formations
- Best suited for rotary drilling

BITS: CASING

CASING BITS

BOART LONGYEAR® offers a large selection of casing bits to serve a wide variety of ground conditions. Casing bits are designed for rotary-percussive or rotation only drilling based on the tungsten carbide inserts utilized as well as the geometry of the bit. In addition to our standard offering, we offer customized tools for unique drilling applications.

CONSTRUCTION

Casing bit bodies are constructed of high strength quenched and tempered steel. The high quality tungsten carbide inserts are induction brazed into the steel bodies ensuring a secure fit without overheating issues associated with flame brazing. Strict machining control of the carbide seats prevent premature loss of carbide inserts.

GAUGE PROTECTION

BOART LONGYEAR® offers tungsten carbide gauge protection on casing bits. Gauge protection will prevent excessive wear on the outer diameter of the bit in abrasive grounds. Additionally, in unconsolidated ground conditions where the ground is caving in on the drill string the gauge protection will assist in freeing the bit and casing by providing another cutting surface.

SHRINK FIT CARBIDES

BOART LONGYEAR® can offer, on request, shrink fitting installation of all hemispherical, ballistic, and two-step tungsten carbide inserts instead of the standard induction brazing. This very precise construction method is often utilized when drilling in extremely hard ground conditions and provides both increased button retention and longer overall life.

ADVANTAGES

- Computer controlled inductive brazing of tungsten carbide inserts provides superior process control and prevents overheating common with flame brazing.
- High grade body construction with quenched and tempered steels.
- Optional tungsten carbide gauge protection available to assist in unconsolidated grounds and increase life in abrasive conditions.
- Specialized designs for unique drilling situations such as drilling through reinforced concrete and drilling without inner bits.

BITS: CASING

HEMISPHERICAL BUTTON TYPE

Designed for percussive drilling in hard ground conditions but can be used universally for all rock ground conditions when drilling with percussion.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand	22010090	22010100	22010553
	100 mm		22010091	22010101	22010554
101.6 mm	107 mm	Left Hand	22010093	22010007	22010551
	115 mm		22010321	22010103	22010552
114.3 mm	120 mm	Left Hand	22010111	22010114	22010451
	125 mm		22010322	22010115	22010452
133 mm	140 mm	Left Hand	22010095	22010105	22010453
	150 mm		22010004	22010158	22010454
152.4 mm	160 mm	Left Hand	22010096	22010106	22010267
	170 mm		22010097	22010285	22010458
177.8 mm	185 mm	Left Hand	22010098	22010108	22010463
	190 mm		22010900	22010234	22010901

BALLISTIC BUTTON TYPE

Casing bit design for percussive drilling as well as some rotary drilling. Ballistic buttons offer more aggressive penetration rates in medium-hard ground conditions when drilling with percussion.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand	22010216	22010902	22010903
	100 mm		22010904	22010905	22010906
101.6 mm	107 mm	Left Hand	22010018	22010538	22010907
	115 mm		22010581	22010908	22010909
114.3 mm	120 mm	Left Hand	22010094	22010415	22010910
	125 mm		22010011	22010911	22010912
133 mm	140 mm	Left Hand	22010414	22010023	22010913
	150 mm		22010914	22010915	22010916
152.4 mm	160 mm	Left Hand	22010112	22010592	22010917
	170 mm		22010918	22010919	22010920
177.8 mm	185 mm	Left Hand	22010921	22010197	22010922
	190 mm		22010923	22010924	22010925

BITS: CASING

BLADED TYPE

Casing bit designed for percussive drilling in medium to hard ground conditions.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand	22020011	22020019	22020031
	100 mm		22020012	22020020	22020146
101.6 mm	107 mm	Left Hand	22020077	22020022	22020139
	115 mm		22020114	22020023	22140145
114.3 mm	120 mm	Left Hand	22020074	22020045	22020095
	125 mm		22020115	22020046	22020133
133 mm	140 mm	Left Hand	22020076	22020079	22020132
	150 mm		22020116	22020101	22020134
152.4 mm	160 mm	Left Hand	22020016	22020025	22020096
	170 mm		22020017	22020117	22020136
177.8 mm	185 mm	Left Hand	22020018	22020027	22020137
	190 mm		22020177	22020072	22020178

TWO-STEP BUTTON WITH GAUGE PROTECTION

Designed for rotary percussive drilling, the two-step button is a balance between the more aggressive ballistic tungsten carbide and the hemispherical button used in hard grounds. This bit can perform well in a wide range of harder ground conditions.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
114.3 mm	120mm	Left Hand	22011009	22010432	22011010
	125mm		22010430	22011011	22011012
133 mm	140mm	Left Hand	22010558	22010476	22011013
	150mm		22011014	22011015	22011016
152.4 mm	160mm	Left Hand	22011017	22010510	22011018
	170mm		22011019	22011020	22011021
177.8 mm	185mm	Left Hand	22011022	22011023	22011024
	190mm		22011025	22011026	22011027

BITS: CASING

SCRAPING BUTTON TYPE

Designed as a good alternative for both rotary and percussive drilling. The tungsten carbide insert geometry allows for some percussive drilling while also providing a efficient cutting action for rotary drilling.

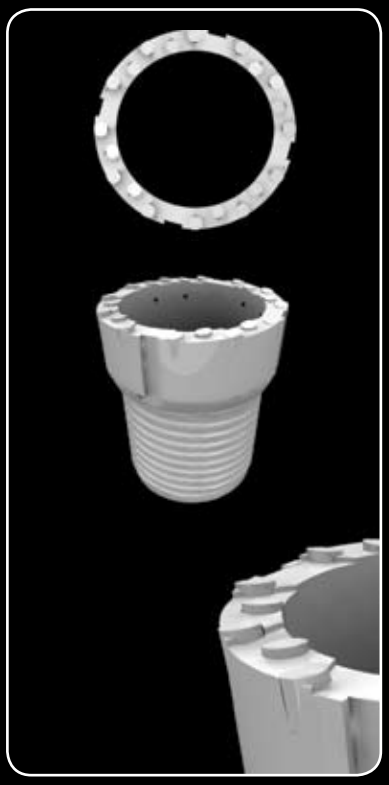
			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand	22010926	22010927	22010928
	100 mm		22010929	22010930	22010931
101.6 mm	107 mm	Left Hand	22010315	22010932	22010933
	115 mm		22010934	22010935	22010936
114.3 mm	120 mm	Left Hand	22010677	22010937	22010938
	125 mm		22010939	22010940	22010941
133 mm	140 mm	Left Hand	22010355	22010319	22010942
	150 mm		22010943	22010944	22010945
152.4 mm	160 mm	Left Hand	22010946	22010947	22010948
	170 mm		22010949	22010950	22010951
177.8 mm	185 mm	Left Hand	22010952	22010953	22010954
	190 mm		22010955	22010956	22010957

SCRAPING BUTTON WITH GAUGE PROTECTION

The Scraping Button type drill bit is available with gauge protection to maintain outer diameter and assists in freeing casing in unconsolidated grounds.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand	22010567	22010958	22010959
	100 mm		22010960	22010961	22010962
101.6 mm	107 mm	Left Hand	22010662	22010963	22010468
	115 mm		22010964	22010965	22010966
114.3 mm	120 mm	Left Hand	22010329	22010817	22010967
	125 mm		22010968	22010520	22010969
133 mm	140 mm	Left Hand	22010358	22010399	22010472
	150 mm		22010970	22010971	22010972
152.4 mm	160 mm	Left Hand	22010973	22010974	22010469
	170 mm		22010975	22010976	22010977
177.8 mm	185 mm	Left Hand	22010410	22010978	22010979
	190 mm		22010980	22010981	22010982

BITS: CASING



SCALPING BUTTONS WITH WEAR PROTECTION FOR REINFORCED CONCRETE

Designed for drilling through reinforced concrete. The additional carbides in this bit provide the additional cutting performance to get through common reinforced construction materials. This bit should only be used for rotary drilling.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand, Rotary Percussive	22011084	22011085	22011086
	100 mm		22011087	22011088	22011089
101.6 mm	107 mm	Left Hand, Rotary Percussive	22011090	22011091	22010543
	115 mm		22011092	22011093	22011094
114.3 mm	120 mm	Left Hand, Rotary Percussive	22011095	22011096	22011097
	125 mm		22011098	22011099	22011100
133 mm	140 mm	Left Hand, Rotary Percussive	22010506	22011101	22010505
	150 mm		22011102	22011103	22011104
152.4 mm	160 mm	Left Hand, Rotary Percussive	22011105	22011106	22011107
	170 mm		22011108	22011109	22011110
177.8 mm	185 mm	Left Hand, Rotary Percussive	22011111	22011112	22011113
	190 mm		22011114	22011115	22011116

SCALPING BUTTON WITH GAUGE PROTECTION

This bit is designed exclusively for rotary drilling. The tungsten carbide design allows for efficient removal of material while in rotation. This bit can be purchased with either a variety of rotary percussive threads or double-start cylindrical threads specifically for use with rotary casing.

			THREAD TYPE		
CASING Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	95 mm	Left Hand, Rotary Percussive	22010983	22010984	22010985
	100 mm		22010986	22010987	22010988
101.6 mm	107 mm	Left Hand, Rotary Percussive	22010989	22010990	22010543
	115 mm		22010991	22010992	22010993
114.3 mm	120 mm	Left Hand, Rotary Percussive	22010994	22010248	22010634
	125 mm		22010995	22010996	22010997
133 mm	140 mm	Left Hand, Rotary Percussive	22010456	22010998	22010999
	150 mm		22011000	22011001	22011002
152.4 mm	160 mm	Left Hand, Rotary Percussive	22011003	22010492	22010754
	170 mm		22011004	22011005	22010760
177.8 mm	185 mm	Left Hand, Rotary Percussive	22010788	22010672	22011006
	190 mm		22011007	22010778	22011008

BOART LONGYEAR™

BITS: CASING

SCALPING BUTTON WITH GAUGE PROTECTION (con'd)

CASING Ø	OUTER Ø	THREAD DIRECTION	THREAD TYPE		
			CYLINDRICAL DOUBLE-START	CONICAL	TWINDRIVE™
114.3 mm	120 mm	Right Hand, DHD Drilling	22010137		
	125 mm		22011080		
133 mm	140 mm	Right Hand, DHD Drilling	22010134		
	150 mm		22011081		
152.4 mm	160 mm	Right Hand, DHD Drilling	22010275		
	170 mm		22011082		
177.8 mm	185 mm	Right Hand, DHD Drilling	22010323		
	190 mm		22011083		

BITS: CASING

W-TYPE WITHOUT WEAR PROTECTION

Arrangement of small and larger ballistic carbides allow for superior percussive drilling performance when the straightness of the hole is critical. The larger center buttons minimize hole deviation while performing the primary cutting action. The outer buttons perform the secondary cutting providing efficient penetration rates.

				THREAD TYPE		
CASING Ø	OUTER Ø	BUTTON TYPE	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
114.3 mm	120 mm	Ballistic Buttons	Left Hand	22010264	22010258	22010436
		2 Step Buttons		22010531	22011056	22011057
133 mm	140 mm	Ballistic Buttons	Left Hand	22010559	22011060	22011061
		2 Step Buttons		22011058	22010479	22011062
152.4 mm	160 mm	Ballistic Buttons	Left Hand	22011063	22011065	22010462
		2 Step Buttons		22011064	22010509	22010548

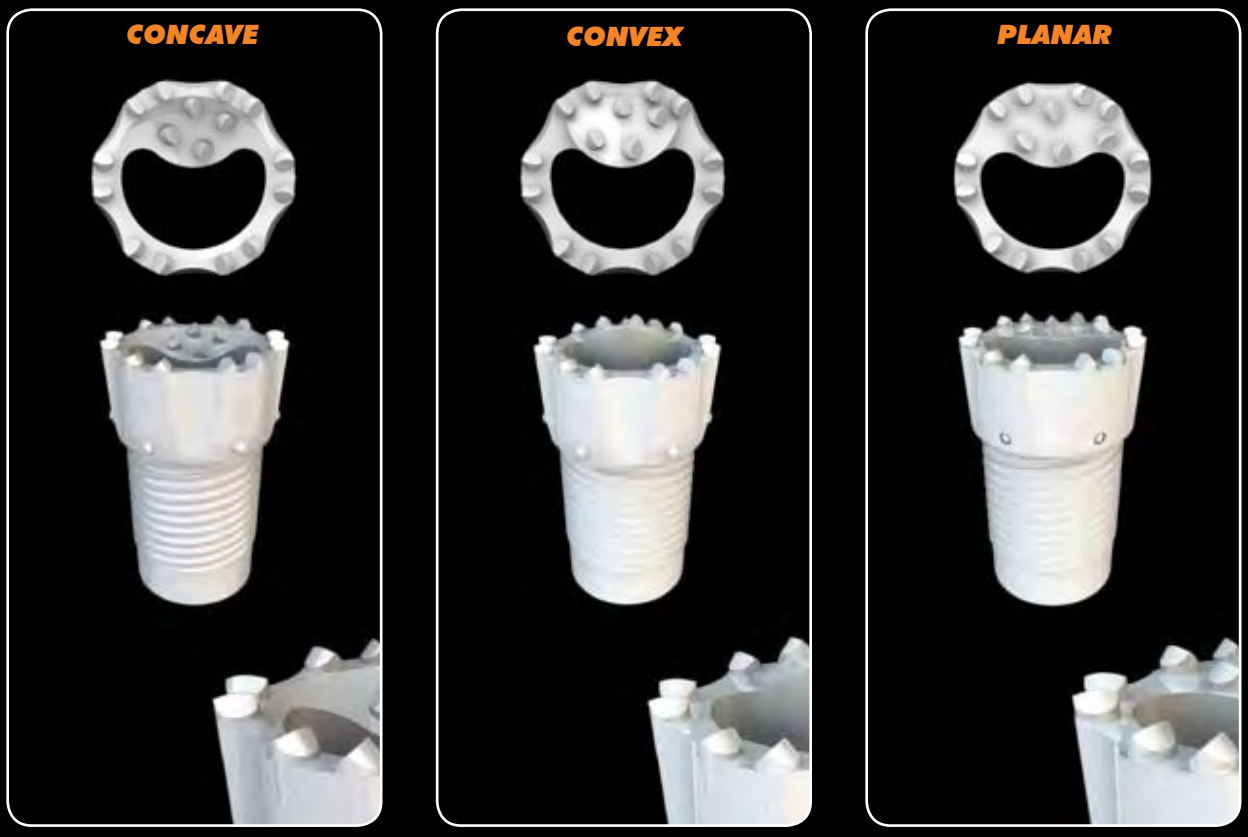
W-TYPE WITH WEAR PROTECTION

				THREAD TYPE		
CASING Ø	OUTER Ø	BUTTON TYPE	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™
114.3 mm	120 mm	Ballistic Buttons	Left Hand	22011066	22011068	22010602
		2 Step Buttons		22011067	22011069	22011070
133 mm	140 mm	Ballistic Buttons	Left Hand	22010590	22011072	22010586
		2 Step Buttons		22011071	22011073	22011074
152.4 mm	160 mm	Ballistic Buttons	Left Hand	22010596	22011076	22011078
		2 Step Buttons		22011075	22011077	22011079

BITS: CASING

EXTRA LOBE BIT

Lobe and eccentric designed bits allow the ability to drill without the use of an inner drill string. The additional carbide cutting areas provide cutting of the inner area of the hole similar to an inner bit operation.



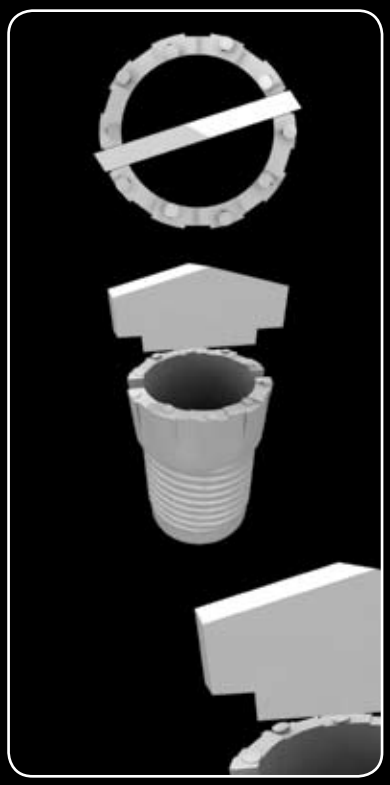
CASING Ø	OUTER Ø	CARBIDE TYPE	CROWN DESIGN	THREAD DIRECTION	THREAD TYPE		
					CYLINDRICAL	CONICAL	TWINDRIVE™
114.3 mm	120 mm	Scraping Buttons	Concave	Left Hand	22011028	22011029	22090038
			Convex		22011030	22011031	22090039
			Planar		22011032	22011033	22090030
	125 mm		concave		22011034	22011035	22090036
			convex		22011036	22011037	22090031
			planar		22011038	22011039	22011040
	130 mm		concave		22011041	22011042	22011043
			convex		22011044	22011045	22011046
			planar		22090086	22011047	22011048
133 mm	148 mm	Scraping Buttons	Concave	Left Hand	22011049	22011050	22011051
			Convex		22090063	22011052	22011053
			Planar		22090062	22011054	22011055

BITS: CASING

EXCENTRIC BIT

CASING Ø	OUTER Ø	THREAD DIRECTION	THREAD TYPE		
			CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	110 mm	Left Hand	22020063	22020179	22020120
114.3 mm	130 mm	Left Hand	22020183	22020184	22020106
	140 mm		22020123	22020188	22020189
133 mm	150 mm	Left Hand	22020192	22020193	22020194
	155 mm		22020197	22020198	22020199
	165 mm		22020165	22020202	22020203

CASING Ø	OUTER Ø	THREAD DIRECTION	THREAD TYPE		
			CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	110 mm	Right Hand	22020180	22020181	22020182
114.3 mm	130 mm	Right Hand	22020185	22020186	22020187
	140 mm		22020190	22020191	22020122
133 mm	150 mm	Right Hand	22020195	22020196	22020090
	155 mm		22020200	22020201	22020088
	165 mm		22020204	22020205	22020206



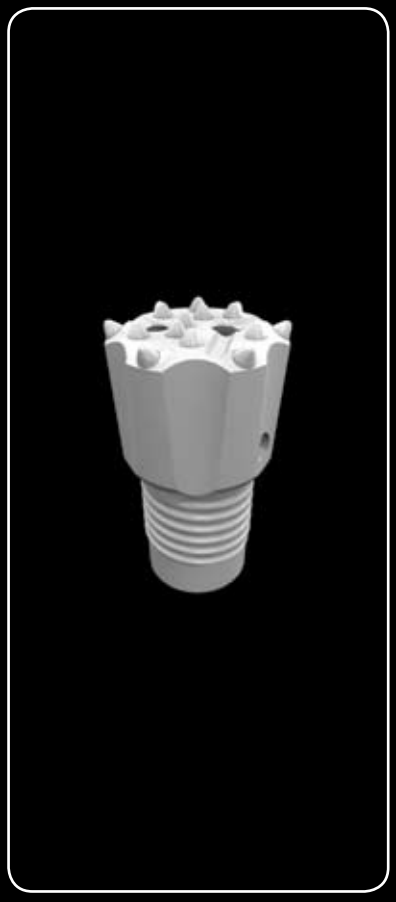
BIT WITH CUTTING BLADE

Cutting blade bits are designed for rotational drilling without an inner drill string. The cutting blade is knocked off the bit and left in the hole during anchor and grout installation.

On request the cutting blade can be supplied with additional hard facing and additional carbide cutting inserts.

CASING Ø	OUTER Ø	CUTTING BLADE	THREAD DIRECTION	THREAD TYPE		
				CYLINDRICAL	CONICAL	TWINDRIVE™
101.6 mm	107 mm	22040025	Left Hand	22011117	22011118	22011119
114.3 mm	120 mm	22040031	Left Hand	22010080	22011120	22011121
133 mm	140 mm	22040150	Left Hand	22011122	22011123	22011124
152.4 mm	160 mm	22040041	Left Hand	22010309	22010493	22010651

BITS: INNER STRING



INNER BITS

BOART LONGYEAR® offers a selection of bits for the inner drill string of overburden drilling systems to serve the wide variety of ground conditions drillers face every day. The inner drill string bits are primarily designed for rotary-percussive drilling but in some situations can perform well in mixed drilling or pure rotary drilling. In addition to the common designs, BOART LONGYEAR® offers several specialty designs for unique drilling situations and can also design custom bits on request.

CONSTRUCTION

The bit bodies are constructed of high strength quenched and tempered steel. The high quality tungsten carbide inserts are induction brazed into the steel bodies insuring a permanent fit without overheating issues associated with flame brazing. Strict machining control of the carbide seats prevent premature loss of carbide inserts.

GAUGE PROTECTION

BOART LONGYEAR® offers tungsten carbide gauge protection on some designs. Gauge protection will prevent excessive wear on the outer diameter of the bit in abrasive grounds.

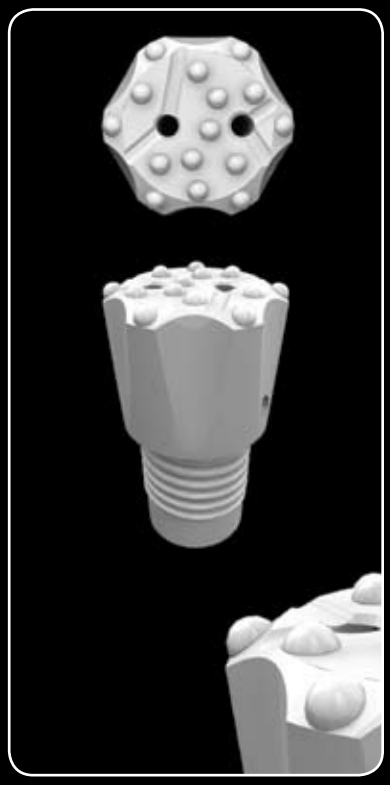
SHRINK FIT CARBIDES

BOART LONGYEAR® can, on request, shrink fitting installation of all hemispherical, ballistic, and two-step tungsten carbide inserts instead of the standard induction brazing. This very precise construction method is often utilized when drilling in extremely hard ground conditions giving the bits enhanced performance.

ADVANTAGES

- Computer controlled inductive brazing of tungsten carbide inserts provides superior process control and prevents overheating common with flame brazing.
- High grade body construction with quenched and tempered steels.
- Optional gauge wear protection tungsten carbides available to assist.

BITS: INNER STRING

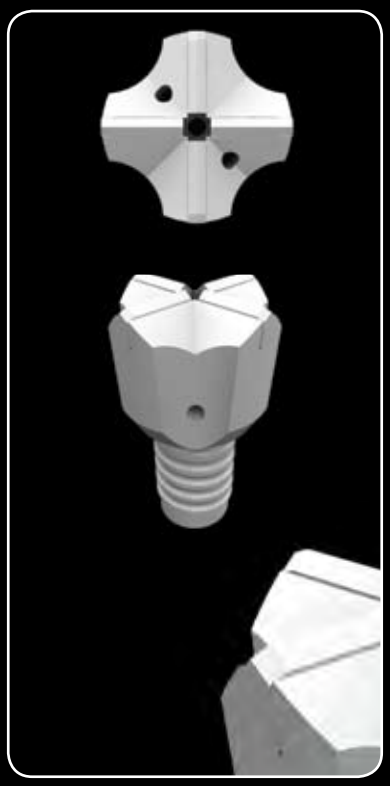


HEMISPHERICAL BUTTON TYPE

Designed for percussive drilling in medium to hard ground conditions. Button bits typically have faster penetration rates and longer service life than bladed style inner drill bits.

			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
51 mm	60 mm	Left Hand, Male	22130157	22130158	22130376	22130504
63.5 mm	70 mm	Left Hand, Male	22130160	22130161	22130375	22130345
76.1 mm	85 mm	Left Hand, Male	22130133	22130073	22130374	22130355
88.9 mm	105 mm	Left Hand, Male	22130063	22130074	22130373	22130194
101.6 mm	125 mm	Left Hand, Male	22130067	22130078	22130182	22130328

		THREAD TYPE	
OUTER Ø	THREAD DIRECTION	1 1/2" T38	1 3/4" T45
60 mm	left hand, Female	22130247	
70 mm		22130019	
85 mm		22130021	22130029
105 mm			22130031
125 mm			22130034



BLADED CROSS TYPE

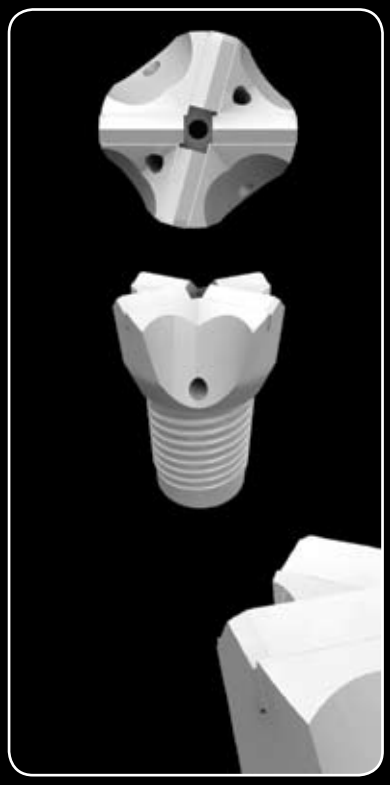
Designed for percussive drilling in medium to hard ground conditions. Bladed bits will typically drill straighter than button style bits. In certain rock conditions cross bits tend to produce a spiraled 5-sided hole.

			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
51 mm	60 mm	Left Hand, Male	22140070	22140135	22140211	22140285
63.5 mm	70 mm	Left Hand, Male	22140072	22140136	22140210	22140286
76.1 mm	85 mm	Left Hand, Male	22140137	22140094	22140209	22140154
88.9 mm	105 mm	Left Hand, Male	22140079	22140088	22140208	22140155
101.6 mm	125 mm	Left Hand, Male	22140083	22140090	22140207	22140156

		THREAD TYPE	
OUTER Ø	THREAD DIRECTION	1 1/2" T38	1 3/4" T45
60 mm	left hand, Female	22140130	
70 mm		22140068	
85 mm		22140287	22140037
105 mm			22140045
125 mm			22140122

Protected by European Patent No. 1117897 in Austria, Germany, Italy, Switzerland, United Kingdom, Korea Patent No. 10-0556271, Japan Patent No. 3961769

BITS: INNER STRING

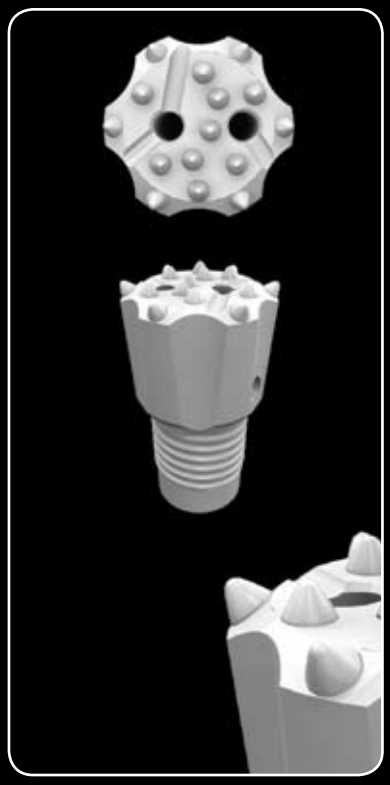


BLADE X-TYPE

Designed for percussive drilling in medium to hard ground conditions. X-type bits will typically drill straighter than button style bits. Additionally X-type bits will tend to drill round holes in all rock conditions.

			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
51 mm	60 mm	Left Hand, Male	22140226	22140227	22140228	22140229
63.5 mm	70 mm	Left Hand, Male	22140230	22140091	22140231	22140232
76.1 mm	85 mm	Left Hand, Male	22140233	22140234	22140235	22140236
88.9 mm	105 mm	Left Hand, Male	22140237	22140238	22140239	22140240
101.6 mm	125 mm	Left Hand, Male	22140241	22140242	22140243	22140244

		THREAD TYPE	
OUTER Ø	THREAD DIRECTION	1 1/2" T38	1 3/4" T45
60 mm	left hand, Female	22140124	
70 mm		22140050	
85 mm		22140047	22140058
105 mm			22140061
125 mm			22140153



BALLISTIC BUTTON TYPE

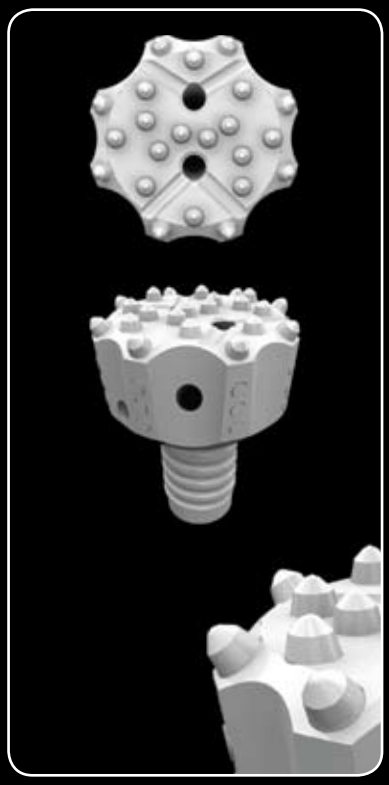
Designed for percussive drilling as well as limited rotary drilling. Ballistic buttons offer more aggressive penetration rates than hemispherical buttons in medium-hard ground conditions.

			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
51 mm	60 mm	Left Hand, Male	22130299	22130507	22130508	22130509
63.5 mm	70 mm	Left Hand, Male	22130510	22130511	22130512	22130513
76.1 mm	85 mm	Left Hand, Male	22130276	22130140	22130514	22130409
88.9 mm	105 mm	Left Hand, Male	22130517	22130059	22130515	22130407
101.6 mm	125 mm	Left Hand, Male	22130335	22130219	22130516	22130203

		THREAD TYPE	
OUTER Ø	THREAD DIRECTION	1 1/2" T38	1 3/4" T45
60 mm	left hand, Female	22130127	
70 mm		22130394	
85 mm		22130505	22130132
105 mm			22130396
125 mm			22130412

BOART LONGYEAR™

BITS: INNER STRING



TWO-STEP BUTTON TYPE

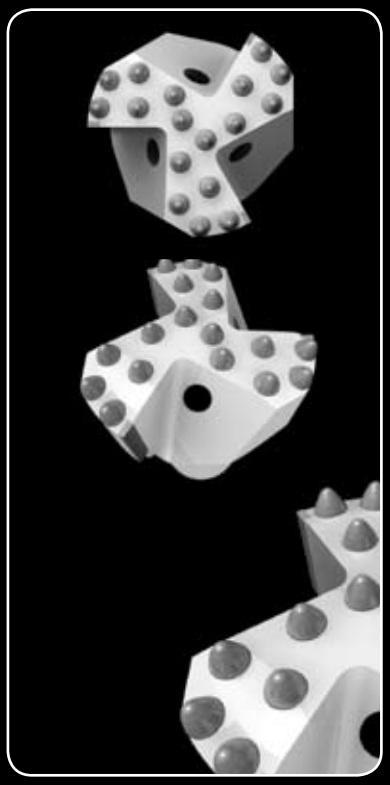
Designed for rotary percussive drilling the two-step button is a balance between the more aggressive ballistic button and the hemispherical button used in harder grounds. This bit can perform well in a larger range of harder ground conditions.

This bit comes standard with gauge protection inserts for improved life in abrasive ground conditions.

			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
51 mm	60 mm	Left Hand, Male	22130518	22130519	22130520	22130521
63.5 mm	70 mm	Left Hand, Male	22130522	22130523	22130524	22130525
76.1 mm	85 mm	Left Hand, Male	22130526	22130527	22130528	22130408
88.9 mm	105 mm	Left Hand, Male	22130529	22130530	22130531	22130532
101.6 mm	125 mm	Left Hand, Male	22130533	22130534	22130535	22130536

		THREAD TYPE	
OUTER Ø	THREAD DIRECTION	1 1/2" T38	1 3/4" T45
60 mm	Left hand, Female	22130537	
70 mm		22130506	
85 mm		22130538	22130539
105 mm			22130370
125 mm			22130540

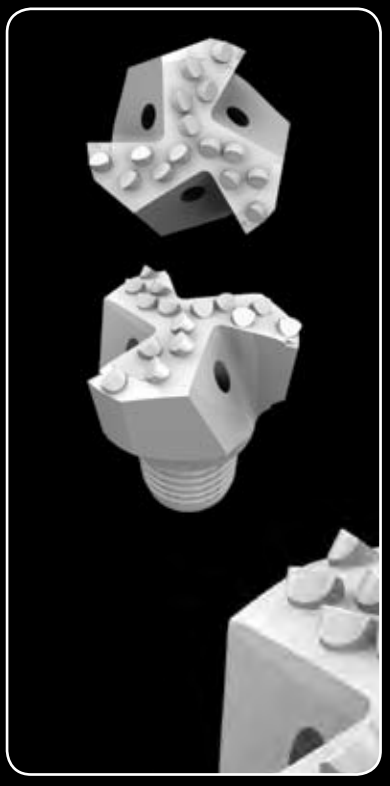
BITS: INNER STRING



BALLISTIC BUTTON 3-WING TYPE

The 3-wing type bits are available with both ballistic and scraping button carbide styles. The carbide buttons allow for penetration through harder ground conditions with percussive drilling. The carbide tipped cutting wings provide efficient penetration when rotary drilling.

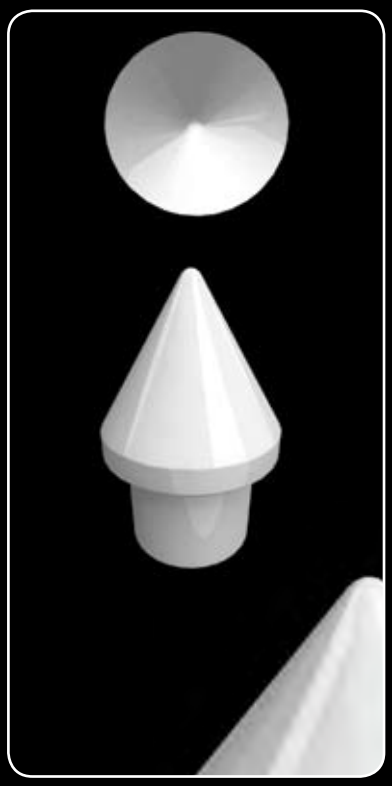
			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
76.1 mm	85 mm	Left Hand	22130541	22130542	22130543	22130544
88.9 mm	105 mm	Left Hand	22130545	22130201	22130547	22130548
101.6 mm	125 mm	Left Hand	22130549	22130550	22130551	22130421



SCRAPING BUTTON ROTARY BIT - 3-WING TYPE

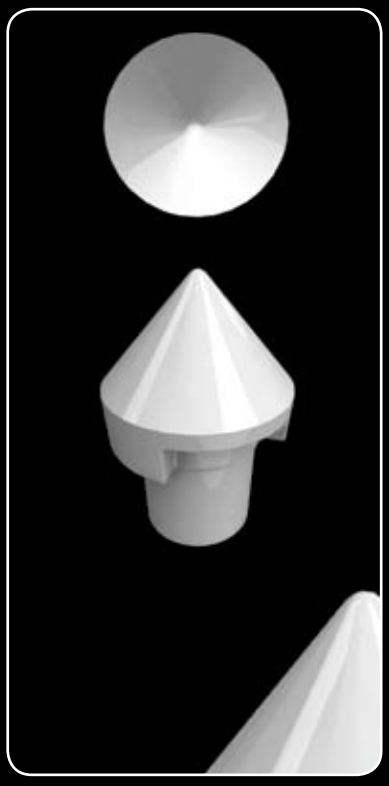
			THREAD TYPE			
ROD Ø	OUTER Ø	THREAD DIRECTION	CYLINDRICAL	CONICAL	TWINDRIVE™	TDN
76.1 mm	85 mm	Left Hand	22130553	22130319	22130546	22130410
88.9 mm	105 mm	Left Hand	22130546	22130144	22130552	22130554
101.6 mm	125 mm	Left Hand	22130555	22130288	22130556	22130557

BITS: DRIVE DRILLING



FLAT COLLAR BIT

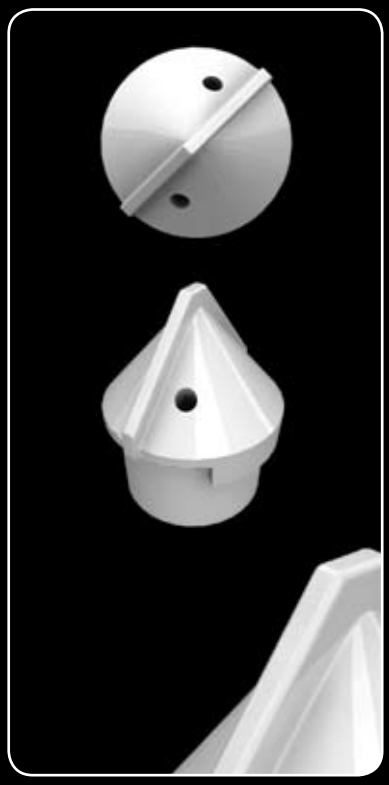
CASING Ø				
88.9 mm	101.6 mm	114.3 mm	133 mm	152.4 mm
62080021	62080011	62080023	62080025	62080027



ROTATION LOCK BIT

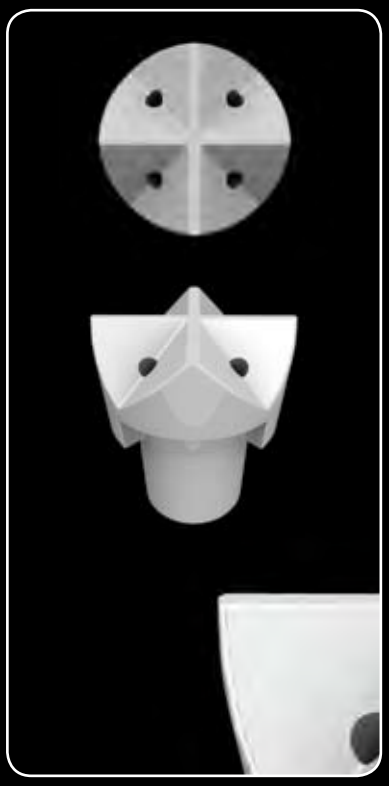
CASING Ø				
88.9 mm	101.6 mm	114.3 mm	133 mm	152.4 mm
62080022	62080004	62080024	62080026	62080027

BITS: DRIVE DRILLING



ROTATION LOCK BIT WITH FLUSHING HOLES AND CUTTING BLADE

CASING Ø	OUTER Ø	PART NUMBER
88.9 mm	105 mm	62080006
101.6 mm	110 mm	62080012
114.3 mm	120 mm	62080029
133 mm	140 mm	62080030
152.4 mm	160 mm	62080031



ROTATION LOCK BIT WITH FLUSHING HOLES

CASING Ø	OUTER Ø	PART NUMBER
88.9 mm	105 mm	62080017
101.6 mm	110 mm	62080007
114.3 mm	120 mm	62080008
133 mm	140 mm	62080018
152.4 mm	160 mm	62080032

DRIVE SHOES: DRIVE DRILLING

FLAT COLLAR DRIVE SHOES

	THREAD TYPE		
CASING Ø	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	22530034	22530059	22530150
101.6 mm	22530049	22530060	22530026
114.3 mm	22530062	22530061	22530105
133 mm	22530079	22530030	22530115
152.4 mm	22530063	22530064	22530151

ROTATION LOCK DRIVE SHOES

	THREAD TYPE		
CASING Ø	CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	22530006	22530007	22530033
101.6 mm	22530011	22530023	22530022
114.3 mm	22530001	22530002	22530100
133 mm	22530021	22530031	22530051
152.4 mm	22530065	22530066	22530152

TOOLS AND ACCESSORIES

GROUTING NIPPLES

CASING Ø		THREAD DIRECTION	THREAD TYPE			
			CYLINDRICAL SINGLE OR TRIPLE-START	CYLINDRICAL DOUBLE-START	CONICAL SINGLE OR TRIPLE-START	TWINDRIVE™
88.9 mm	R 1 1/4"	Left Hand	24080043		24080044	24080103
101.6 mm	R 1 1/4"	Left Hand	24080039		24080040	24080101
114.3 mm	R 1 1/4"	Left Hand	24080003	24080068	24080037	24080088
133 mm	R 1 1/4"	Left Hand	24080006	24080071	24080047	24080090
152.4 mm	R 1 1/4"	Left Hand	24080049	24080072	24080050	24080091
177.8 mm	R 1 1/4"	Left Hand	On Request	2408007	On Request	On Request

CASING Ø		THREAD DIRECTION	THREAD TYPE
			CYLINDRICAL DOUBLE-START
114.3 mm	R 1 1/4"	Right Hand	24080059
133 mm	R 1 1/4"	Right Hand	24080061
152.4 mm	R 1 1/4"	Right Hand	24080062
152.4 mm	R 1 1/4"	Right Hand	24080064

GROUTING HEAD

CASING Ø		THREAD DIRECTION	THREAD TYPE			
			CYLINDRICAL SINGLE OR TRIPLE-START	CYLINDRICAL DOUBLE-START	CONICAL SINGLE OR TRIPLE-START	TWINDRIVE™
88.9 mm	R 1 1/4"	Left Hand	24080045		24080046	24080104
101.6 mm	R 1 1/4"	Left Hand	24080041		24080042	24080102
114.3 mm	R 1 1/4"	Left Hand	24080002	24080069	24080038	24080087
133 mm	R 1 1/4"	Left Hand	24080004	24080070	24080048	24080089
152.4 mm	R 1 1/4"	Left Hand	24080051	24080073	24080052	24080092
177.8 mm	R 1 1/4"	Left Hand	On Request	24080075	On Request	On Request

CASING Ø		THREAD DIRECTION	THREAD TYPE
			CYLINDRICAL DOUBLE-START
114.3 mm	R 1 1/4"	Right Hand	24080060
133 mm	R 1 1/4"	Right Hand	24080005
152.4 mm	R 1 1/4"	Right Hand	24080063
152.4 mm	R 1 1/4"	Right Hand	24080065

TOOLS AND ACCESSORIES

MANUAL WRENCH

		CASING DIAMETER					
ROD TYPE	FLATS	88.9 mm	101.6 mm	114.3 mm	133 mm	152.4 mm	177.8 mm
ø1 1/2" T38	32 mm	24710046					
ø1 3/4" T45	38 mm			24710033	24710010	24710038	
ø51 mm	46 mm	24710011					
ø51 mm TDN	40 mm				24710142		
ø63.5 mm	55 mm		24710018				
ø76.1 mm	60 mm			24710043			
ø76.1 mm TDN	65 mm					24710143	
ø76.1 mm	70 mm			24710020		24710020	
ø88.9 mm	65 mm				24710024		
ø88.9 mm	80 mm	24710025			24710025		
ø101.6 mm	90 mm		24710066		24710066		24710066
ø114.3 mm	95 mm						24710101
ø114.3 mm	105 mm			24710028			24710028
ø133 mm	120 mm				24710009		
ø152.4 mm	140 mm					24710014	
ø177.8 mm							On Request

TOOLS AND ACCESSORIES

FISHING BELL

Ø	T38	T45	CYLINDRICAL SINGLE OR TRIPLE-START	CONICAL SINGLE OR TRIPLE-START	TWINDRIVE™	CYLINDRICAL DOUBLE-START		API 2 3/8"	API 3 1/2"	TDN
	LEFT HAND						RIGHT HAND	FEMALE	FEMALE	LEFT HAND
51 mm			24720043	24720044	24720132					24720167
63.5 mm			24720047	24720048	24720128					
76.1 mm			24720051	24720017	24720126			24720027		24720143
88.9 mm			24720045	24720046	24720110			24720086		
101.6 mm			24720049	24720050	24720125				24720090	24720114
114.3 mm			24720007	24720052	24720107	24720082	24720068		24720092	
133 mm			24720053	24720054	24720111	24720084	24720070			
152.4 mm			24720055	24720056	24720115	24720088	24720076			
177.8 mm			On Request			24720078	24720077			
1 1/2" rod	24720057									
1 1/2" coupling	24720058									
ø1 3/4" rod		61990039								
ø1 3/4" coupling		61990104								

FISHING SPEAR

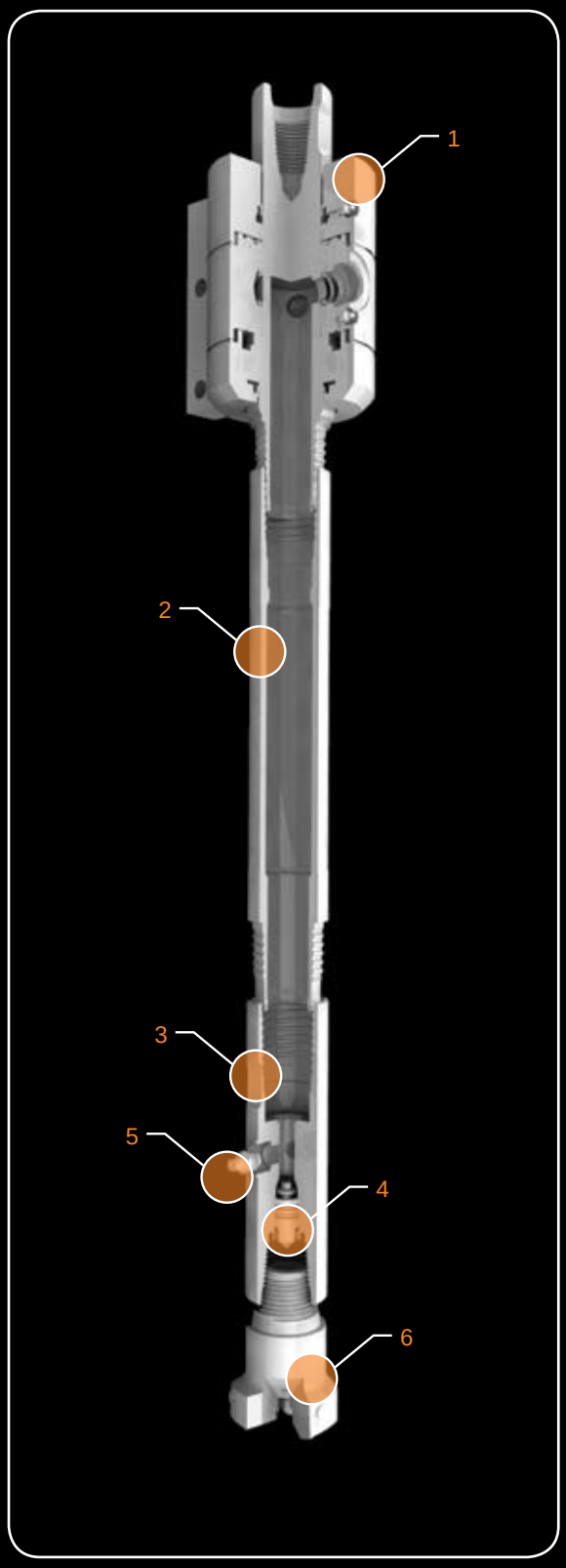
Ø	CYLINDRICAL SINGLE OR TRIPLE-START	CONICAL SINGLE OR TRIPLE-START	TWINDRIVE™	CYLINDRICAL 2-START		API 2 3/8"	API 3 1/2"	TDN
	LEFT HAND				RIGHT HAND	FEMALE	FEMALE	LEFT HAND
51 mm	24720039	24720040	24720131					24720166
63.5 mm	24720001	24720041	24720127					
76.1 mm	24720042	24720015	24720104			2470026		24720142
88.9 mm	24720031	24720022	24720108			24720085		
101.6 mm	24720030	24720002	24720103				24720089	24720112
114.3 mm	24720005	24720006	24720106	24720081	24720067		24720091	
133 mm	24720008	24720028	24720109	24720083	24720069			
152.4 mm	24720011	24720029	24720113	24720087	24720012			
177.8 mm	On Request			24720020	24720075			

JET GROUTING SYSTEMS

JET GROUTING SYSTEM

SYSTEM OVERVIEW

JET GROUTING SYSTEM - SINGLE TUBE



FLUSHING HEAD (1)

Flushing heads for single tube jet grouting systems provide the connection point to the drill string for both the flushing media during drilling and the high pressure grout during grout injection. Heads are mounted to a flushing head carrier which will travel up the mast extension on the specific jet grouting rig.

ROD (2)

Single tube jet grouting rods provide the drill string for drill rotation and flushing as well as the path to the nozzles for the high pressure grout injection. Rod ends are constructed of high strength nitrated steel and friction welded to an annealed mid-body. Rods come with special seals between rods which resist damage from abrasive grouts and multiple cycles of making and breaking rod joints.

VALVE FASTENER (MONITOR) (3)

The valve fastener (also called a monitor) mounts between the drill rod string and the drill bit. The valve fastener contains the injection nozzles as well as the automatic valve.

AUTOMATIC VALVE (4)

The automatic valve is located within the valve fastener and controls the flow of both low pressure flushing fluids and high pressure grouting media. During the drilling operations the spring loaded automatic valve allows for flushing fluids to pass out through the drill bit. When high pressure grout is introduced into the drill string the automatic valve will close directing the jet grouting media out through the injection nozzles in the valve fastener.

INJECTION NOZZLE (5)

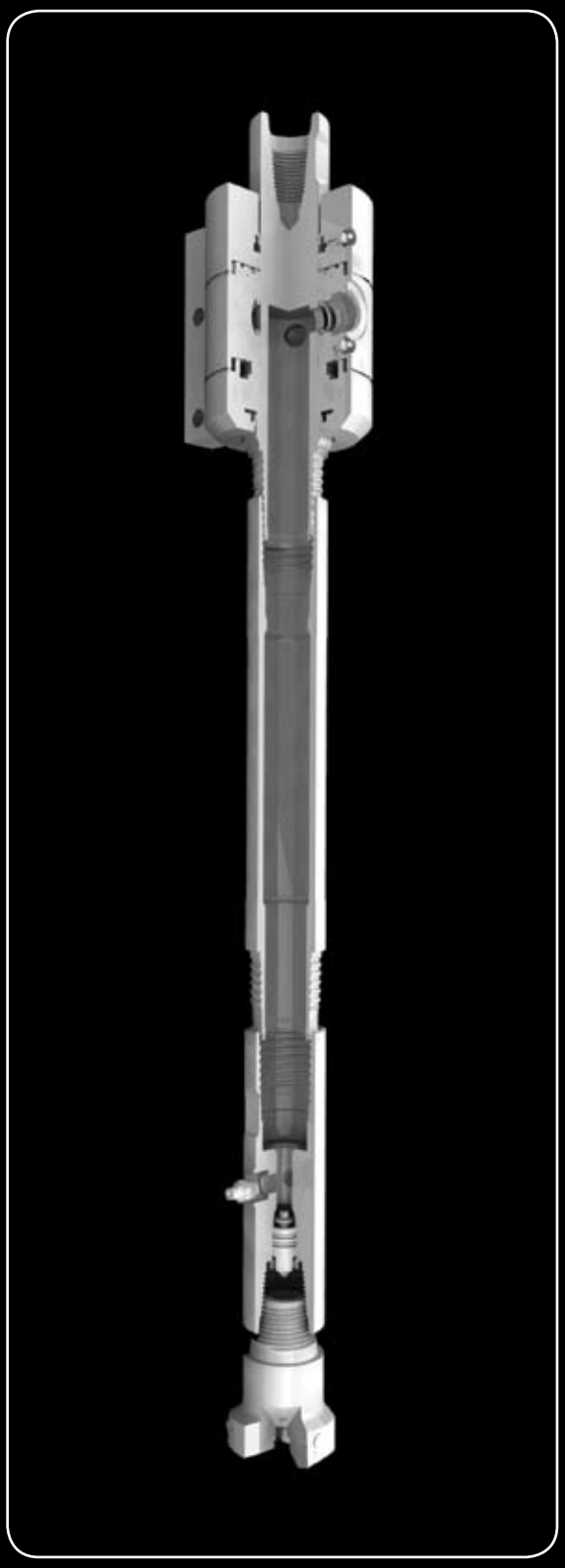
The grout injection nozzles mounted in the valve fastener are the exit point for the high pressure grout into the grouting zone. Injection nozzles are constructed with a tungsten carbide body with a threaded steel base. The nozzles are available with various sizes of a standard round injection orifice or a ribbed injection orifice.

ROTARY BIT (6)

The rotary bit for a single tube jet grouting system mounts below the valve fastener. They are designed for rotary drilling only in overburden. They come in a variety of winged bit designs with tungsten carbide inserts and flushing ports.

SYSTEM OVERVIEW

JET GROUTING SYSTEM - SINGLE TUBE



APPLICATION

Jet Grouting or High Pressure Injection is a ground stabilization technique as well as a sealing method used in soil conditions ranging from loose sediment up to soft rock structures.

In the Jet Grouting process a cement suspension is injected at pressures of 100-600 bar (1,450-8,700 psi) through the jet grouting tooling and into the soil in the drilled hole. The cement suspension mixes with the surrounding soil as the Jet Grouting tool string is slowly rotated and retracted from the hole. The result is a subsurface grout column.

Jet grouting is performed with either single, double or triple tube jet grouting systems.

- Single tube systems provide a path only for the injection of the cement suspension from the top of the drill string at the drill rig to special injection nozzles on the bottom of the drill tools above the drill bit.

Jet Grouting tools are designed to withstand high injection pressures using proper materials as well as specialized seals between the rod joints. Above the drill bit is the drill string monitor which houses the injection nozzles as well as the automatic valve which controls flushing and injection. The automatic valve allows regular low pressure flushing through the drill bit while the hole is being drilled. Once high pressure fluids are injected into the drill string the automatic valve closes directing the high pressure flow out through special injection nozzles.

DIAMETER OFFERING

HOLE Ø	
88.9 mm	

JET GROUTING SYSTEM SELECTION

FLUSHING HEAD

ID	THREAD TYPE	THREAD DIRECTION	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
1	Cylindrical	Right Hand	
	Conical		
	TwinDrive™		23410286

FLUSHING HEAD SEAL KIT

ID	THREAD TYPE	THREAD DIRECTION	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
1.1	Cylindrical	Right Hand	
	Conical		
	TwinDrive™		55030466

FLUSHING BODY

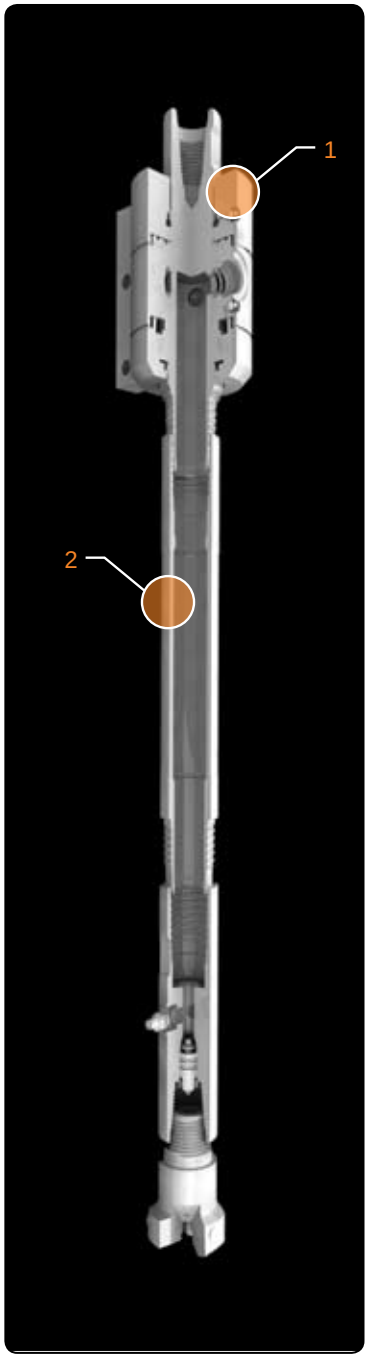
ID	THREAD TYPE		ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
1.2	Cylindrical	High Pressure	
	Conical		
	TwinDrive™		23410290

MOUNTING BRACKET (NOT SHOWN)

ID	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
1.3	23080061

JET GROUTING TUBE

ID	LENGTH	THREAD TYPE	THREAD DIRECTION	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
2	500 mm	Cylindrical	Right Hand	
		Conical		
		TwinDrive™		21050433
	1000 mm	Cylindrical		
		Conical		
		TwinDrive™		21050434
	1500 mm	Cylindrical		
		Conical		
		TwinDrive™		21050435
	2000 mm	Cylindrical		
		Conical		
		TwinDrive™		21050436
	3000 mm	Cylindrical		
		Conical		
		TwinDrive™		21050437



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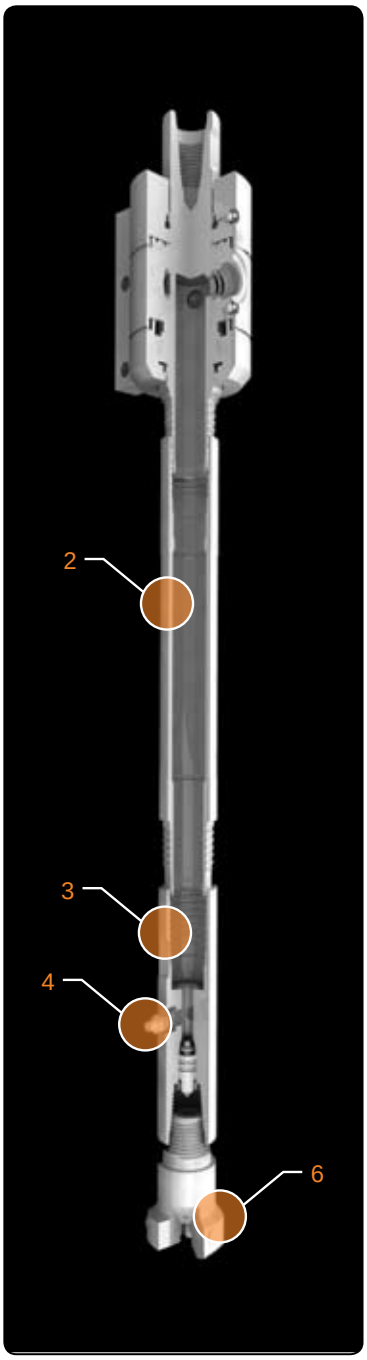
JET GROUTING SYSTEM SELECTION

JET GROUTING TUBE SPARES

ID		THREAD TYPE	Qty. Seals	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
2.1	Jet Grouting Tube	TwinDrive™	1	55030220



VALVE FASTENER (MONITOR)

ID	INPUT THREAD	OUTPUT THREAD	INJECTION NOZZLE THREAD	AIR NOZZLE THREAD	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
3	Cylindrical	"2 7/8 API Reg - Short Female"	M22 X 1.5mm	M40 X 1.5mm	
	Conical				
	TwinDrive™				23420420

VALVE FASTENER PARTS

ID		ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
3.1	Automatic Valve	23420097
	Spring Kit for automatic valve (6 spring options included)	55010367

GROUT INJECTION NOZZLE

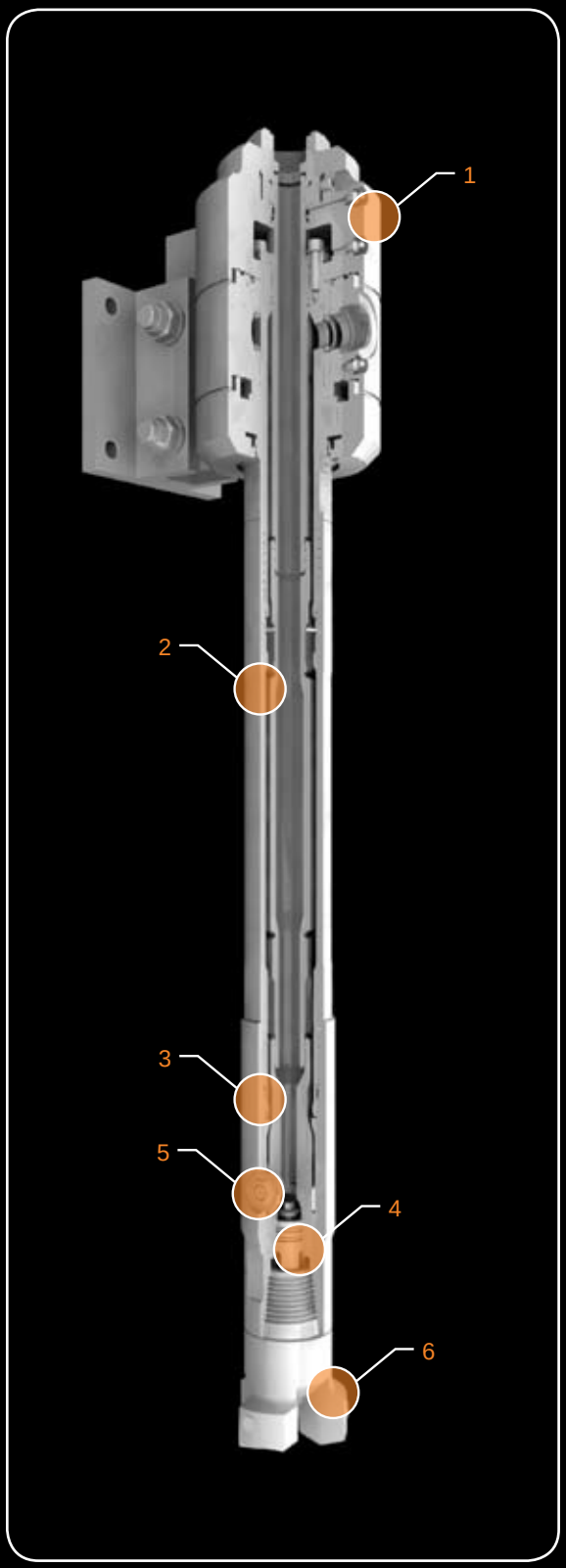
ID	NOZZLE ORIFICE	THREAD	ROD OUTER DIAMETER 88.9 mm SINGLE/DUAL TUBE STANDARD ORIFICE	88.9 mm SINGLE/DUAL TUBE RIBBED ORIFICE
4	ø 2.5 mm ID	M22 X 1.5mm	23420385	23420425
	ø 3.0 mm ID		23420362	23420426
	ø 3.5 mm ID		23420297	23420427
	ø 4.0 mm ID		23420328	23420428
	ø 4.5 mm ID		23420299	23420429
	ø 5.0 mm ID		23420300	23420430
	ø 5.5 mm ID		23420307	23420431
	ø 6.0 mm ID		23420366	23420432
	Special ID		On Request	On Request

ROTARY BIT

ID	THREAD	OUTPUT DIAMETER	TYPE	FLUSHING	ROD OUTER DIAMETER 88.9 mm SINGLE TUBE
6	2 7/8 API Reg - Short	127 mm	3-wing, GDU style	Std. flushing holes	22330003
	2 7/8 API Reg - Short	127 mm	3-wing, welded cutting edges	Std. flushing holes	22330007
		180 mm	Reaming Bit 4-wing type		22380072

SYSTEM OVERVIEW

JET GROUTING SYSTEM - DOUBLE TUBE



FLUSHING HEAD (1)

Flushing heads for double tube jet grouting systems provide the connection point to the drill string for the flushing media during drilling as well as the high pressure grout and air during grout injection. Flushing heads are mounted to a flushing head carrier which allows the head to move up the mast extension on the rig.

ROD (2)

Double tube jet grouting rods provide the drill string for drill rotation and flushing as well as the path to the nozzles for the high pressure grout injection. Rod ends are constructed of high strength nitrated steel and friction welded to an annealed mid-body. Inner tubes in the dual tube systems are secured inside the outer rod utilizing a circlip or wire fuse connection. Rods come with special seals between rods which resist damage from abrasive grouts and multiple cycles of making and breaking rod joints.

VALVE FASTENER (MONITOR) (3)

The valve fastener (also called a monitor) mounts between the drill rod string and the drill bit. The valve fastener contains the injection nozzles as well as the automatic valve.

AUTOMATIC VALVE (4)

The automatic valve is located within the valve fastener and controls the flow of both low pressure flushing fluids and high pressure grouting media. During the drilling operation the spring-loaded automatic valve allows for flushing fluids to pass out through the drill bit. When high pressure grout is introduced into the drill string the automatic valve will close directing the jet grouting media and air out through the injection nozzles in the valve fastener.

INJECTION NOZZLE (5)

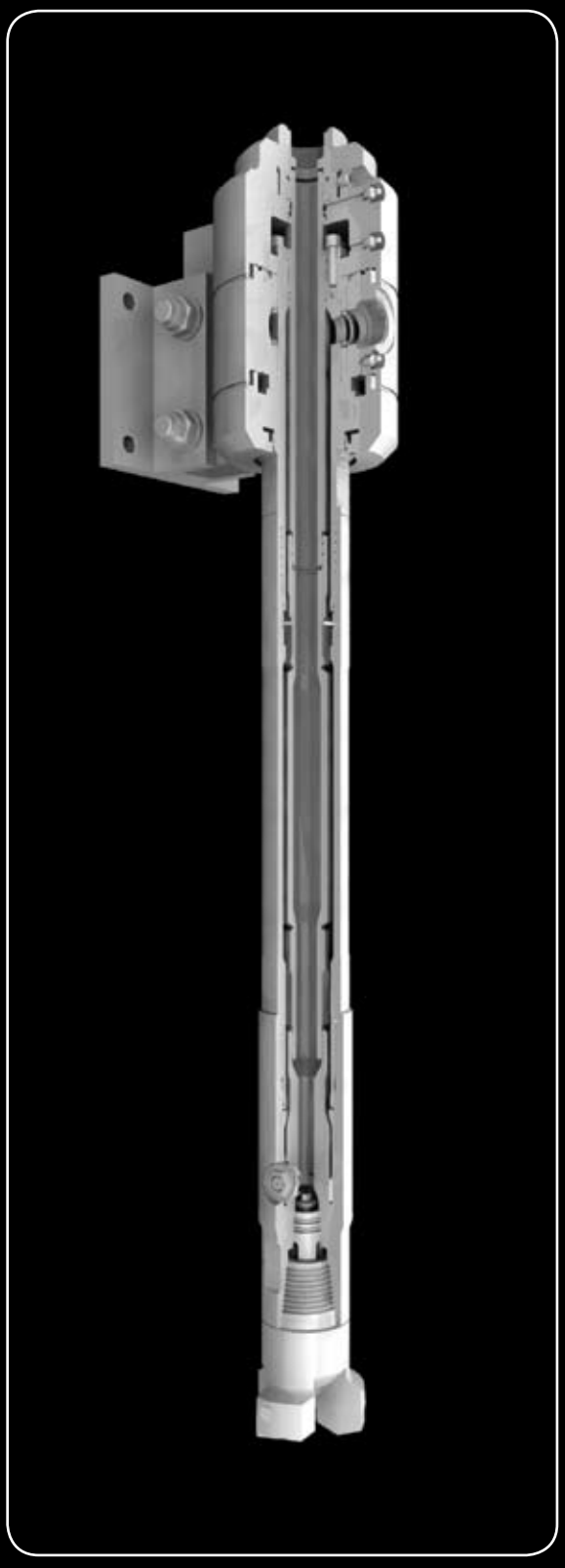
The grout injection nozzles mounted in the valve fastener are the exit point for the high pressure grout into the grouting zone. Injection nozzles are constructed with a tungsten carbide body with a threaded steel base. The nozzles are available with various sizes of a standard round injection orifice or a ribbed injection orifice.

ROTARY BIT (6)

The rotary bit for a single tube jet grouting system mounts below the valve fastener. They are designed for rotary drilling only in overburden. They come in a variety of winged bit designs with tungsten carbide inserts and flushing ports.

SYSTEM OVERVIEW

JET GROUTING SYSTEM - DOUBLE TUBE



APPLICATION

Jet Grouting or High Pressure Injection is a ground stabilization technique as well as a sealing method used in soil conditions ranging from loose sediment up to soft rock structures.

In the Jet Grouting process a cement suspension is injected at pressures of 100-600 bar (1,450-8,700 psi) through the jet grouting tooling and into the soil in the drilled hole. The cement suspension mixes with the surrounding soil at the Jet Grouting tool string is slowly rotated and retracted from the hole. The result is a subsurface grout column.

Jet grouting is performed with either single, double or triple tube jet grouting systems.

- A double tube jet grouting system is made up of drill rods that have an inner and outer tube providing two separate paths for injection of the cement suspension and high pressure air in to the soil. The air shrouds the cement stream as they both pass through a special nozzle and reducing the width of the cement stream injected into the soil. This focused jet stream allows better penetration into the surrounding materials resulting in larger diameter and better quality grout columns.
- A triple tube jet grouting system includes a third tube which carries water in addition to the cement and air. This further enhances diameter and quality of the resulting jet grout column.

Jet Grouting tools are designed to withstand high injection pressures using proper materials as well as specialized seals between the rod joints. Above the drill bit is the drill string monitor which houses the injection nozzles as well as the automatic valve which controls flushing and injection. The automatic valve allows regular low pressure flushing through the drill bit while the hole is being drilled. Once high pressure fluids are injected into the drill string the automatic valve closes directing the high pressure flow out through special injection nozzles.

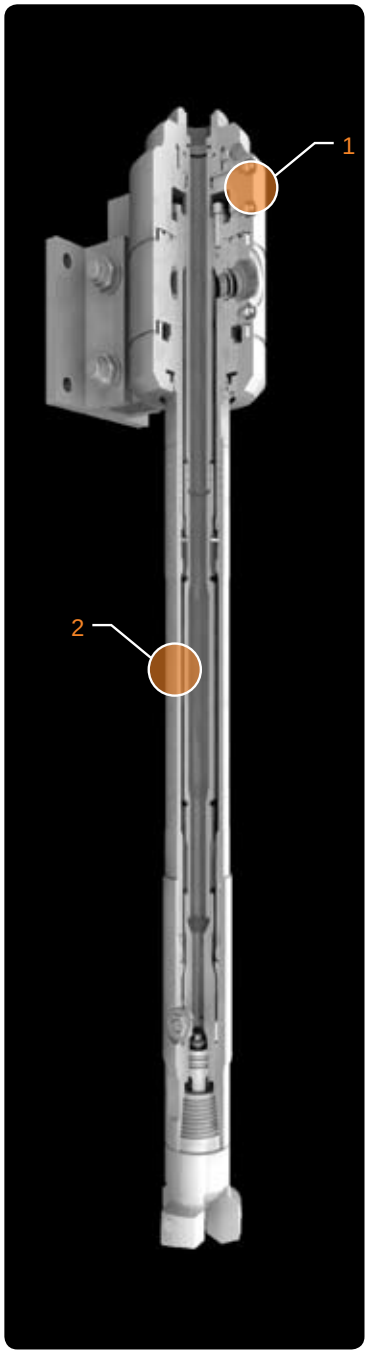
DIAMETER OFFERING

HOLE Ø	
88.9 mm	
114.3 mm	

JET GROUTING SYSTEM SELECTION

FLUSHING HEAD

ID	THREAD TYPE	THREAD DIRECTION	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
1	Cylindrical	Right Hand	23410218	23410256
	Conical		23410234	
	TwinDrive™		23410228	23410181



FLUSHING HEAD SEAL KIT

ID	THREAD TYPE	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
1.1	Cylindrical	55030411	55030372
	Conical	55030364	
	TwinDrive™	55030344	55030348

FLUSHING BODY

ID		THREAD TYPE	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
1.2	High Pressure	Cylindrical	23410220	23410188
		Conical	23410236	
		TwinDrive™	23410230	23410188
	Low Pressure	Cylindrical	23410219	23410257
		Conical	23410235	
		TwinDrive™	23410229	23410189

MOUNTING BRACKET

ID	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
1.3	23080061	23080063

JET GROUTING TUBE

ID	EFFECTIVE LENGTH	THREAD TYPE	THREAD DIRECTION	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
2	500 mm	Cylindrical	Right Hand	21050438	21050439
		Conical		21050167	
		TwinDrive™		21050267	21050268
	1000 mm	Cylindrical		21050316	21050303
		Conical		21050124	
		TwinDrive™		21050136	21050273
	1500 mm	Cylindrical		21050418	21050318
		Conical		21050173	
		TwinDrive™		21050292	21050407
	2000 mm	Cylindrical		21050314	21050304
		Conical		21050145	
		TwinDrive™		21050176	21050221
	3000 mm	Cylindrical		21050217	21050300
		Conical		21050161	
		TwinDrive™		21050135	21050222

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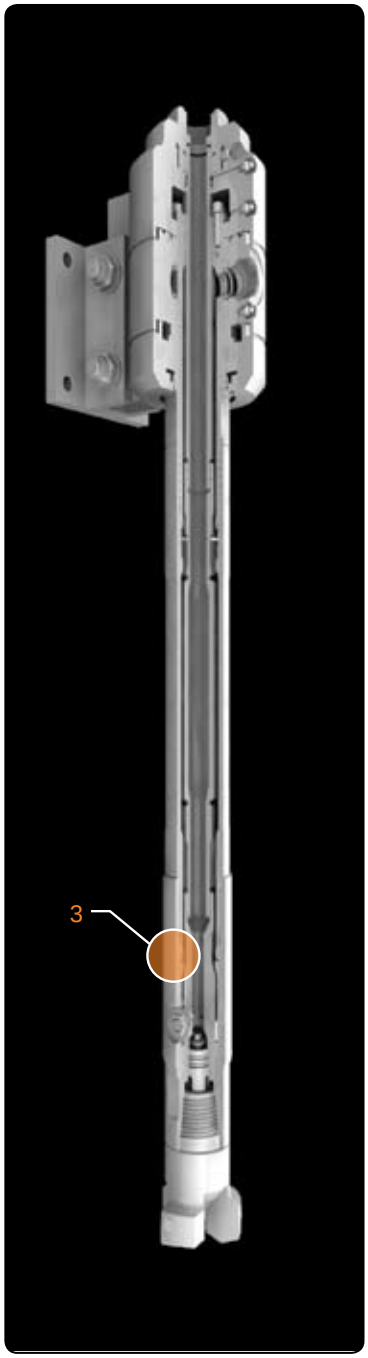
JET GROUTING SYSTEM SELECTION

JET GROUTING TUBE SPARES

ID		THREAD TYPE	QTY. SEALS	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
2.1	External Tube	Cylindrical	2	55030220	55030262
		TwinDrive™	1	55030220	
	Inner Tube	Cylindrical	2	55030252	55030261
		Conical		55030118	
		TwinDrive™			
	Wire Fuse		1	55010351	55010436



VALVE FASTENER (MONITOR)

ID	INPUT THREAD	OUTPUT THREAD	INJECTION NOZZLE THREAD	AIR NOZZLE THREAD	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
3	Cylindrical	"2 7/8 API Reg - Short Female"	M22 X 1.5mm	M40 X 1.5mm	23420377	
	Conical				23420275	
	TwinDrive™				23420360	
	Cylindrical	3 1/2" API Reg Female	M24 X 1.5mm	M44 X 1.5mm		23420316
	TwinDrive™					23420351

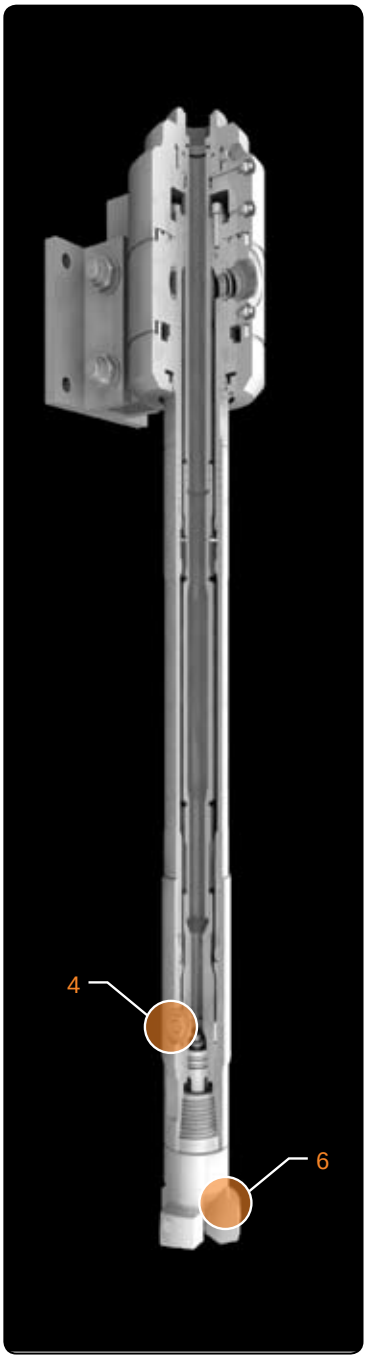
VALVE FASTENER PARTS

ID		THREAD TYPE	QTY. SEALS	ROD OUTER DIAMETER 88.9 mm DOUBLE TUBE	ROD OUTER DIAMETER 114.3 mm DOUBLE TUBE
3.1	Valve Fasteners Seals	Cylindrical			
		Conical	2	55030118	
		TwinDrive™	2	55030118	
	Automatic Valve			23420097	23420167
	Spring Kit for Automatic valve (6 spring options included)			55010367	

JET GROUTING SYSTEM SELECTION

GROUT INJECTION NOZZLE

ID	NOZZLE ORIFICE	THREAD	ROD OUTER DIAMETER			
			88.9mm DOUBLE TUBE STANDARD ORIFICE	88.9 mm DOUBLE TUBE RIBBED ORIFICE	114.3 mm DOUBLE TUBE STANDARD ORIFICE	114.3 mm DOUBLE TUBE RIBBED ORIFICE
4	ø 2.5 mm ID	M22 X 1.5mm	23420385	23420425		
	ø 3.0 mm ID		23420362	23420426		
	ø 3.5 mm ID		23420297	23420427		
	ø 4.0 mm ID		23420328	23420428		
	ø 4.5 mm ID		23420299	23420429		
	ø 5.0 mm ID		23420300	23420430		
	ø 5.5 mm ID		23420307	23420431		
	ø 6.0 mm ID		23420366	23420432		
	Special ID		On Request	On Request		
	ø 2.5 mm ID	M24 X 1.5mm			23420436	23420439
	ø 3.0 mm ID				23420349	23420438
	ø 3.5 mm ID				23420272	23420343
	ø 4.0 mm ID				23420265	23420363
	ø 4.5 mm ID				23420266	23420364
	ø 5.0 mm ID				23420331	23420333
	ø 5.5 mm ID				23420350	23420352
	ø 6.0 mm ID				23420410	23420365
	Special ID				On Request	On Request



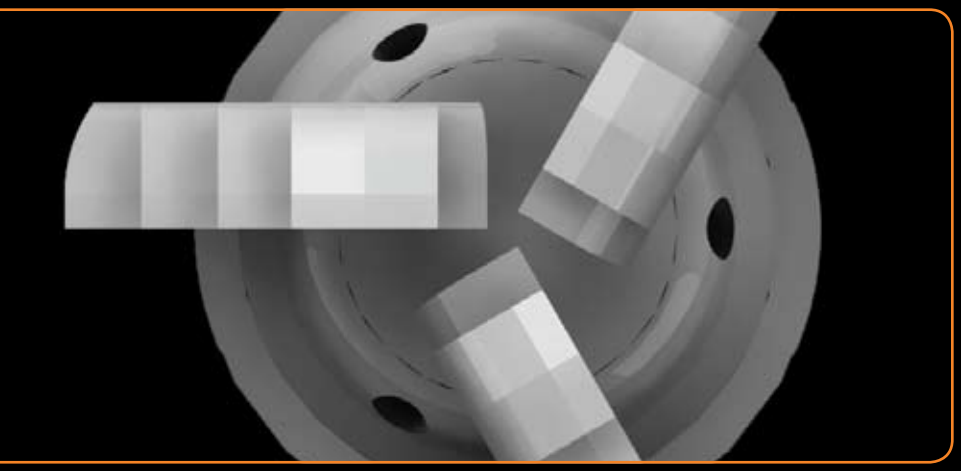
AIR NOZZLE

ID	THREAD	ROD OUTER DIAMETER	
		88.9 mm DOUBLE TUBE	114.3 mm DOUBLE TUBE
5	M40 X 1.5 mm	23420027	
	M44 X 1.5 mm		23420264

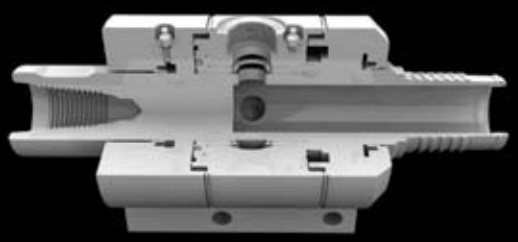
ROTARY BITS

ID	THREAD	OUTPUT DIAMETER	TYPE	FLUSHING	ROD OUTER DIAMETER	
					88.9 mm DOUBLE TUBE	114.3 mm DOUBLE TUBE
6	2 7/8 API Reg - Short	127 mm	3-wing, GDU style	Std. flushing holes	22330003	
	2 7/8 API Reg - Short	127 mm	3-wing, welded cutting edges	Std. flushing holes	22330007	
		180 mm	Reaming Bit 4-wing type		22380072	
	3 1/2 API Reg Male	140 mm	3-wing, GDU style	Std. flushing holes		22330019
		145 mm	3-wing, GDU style	Std. flushing holes		22330020
		150 mm	3-wing, GDU style	Std. flushing holes		22330021
		200 mm	Reaming Bit 4-wing type			22380098

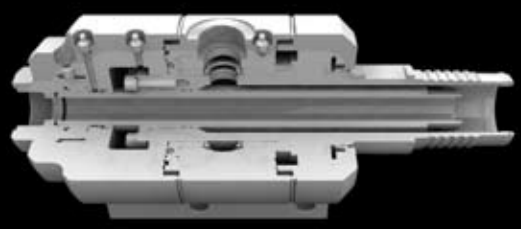
COMPONENTS



FLUSHING HEADS: JET GROUTING



SINGLE TUBE



DOUBLE TUBE

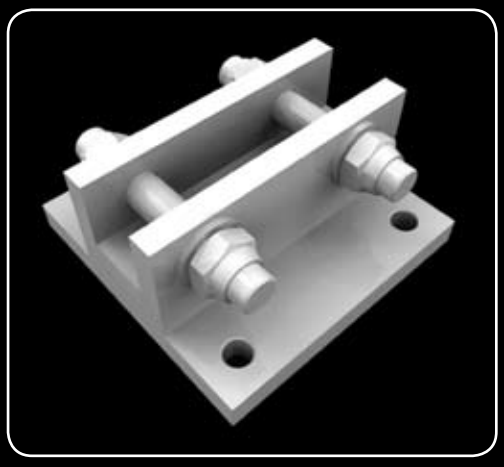
JET GROUTING SYSTEM FLUSHING HEAD

Single and double tube jet grouting flushing heads are designed for long and reliable service under extremely difficult operating conditions. The component layout of the flushing head system allows for optimum grout flow with minimum pressure drops. Tight tolerance control on machined surfaces, specially designed seals and the utilization of high quality bearings provide long life without costly downtime.

Jet grouting utilizes high pressure fluids and grouts which can cause injury if not properly controlled. As a safety feature in all flushing heads relief valves have been implemented between critical seals to provide early indication if maintenance is required.

The flushing heads are designed in a modular manner which provides the customers the opportunity to change the head for use with single or double tube jet grouting systems.

ROD OUTER Ø	SYSTEM TYPE	THREAD DIRECTION	THREAD TYPE		
			CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	Single Tube	Right Hand			23410286
	Double Tube		23410218	23410234	23410228
114.3 mm	Single Tube	Right Hand			
	Double Tube		23410256		23410181



MOUNTING BRACKET

ROD OUTER Ø	SYSTEM TYPE	PART NUMBER
88.9 mm	Single Tube	23080061
	Double Tube	
114.3 mm	Single Tube	
	Double Tube	23080063

BOART LONGYEAR™

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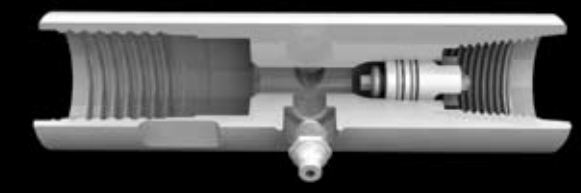
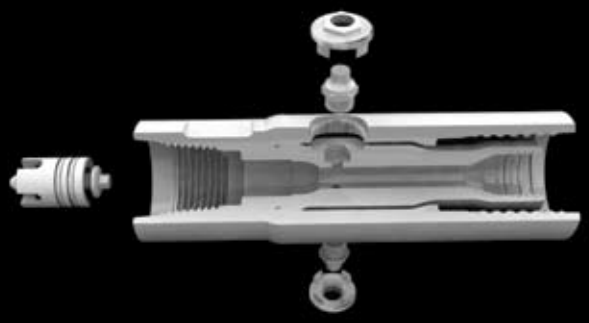
FLUSHING HEADS: JET GROUTING



SINGLE TUBE



DOUBLE TUBE

VALVE FASTENER (MONITOR)

Valve fasteners (also called monitors) are designed to optimize the high pressure grout flows and minimize pressure losses. By ensuring that the maximum possible pressure of the grout stream is allowed to pass through the injection nozzles you can optimize the size of your grout column.

Additionally by reducing the damaging affects of turbulent grout flows inside the monitor the internal wear is reduced allowing for a long operating life. For protection of the external surface of the valve fastener, it is nitrated and hard surface welding is applied to the outer diameter. This provides additional resistance to wear from abrasive ground conditions and grout materials.

Standard configuration of the valve fastener has two injection nozzles positioned 180° from each other. BOART LONGYEAR® can, on request, customize the nozzle orientations to suit specific drilling needs.

ROD OUTER Ø	SYSTEM TYPE	INJECTION NOZZLE THREAD	AIR NOZZLE THREAD	OUTPUT THREAD	INPUT THREAD TYPE		
					CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	Single Tube	M22 X 1.5 mm	M40 X 1.5 mm	2 7/8 API Reg - Short Female			23420420
	Double Tube				23420377	23420375	23420360
114.3 mm	Single Tube	M24 X 1.5 mm	M44 X 1.5 mm	3 1/2"API Reg Female			
	Double Tube				23420316		23420437

VALVE FASTENER SEALS

ROD OUTER Ø	SYSTEM TYPE	QTY	INPUT THREAD TYPE		
			CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	Single Tube	2			
	Double Tube			55030118	

FLUSHING HEADS: JET GROUTING

AUTOMATIC VALVE

The automatic valve is located within the valve fastener and controls the flow of both low pressure flushing fluids and high pressure grouting media. During the drilling operations the automatic valve allows for flushing fluids to pass out through the bit to clear cuttings while drilling. When high pressure grout is introduced into the drill string the automatic valve will close directing the jet grouting media out through the injection nozzles in the valve fastener.

All automatic valves are supplied with a selection of 6 different springs with varied spring forces so that the automatic valve can be configured to your specific injection pressures and grout mixture consistency.

ROD OUTER Ø	SYSTEM TYPE	PART NUMBER
88.9 mm	Single Tube	23420097
	Double Tube	
114.3 mm	Single Tube	
	Double Tube	23420167

SINGLE TUBE

DOUBLE TUBE

GROUT INJECTION NOZZLE

The grout injection nozzle bodies are constructed of tungsten carbide with a threaded steel base. The nozzles are available with a standard round injection orifice or can be ordered with a ribbed injection orifice. The ribbed injection orifice reduces turbulence and pressure drop in the grout injection flow which leads to lower component wear and larger grout columns. Injection nozzles are available in standard orifice diameters from 1 mm to 6 mm or custom sizes as required.

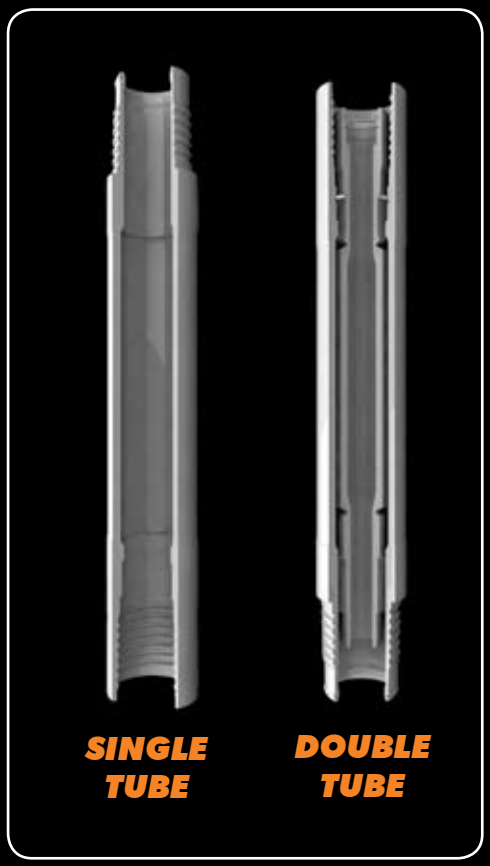
ROD OUTER Ø	NOZZLE ORIFICE	SYSTEM TYPE	THREAD	STANDARD ORIFICE	RIBBED ORIFICE
88.9 mm	ø 2.5 mm ID	Single/Double Tube	M22 X 1.5 mm	23420385	23420425
	ø 3.0 mm ID			23420362	23420426
	ø 3.5 mm ID			23420297	23420427
	ø 4.0 mm ID			23420328	23420428
	ø 4.5 mm ID			23420299	23420429
	ø 5.0 mm ID			23420300	23420430
	ø 5.5 mm ID			23420307	23420431
	ø 6.0 mm ID			23420366	23420432
114.3 mm	ø 2.5 mm ID	Double Tube	M24 X 1.5 mm	23420436	23420439
	ø 3.0 mm ID			23420349	23420438
	ø 3.5 mm ID			23420272	23420343
	ø 4.0 mm ID			23420265	23420363
	ø 4.5 mm ID			23420266	23420364
	ø 5.0 mm ID			23420331	23420333
	ø 5.5 mm ID			23420350	23420352
	ø 6.0 mm ID			23420410	23420365

AIR NOZZLE

Air injection nozzles are constructed of hardened steel with a 1.5 mm orifice diameter.

ROD OUTER Ø	SYSTEM TYPE	THREAD	PART NUMBER
88.9 mm	Double Tube	M40 X 1.5 mm	23420425
114.3 mm	Double Tube	M44 X 1.5 mm	23420264

RODS



JET GROUTING RODS

The jet grouting rod ends are constructed from the same high strength steel utilized in all percussive casing. Rod ends are then nitrated and friction welded to an annealed steel mid-body. Inner tubes in the dual tube systems are secured inside the outer rod utilizing a circlip or wire fuse connection. This allows for easy removal, repair, or replacement of the inner rod as required.

The sealing materials in the jet grouting systems are specially designed to resist damage from the abrasive grouts and numerous make and break cycles. This limits the amount of time spent changing rod seals and maximizes time spent grouting.

ROD OUTER Ø	LENGTH	SYSTEM TYPE	THREAD DIRECTION	THREAD TYPE		
				CYLINDRICAL	CONICAL	TWINDRIVE™
88.9 mm	500 mm	Single Tube	Right Hand			21050433
		Double Tube		21050438	21050167	21050267
	1000 mm	Single Tube				21050434
		Double Tube		21050316	21050124	21050136
	1500 mm	Single Tube				21050435
		Double Tube		21050418	21050173	21050292
	2000 mm	Single Tube				21050436
		Double Tube		21050314	21050145	21050176
	3000 mm	Single Tube				21050437
		Double Tube		21050217	21050161	21050135
114.3 mm	500 mm	Double Tube	Right Hand	21050439		21050268
	1000 mm			21050303		21050273
	1500 mm			21050318		21050407
	2000 mm			21050304		21050221
	3000 mm			21050300		21050222

JET GROUTING TUBE SPARES

EXTERNAL TUBE

ROD OUTER Ø	SYSTEM TYPE	THREAD TYPE	
		CYLINDRICAL (QTY 2)	TWINDRIVE™ (QTY 1)
88.9 mm	Single Tube		55030220
	Double Tube	55030220	
114.3 mm	Double Tube	55030262	

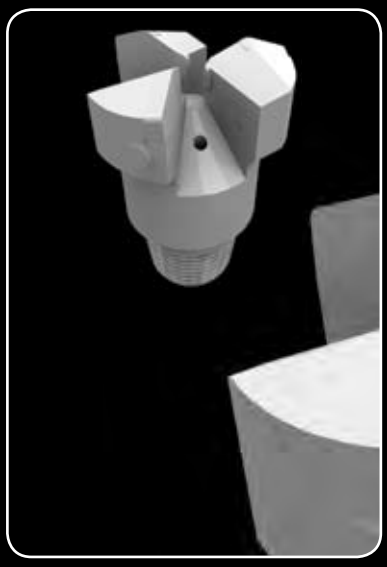
INNER TUBE

ROD OUTER Ø	SYSTEM TYPE	THREAD TYPE		
		CYLINDRICAL (QTY 2)	CONICAL (QTY 2)	TWINDRIVE™ (QTY 1)
88.9 mm	Double Tube	55030252	55030118	
114.3 mm	Double Tube	55030261		

WIRE FUSE

ROD OUTER Ø	SYSTEM TYPE	PART NUMBER
88.9 mm	Double Tube	55010351
114.3 mm	Double Tube	55010436

BITS: ROTARY

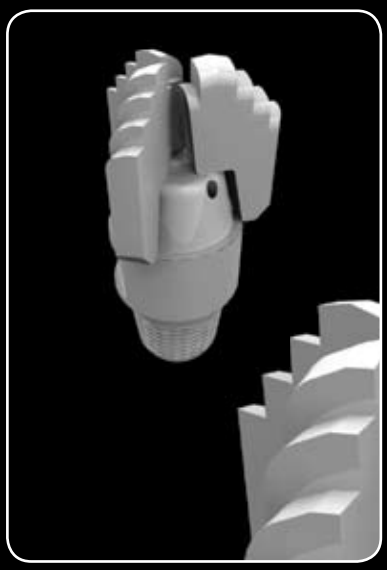


ROTARY BITS

BOART LONGYEAR® offers a wide selection of rotary bits to work in a variety of ground conditions. All feature tungsten carbide tipped cutting wings to efficiently drill to depth.

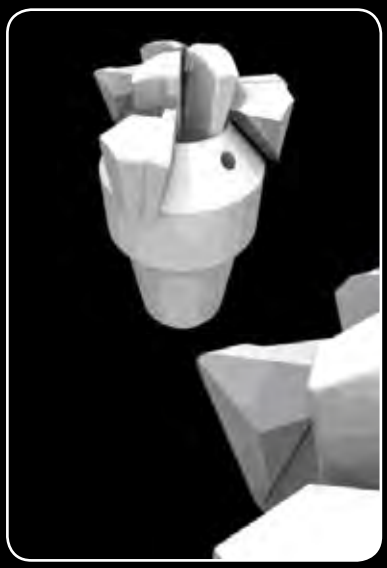
3-WING GDU TYPE

ROD OUTER Ø	SYSTEM TYPE	OUTER Ø	FLUSHING	THREAD TYPE	
				2 7/8 API REG - SHORT	3 1/2" API REG MALE
88.9 mm	Single/Double	127 mm	Standard Flushing Holes	22330003	
		180 mm			
114.3 mm	Single/Double	140 mm	Standard Flushing Holes		22330019
		145 mm			22330020
		150 mm			22330021



WELDED TYPE

ROD OUTER Ø	SYSTEM TYPE	OUTER Ø	FLUSHING	THREAD TYPE
				2 7/8 API REG - SHORT
88.9 mm	Single/Double	127 mm	Standard Flushing Holes	22330007



ROD OUTER Ø	SYSTEM TYPE	OUTER Ø	FLUSHING	THREAD TYPE
				3 1/2" API REG - SHORT
114.3 mm	Double	140 mm	Standard Flushing Holes	22320056

TOOLS AND ACCESSORIES

WRENCHES / TOOLS

MANUAL WRENCH

ROD OUTER Ø	SYSTEM	FLATS	PART NUMBER
88.9 mm	Single Tube	70 mm	
		80 mm	24710025
		100 mm	
		Clamping Nut	24890004
	Double Tube	70 mm	24710067
		80 mm	24710025
		100 mm	
		Clamping Nut	24890004
114.3 mm	Double Tube	70 mm	
		80 mm	24710025
		100 mm	24710107
		Clamping Nut	24890003

ASSEMBLY TOOLS

ROD OUTER Ø	SYSTEM	FEATURE	PART NUMBER
88.9 mm	Double Tube	Wire Fuse	24890002
114.3 mm	Double Tube	Wire Fuse	24890010

DISASSEMBLY TOOLS

ROD OUTER Ø	SYSTEM	FEATURE	PART NUMBER
88.9 mm	Double Tube	Wire Fuse	24890005
114.3 mm	Double Tube	Wire Fuse	24890009

GROUT NOZZLE PLUG

AIR NOZZLE PLUG

AIR PHASE STOP-PLUG

PLUGS

GROUT NOZZLE PLUG

ROD OUTER Ø	SYSTEM	THREAD TYPE M22 X 1.5 mm	THREAD TYPE M24 X 1.5 mm
88.9 mm	Single Tube	55440038	
	Double Tube	55440038	
114.3 mm	Double Tube		23420269

AIR NOZZLE PLUG

ROD OUTER Ø	SYSTEM	THREAD TYPE M22 X 1.5 mm	THREAD TYPE M24 X 1.5 mm
88.9 mm	Single Tube		
	Double Tube	23420023	
114.3 mm	Double Tube		23420270

AIR PHASE STOP-PLUG

ROD OUTER Ø	SYSTEM	THREAD TYPE M22 X 1.5 mm	THREAD TYPE M24 X 1.5 mm
88.9 mm	Single Tube		
	Double Tube	23420110	
114.3 mm	Double Tube		23420399

TOOLS AND ACCESSORIES

FISHING TOOLS

FISHING SPEAR

ROD OUTER Ø	SYSTEM	THREAD TYPE		
		CONICAL	CYLINDRICAL	TWINDRIVE™
88.9 mm	Single Tube			24720171
	Double Tube	24720198	24720096	24720171
114.3 mm	Double Tube	24720139		24720196

FISHING BELL

ROD OUTER Ø	SYSTEM	THREAD TYPE		
		CONICAL	CYLINDRICAL	TWINDRIVE™
88.9 mm	Single Tube			24720172
	Double Tube	24720199	24720097	24720172
114.3 mm	Double Tube	24720195		24720197

GROUND FREEZING SYSTEMS

GROUND FREEZING SYSTEMS

GROUND FREEZING SYSTEMS

OVERVIEW

Ground freezing is a temporary ground support technique that is used extensively for groundwater control and ground stabilization in underground construction and deep excavations. The process involves circulating refrigerated liquids through a series of subsurface pipes to freeze the ground creating a solid barrier that prevents water intrusion and provides structural support for excavation.

BOART LONGYEAR® manufactures ground freezing drill rods that are installed for refrigerated liquid circulation. Freezing rod applications have some unique challenges that are not found in typical foundation construction drilling application. BOART LONGYEAR® has gone through extensive development processes to ensure the freezing rods we provide incorporate our knowledge of construction drilling as well as unique technologies that are special to the ground freezing application.

Each ground freezing project has its own distinctive challenges which make the tooling requirements unique. BOART LONGYEAR® offers the services of designing the tooling package to meet your specific needs.

PRODUCT RANGE

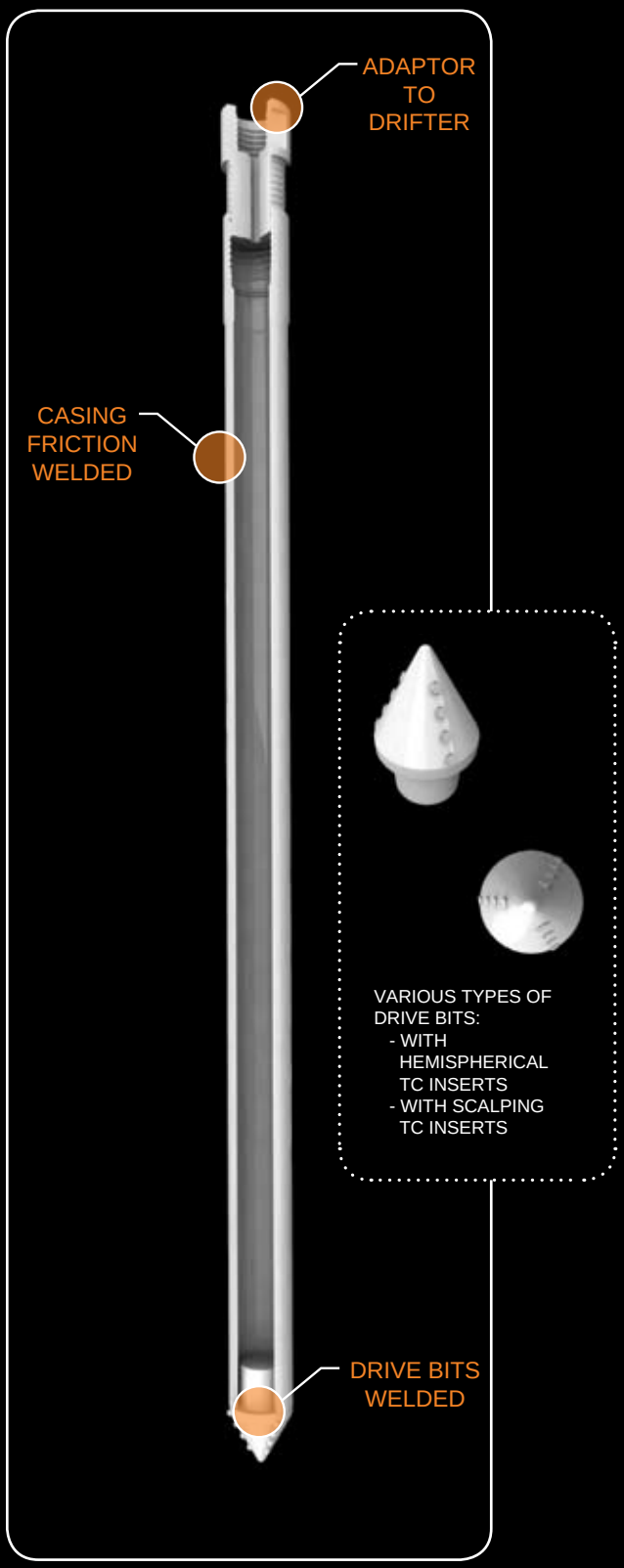
- Freezing rods up to 114 mm diameter and lengths up to 3 m.
- Driving rods with various bit configurations including carbide tips and flushing holes with check valves.
- Rotary drive flanges.
- Rotary percussive freeze rod systems available upon request.

KEY FEATURES

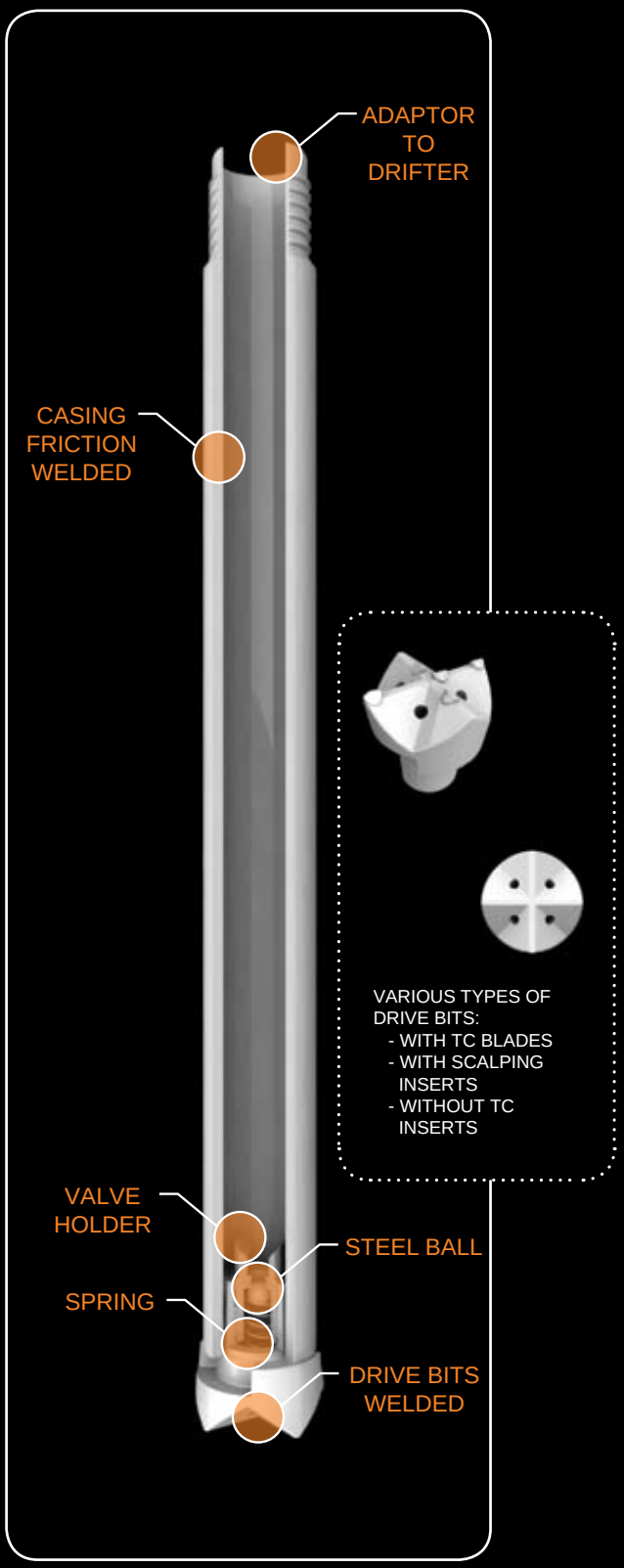
- Specially selected steel to provide strength required for drilling while also remaining stable when subjected to extreme low temperatures.
- Specially designed threads that maintain a tight seal in the drill string, preventing leakage of freezing fluids into the surrounding ground.
- Custom designed rod seals that can withstand low temperature as well as tolerate various greases commonly found on drilling sites.
- Various configurations of driving points incorporating carbide inserts, flushing holes with check valves, and percussive bits.
- Economical rod designs keeping total project cost to a minimum.

GROUND FREEZING SYSTEMS

STANDARD SYSTEM



BACK PRESSURE SYSTEM



WARRANTY

Limited Warranty.

(a) Consumables. BOART LONGYEAR® warrants for a period of one (1) year after the date of shipment of the consumable products manufactured by it, or the performance of related services, under the Contract, that such consumable products are free from defects in materials and workmanship and such services are performed in a professional and workmanlike manner; provided, however, with respect to consumable products purchased through an authorized BOART LONGYEAR® distributor, the warranty period shall commence on the date of purchase by the end-user.

(b) Capital Equipment. BOART LONGYEAR® warrants for a period equal to the lesser of (i) one (1) year after the date of shipment, or (ii) the initial 1,000 operating hours. BOART LONGYEAR® warrants for a period of six (6) months after the performance of related services that such services are performed in a professional and workmanlike manner.

(c) General Terms. BOART LONGYEAR® further warrants that, to the extent applicable, as of the date of shipment or performance, all goods manufactured by it and services performed shall conform to the written specifications agreed between the parties. THIS IS BOART LONGYEAR®'S ONLY WARRANTY. BOART LONGYEAR® MAKES NO OTHER WARRANTY, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. As a condition to BOART LONGYEAR®'s warranty obligations, any goods claimed to be defective under the foregoing warranty must be returned to the facility designated by BOART LONGYEAR®, which return shall be made promptly upon Purchaser's discovery of the alleged defect. With respect to consumable products purchased through an authorized BOART LONGYEAR® distributor, the party making the warranty claim must also deliver to BOART LONGYEAR® reasonable evidence of the date of purchase. BOART LONGYEAR® shall perform its examination of the goods so returned by Purchaser and shall report the results of its examination to Purchaser within thirty (30) days following its receipt of such goods from Purchaser, or, if longer time is required to complete such examination, within such time as would be required through the exercise of reasonable diligence. As a further condition to BOART LONGYEAR®'s obligations hereunder for breach of warranty, Purchaser shall offer its reasonable cooperation and assist BOART LONGYEAR® in the course of BOART LONGYEAR®'s review of any warranty claim. If requested by Purchaser, BOART LONGYEAR® will promptly repair or replace at BOART LONGYEAR®'s expense. Goods that are non-conforming according to BOART LONGYEAR®'s warranty as set forth herein. All removal and installation of goods shall be at Purchaser's expense. BOART LONGYEAR® reserves the right to reimburse Purchaser for an amount equal to the purchase price of any defective goods in lieu of providing repaired or replacement goods. Anything contained herein to the contrary notwithstanding, in no event shall BOART LONGYEAR® be liable for breach of warranty or otherwise in any manner whatsoever for: (i) normal wear and tear; (ii) corrosion, abrasion or erosion; (iii) any goods, components, parts, software or services which, following delivery or performance by BOART LONGYEAR®, has been subjected to accident, abuse, misapplication, modification, improper repair, alteration, improper installation or maintenance, neglect, or excessive operating conditions; (iv) defects resulting from Purchaser's specifications or designs or those of its contractors or subcontractors other than BOART LONGYEAR®; (v) defects associated with consumable parts or materials, the lifetime of which is shorter than the warranty period set forth in this Section; (vi) defects associated with Purchaser's specifications or designs or those of its contractors or subcontractors other than BOART LONGYEAR®; (vii) defects resulting from the manufacture, distribution, promotion or sale of Purchaser's own products; or (viii) accessories of any kind used by the Purchaser which are not manufactured by or approved by BOART LONGYEAR®.

(d) Sourced Goods. If the defective parts or components are not manufactured by BOART LONGYEAR®, the guarantee of the manufacturer of those defective parts or components is accepted by the Purchaser and is the only guarantee given to the Purchaser in respect of the defective parts or components. BOART LONGYEAR® agrees to assign to the Purchaser on request made by the Purchaser the benefit of any warranty or entitlement to the defective parts or components that the manufacturer has granted to BOART LONGYEAR® under any contract or by implication or operation of law to the extent that the benefit of any warranty or entitlement is assignable.

(e) Limitation on Liability. Except as provided for herein, in no event will BOART LONGYEAR® be liable for any indirect, incidental, special, consequential, punitive or similar damages including, but not limited to, lost profits, loss of data or business interruption losses. In no event will the total, aggregate liability of BOART LONGYEAR® under the Contract exceed the value of the Contract under which liability is claimed. The liability limitations shall apply even if BOART LONGYEAR® has been notified of the possibility or likelihood of such damages occurring and regardless of the form of action, whether in contract, negligence, strict liability, tort, products liability or otherwise. The parties agree that these limits of liability shall survive and continue in full force and effect despite any termination or expiration of any Contract. Any action by Purchaser against BOART LONGYEAR® must be commenced within one year after the cause of action has accrued. No employee or agent of BOART LONGYEAR® is authorized to make any warranty other than that which is specifically set forth herein. The provisions in any specification, brochure or chart issued by BOART LONGYEAR® are descriptive only and are not warranties.

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BOART LONGYEAR™

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