# IPS ROCK BITS CATALOG 2016 - 2017

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Features of Bearing Series

# X - Series Bearing (Sealed Journal, 4 - 3/4" to 17 - 1/2") M - Series Bearing (Sealed Journal: Motor, 4 - 3/4" to 15 - 1/2")

### Performance

1. This type has the best bearing performance of all the bit bearing types manufactured by TSK.

 As this floating journal bearing is designed using bearing metal having excellent anti-galling properties, the bearing is highly resistant to shock loads.

### Structure

1. This bearing has a nose-pin floating bushing, a thrust washer, a ball bearing, a journal floating bushing and a special seal.

2. The floating bushing and the thrust washer are made of bearing metal that has been correctly heat treated, polished, and coated with a solid lubricant.

3. The seal has been specially developed for highspeed rotary and motor drilling.



A grease reservoir with a rubber bellows is located in the bit body.

# XZ - Series Bearing (Sealed Roller / Floating, 9 - 5/8" a 17 - 1/2")

### Performance

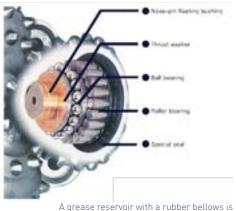
This type is highly suited for high-speed rotary drilling.

### Structure

1. This bearing has a nose-pin floating bushing, a thrust washer, a ball bearing, a journal roller bearing and a special seal.

2. As less heat is generated by flangeless roller bearings polished on all surfaces, this bearing is well suited for high-speed rotary drilling.

3. The seal has been specially developed for highspeed rotary drilling.



A grease reservoir with a rubber bellows is located in the bit body.

# MZ - Series Bearing (Sealed Roller: Motor, 13-3/8" to 26")

### Performance

This type has the performance needed for highspeed motor drilling.

### Structure

 The bearing has a thrust button, a roller bearing, a thrust washer, a ball bearing and a special seal.
 Heat generation is minimized by the use of flangeless roller bearings polished on all surfaces. This bearing is well suited for motor drilling.

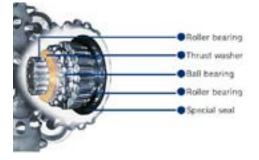
3. The seal has been specially developed for motor drilling.

# A grease reservoir with a rubber bellows is located in the bit body.

# Z – Series Bearing (Sealed Roller: For Insert Bits)

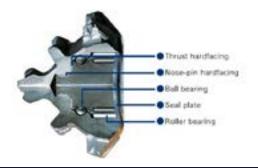
1. Heat generation is minimized by the use of flangeless roller bearings with polished surfaces.

2. The thrust washer is made of bearing metal having excellent anti-galling properties.



# Z – Series Bearing (Sealed Roller: For Steel Tooth Bits)

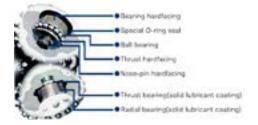
This sealed roller bearing has a special seal plate structure that keeps out mud and cuttings. This type of bearing is used for steel tooth bits.



# K – Series Bearing (Sealed Journal)

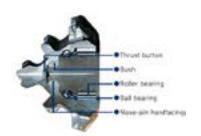
1. This type of bearings is well suited for high-load drilling at medium to low speeds.

2. The journal bearing faces are covered with a stellite layer (body section) and a silver alloy layer deposited over a carburized and hardened case (cutter section).



# Non – Sealed Roller Bearing

This non-sealed roller bearing comprises a ball bearing and a roller bearing. It is mainly used with light loads, when drilling shallow wells, with either large-diameter bits or small-diameter bits that do not require sealing.



# Insert Bits / 12 - ¼" X 30 G Y R F V P C - G

12 - 1/4": Bit Diameter X: Bearing Series X: Sealed Journal M: Sealed Journal (Motor Bits) K: Sealed Journal 7: Sealed Roller XZ: Sealed Roller / Floating MZ: Sealed Roller (Motor Bits) **30**: Type (05, 08, 10, 15, 20, 25, 30, 40, 50, 60, 65, 70, 90) IADC (41, 42, 43, 44, 51, 52, 53, 61, 62, 63, 72, 73, 83) **G:** Shirttail Inserts G: Shirttail TC Inserts G2: Diamond Inserts on the Shirttail Y: Inner Rows Y: Conical – Shaped R: Gage Reinforcement H: Chisel - Shaped (Gage Row) R: Round - Shaped (Gage Row) **F**: Gage Protection (Sub Gage Row) F: Side - Scraper V- Gage Protection D: Diamond Gage Inserts (D1: 33%, D2: 50%, D3: 100%) V: Diamond Heel Inserts (V1: 33%, V2: 50%, V3: 100%) S: Diamond Particle Heel Inserts (S: 50%) P. Leg Protection / Increased Stabilization P: Stabilizer Pads P2: Diamond Inserts to the Leading Edge of the Pads P3: Full Diamond Inserts of the Pads C: Center Jet

-G: High Temperature Use



# Steel Tooth Bits / 12 - 1/4" MH - Q T X G P C -G

12 - 1/4": Bit Diameter MH: Type (SS, S, MSS, MS, MH, HS, H, HR) IADC (11, 12, 13, 21, 23, 31, 32, 34) Q: Full Hardfacing on Teeth (M, XŽ, MZ – Series Bearing: Standard: Full Hardfacing on Teeth) **T:** Gage Protection (Heel Row) T: TC Inserts V: Diamond Heel Inserts (V1: 33%, V2: 50%, V3: 100%) X: Bearing Series X: Sealed Journal M: Sealed Journal (Motor Bits) Z: Sealed Roller XZ: Sealed Roller / Floating MZ: Sealed Roller (Motor Bits) G: Shirttail TC Inserts No mark Non Sealed Roller **P:** Leg Protection / Increased Stabilization P: Stabilizer Pads C: Center Jet

-G: High Temperature Use



	Bearing / Gage									
				Standard Roller Bearing	Roller Bearing, Air Cooled	Roller Bearing, Gage Protected	Sealed Roller Bearing	Sealed Roller Bearing, Gage Protected	Sealed Friction Bearing	Sealed Friction Bearing, Gage Protected
			1	SS		SS - T	SS - (Z, XZ, MZ)	SS - (TZ,TXZ,TMZ)	SS- (X, M)	SS - (TX, TM)
	Soft	1	2	S		S - T	S - [Z, XZ, MZ]	S - (TZ,TXZ,TMZ)	S- (X, M)	S - (TX, TM)
ഗ	Formations	1	3	MSS		MSS - T	MSS - (Z, XZ, MZ)	MSS-(TZ,TXZ,TMZ)	MSS- (X, M)	MSS - (TX, TM)
h Bits			4	MS		MS - T	MS - [Z, XZ, MZ]	MS-(TZ,TXZ, TMZ)	MS- (X, M)	MS - (TX, TM)
otl	Medium	2	2							
Р	Formations	2	3	MH		MH - T	MH - (Z, XZ)	MH - (TZ,TXZ)	MH - X	MH - TX
Steel Tooth			4							
Ste			1	HS		HS - T	HS - (Z, XZ)	HS - (TZ, TXZ)	HS - X	HS - TX
	Hard Formations	3	2 3	Н		H - T	H - (Z, XZ)	H - (TZ, TXZ)	H - X	H - TX
			4	HR		HR - T	HR - (Z, XZ)	HR- (TZ, TXZ)	HR - X	HR - TX
			1					Z05G XZ05G MZ05G		M04G X05G M05G
	Soft		2					XZ08G, MZ08G		X05GY, X08G,M08G
	Formations	4	3					Z10G XZ10G MZ10G		X10G X10GY M10G
	4		4					Z15G XZ15G MZ15G		X15G M15G
			1					Z20G XZ20G MZ20G		X20G M20G
	Soft to	-	2					XZ25G, MZ25G		X20GY, X25G, M25G
its	Medium Formations	5	3		A30			Z30G XZ30G MZ30G		X30G M30G
Insert Bits			4					XZ30GY		X30GY
Ins	Medium		1		A40			Z40G XZ40G MZ40G		X40G M40G
	Hard Formations	6	2		A50			Z50G, XZ50G		X50G
			3		A60			Z60G, XZ60G		X60G
			4							
			1							
	Hard Formations	7	2		151					X65G
	i ormations		<b>3</b> 4		A70					X70G
			4							
	Extremely		2							
	Hard Formations	8	3		A90					X90G
	. critications		4							

# List of Products - Insert Bits

mm         a         mm         k306         k406         3.8           101.4         4         2         3/8'         K306, K406         3.8           101.4         4         1/2'         2         3/8'         K306, K406         3.8           101.7         4.3/4'         2         7/8'         X306, X406, M306, M406         9.6           123.8         4         7/8'         2         3/8'         X306, X406, M306, M406         9.7           142.9         5         5/8'         3         1/2'         X206, X306, X406, M206, M306, M406         17.0           152.4         6'         3         1/2'         X206, X306, X406, M206, M306, M406         17.0           155.4         6         1/2'         1/2'         X206, X306, X406, M206, M306, M406         18.0           155.4         6         1/2'         3         1/2'         X206, X306, X406, M206, M306, M406         18.0           16.1         6         1/2'         3         1/2'         X206, X306, X406, M206, M306, M406         22.0           178.5         7         1/2'         X206, X306, X406, M206, M306, M406         22.0         23.3           193.7         7         5/8'         1/2'	Bit Size		Connection thread API Reg.	Sealed roller bearings	Sealed journal bearings	Air bearings	Weight
101.6         4 <sup></sup> 2 - 3/8 <sup></sup> H306, K406         4.4           114.3         4 - 1/2 <sup></sup> 2 - 3/8 <sup></sup> K306, K406         5.3           1207         4 - 3/4 <sup></sup> 2 - 7/8 <sup></sup> X306, X406, M306, M406         9.6           123.8         4 - 7/8 <sup></sup> 2 - 7/8 <sup></sup> X306, X406, M306, M406         9.7           142.7         5 - 6/8 <sup></sup> 3 - 1/2 <sup></sup> X206, X406, M306, M406         11.0           152.4         6 <sup></sup> 3 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         11.0           152.4         6 <sup></sup> 3 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         11.0           152.4         6 <sup></sup> 3 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         11.0           153.6         6 - 1/8 <sup></sup> 3 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         18.0           155.6         6 - 1/8 <sup></sup> 3 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         12.0           155.6         6 - 1/8 <sup></sup> 3 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         22.0           160.5         7 - 1/2         4 - 1/2 <sup></sup> X206, X306, X406, M206, M306, M406         22.0           175.7         5 - 3/8 <sup></sup>	mm	in	AFI Key.	Ŭ	, , , , , , , , , , , , , , , , , , ,		(kgf)
114.3         4 - 1/2"         2 - 3/8"         H306, K406         5.3           120.7         4 - 3/4"         2 - 7/8"         X306, X406, M406         9.6           123.8         4 - 7/8"         2 - 7/8"         X306, X406, M306, M406         9.7           123.8         4 - 7/8"         2 - 7/8"         X306, X406, M306, M406         17.0           152.4         6"         3 - 1/2"         X206, X306, X406, M206, M306, M406         17.0           152.4         6"         3 - 1/2"         X206, X306, X406, M206, M306, M406         17.0           152.4         6"         3 - 1/2"         X206, X306, X406, M206, M306, M406         18.0           152.4         6"         3 - 1/2"         X206, X306, X406, M206, M306, M406         18.0           153.6         6 - 1/8"         3 - 1/2"         X206, X306, X406, M206, M306, M406         20.0           171.5         6 - 1/8"         3 - 1/2"         X206, X306, X406, M306, M406         23.3           193.7         7 - 5/8"         4 - 1/2"         X206, X306, X406, M306, M306, M406         33.3           200.0         7 - 7/8"         4 - 1/2"         X206, X306, X406, M306, M306         42.0           215.7         8 - 3/4"         4 - 1/2"         X206, X306, X406, M306, M306		,	2 - 3/8"		K30G, K40G		
120.7         4 - 3/4"         2 - 7/8"         X30G, X40G, M30G, M40G         9.6           123.8         4 - 7/8"         2 - 7/8"         X30G, X40G, M30G, M40G         9.7           142.9         5 - 7/8"         3 - 1/2"         X20G, X40G, M30G, M40G         116.0           142.9         5 - 7/8"         3 - 1/2"         X20G, X40G, M20G, M40G, M40G         17.0           152.4         4"         3 - 1/2"         X20G, X40G, M20G, M40G, M40G         18.0           155.6         1-1/8"         3 - 1/2"         X20G, X40G, M20G, M40G, M40G         18.0           155.6         1-1/8"         3 - 1/2"         X20G, X40G, M20G, M40G, M40G         22.0           190.5         7 - 1/8"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         22.0           190.5         7 - 1/8"         4 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         33.3           200.0         7 - 7/8"         4 - 1/2"         X20G, X30G, X40G, M20G, M30G         44.3           212.9         8 - 3/4"         4 - 1/2"         X20G, X30G, X40G, M20G, M30G         44.3           212.9         8 - 3/4"         4 - 1/2"         X20G, X30G, X40G, M30G         44.3           214.1         8 - 5/8"         2200, 200, X230G         X20G, X30G, X40G, M							
123.8         4 - 7/8"         2 - 7/8"         X30G, X40G, M30G, M40G         9.7           142.9         5 - 5/8"         3 - 1/2"         X20G, X30G, X40G, M20G, M40G         17.0           152.4         6"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         17.0           152.4         6"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         17.5           155.6         6 - 1/8"         3 - 1/2"         X20G, X30G, X40G, M20G, M40G         18.0           165.1         6 - 1/8"         3 - 1/2"         X20G, X30G, X40G, M20G, M40G         20.0           171.5         6 - 3/4"         3 - 1/2"         X20G, X30G, X40G, M20G, M40G         20.0           171.5         6 - 3/4"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         23.3           190.5         7 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         33.3           200.0         7 - 7/8"         4 - 1/2"         X20G, X30G, X40G, M20G, M30G         44.3           212.7         8 - 3/8"         4 - 1/2"         X20G, X30G, X40G, M20G, M30G         42.0           215.9         8 - 1/2"         X20G, X30G, X40G, M20G, M30G         42.0         44.3           214.1         8 - 5/8"         220, 20G, Z30G, Z30G, Z30G, Z30G, Z30G, Z30G, Z30G, Z30							
142.9         5 - 5/8"         3 - 1/2"         X206, X306, X406, M206, M306, M406         16.0           142.2         5 - 7/8"         3 - 1/2"         X206, X406, M206, M306, M406         17.0           152.4         6 *         3 - 1/2"         X206, X406, M206, M306, M406         18.0           152.4         6 *         3 - 1/2"         X206, X306, X406, M206, M306, M406         18.0           158.8         6 - 1/8"         3 - 1/2"         X206, X306, X406, M206, M306, M406         18.0           158.8         6 - 1/8"         3 - 1/2"         X206, X306, X406, M206, M306, M406         22.0           190.5         7 - 1/2"         4 - 1/2"         X206, X306, X406, M206, M306, M406         22.0           190.7         7 - 7/8"         4 - 1/2"         X206, X306, X406, M206, M306, M406         33.3           200.0         7 - 7/8"         4 - 1/2"         X206, X306, M306, M406         34.8           212.7         8 - 3/8"         4 - 1/2"         X206, X306, M306, M306, M406         43.0           215.9         8 - 1/2"         Z206, Z306, Z306         X206, X306, M306, M306, M406         43.0           223.3         8 - 3/8"         4 - 1/2"         Z206, Z306, Z306         X206, X306, M306, M406         45.0           224.4					X30G, X40G, M30G, M40G		
149.2         5 - 7/8"         3 - 1/2"         X206, X306, X406, M206, M306, M406         17.0           152.4         6"         3 - 1/2"         X206, X306, X406, M206, M306, M406         17.5           155.6         6 - 1/4"         3 - 1/2"         X206, X306, X406, M206, M306, M406         18.0           155.8         6 - 1/4"         3 - 1/2"         X206, X306, X406, M206, M306, M406         20.0           171.5         6 - 1/4"         3 - 1/2"         X206, X306, X406, M206, M306, M406         22.0           170.5         7 - 1/2"         4 - 1/2"         X206, X306, X406, M206, M306, M406         33.3           200.0         7 - 7/8"         4 - 1/2"         X206, X306, X406, X406, X406, X406         33.3           200.0         7 - 7/8"         4 - 1/2"         X206, X306, X406, X406, X406         34.8           212.7         8 - 3/8"         4 - 1/2"         X206, Z406, X406, X406, X406         34.8           212.7         8 - 3/8"         4 - 1/2"         Z206, Z406, X406, X406, X406, X406         34.8           212.7         8 - 3/8"         4 - 1/2"         Z206, Z406, X406, X406	123.8	4 - 7/8"	2 - 7/8"		X30G, X40G, M30G, M40G		9.7
152.4         6*         3 - 1/2*         X206, X306, X406, M206, M306, M406         17.5           155.6         6 - 1/8*         3 - 1/2*         X206, X306, X406, M206, M306, M406         18.0           158.8         6 - 1/4*         3 - 1/2*         X206, X306, X406, M206, M306, M406         18.0           151.1         6 - 1/2*         3 - 1/2*         X206, X306, X406, M206, M306, M406         20.0           171.5         6 - 3/4*         3 - 1/2*         X206, X306, X406, M206, M306, M406         22.3           190.5         7 - 1/2*         4 - 1/2*         X206, X306, X406, M206, M306, M406         32.3           200.0         7 - 7/8*         4 - 1/2*         X206, X306, X406, X506, X606, M306, M406         32.3           212.7         8 - 3/4*         4 - 1/2*         Z206, Z306, Z406, M306, M406         33.3           211.1         8 - 5/8*         2 - 1/2*         Z206, Z306, Z406, M306, M406         43.0           212.7         8 - 3/4*         4 - 1/2*         Z206, Z306, Z406, M306, M406         43.0           212.8         8 - 3/4*         4 - 1/2*         Z206, Z306, Z206, X206, X306, X406, M306, M406         45.0           222.3         8 - 3/8*         2 - 1/8*         6 - 5/8*         Z206, Z06, X2306         X206, X306, X406, M306, M406	142.9	5 - 5/8"	3 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		
155.6         6         1/2"         X206, X306, X406, M206, M306, M406         18.0           158.8         6         1/4"         3         1/2"         X206, X306, X406, M206, M306, M406         18.0           165.1         6         1/4"         3         1/2"         X206, X306, X406, M206, M306, M406         20.0           171.5         6         3/4"         3         1/2"         X206, X306, X406, M206, M306, M406         22.0           190.5         7         1/2"         4         1/2"         X206, X306, X406, M206, M306, M406         33.3           200.0         7         7/8"         4         1/2"         X206, X306, X406, M206, M306, M406         34.8           212.7         8         3/8"         4         1/2"         X206, X306, X406, M206, M306, M406         42.0           215.9         8         1/2"         4         1/2"         Z206, Z306, Z406, M106, M206, M306, M406, M306, M406         45.0           222.3         8         3/4"         4         1/2"         Z206, Z306, X206, X406, M206, M306, M406         45.0           244.5         9         5/8"         2006, Z06, X2306         X206, X306, X406, M206, M306, M406         45.0           244.5         9         5/8"         Z20					X20G, X30G, X40G, M20G, M30G, M40G		
158.8         6 - 1/4"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         18.0           155.1         6 - 1/2"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         22.0           171.5         6 - 3/4"         3 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         22.0           191.5         7 - 1/2"         4 - 1/2"         X20G, X30G, X40G, M20G, M30G, M40G         33.3           200.0         7 - 7/8"         4 - 1/2"         X20G, X30G, X40G, X30G, X40G, M20G, M30G         42.0           212.7         8 - 3/8"         4 - 1/2"         X20G, X30G, X40G, X30G, X40G, X70G, M20G         34.8           212.7         8 - 3/8"         4 - 1/2"         Z20G, Z30G, Z40G, M20G, M30G         42.0           215.9         8 - 1/2"         4 - 1/2"         Z20G, Z30G, X20G, X20G, X20G, X20G, X40G         X40G, M30G         43.3           219.1         8 - 5/8"         4 - 1/2"         Z20G, Z0G, Z30G         X20G, X30G, X40G, M30G         46.0           244.5         9 - 5/8"         4 - 1/2"         Z20G, Z0G, X230G         X20G, X30G, X40G, M30G         46.0           244.5         9 - 5/8"         4 - 1/2"         Z20G, Z0G, X230G         X20G, X30G, X40G, M30G         46.0           250.8         9 - 7/8"         6 - 5/8"	152.4	6"	3 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		17.5
165.1         6 - 1/2"         3 - 1/2"         X206, X306, X406, M206, M306, M406         20.0           171.5         6 - 3/4"         3 - 1/2"         X206, X306, X406, M206, M306, M406         22.0           190.5         7 - 1/2"         4 - 1/2"         X206, X306, X406, M206, M306, M406         32.3           193.7         7 - 5/8"         4 - 1/2"         X206, X306, X406, M206, M306, M406         33.3           200.0         7 - 7/8"         4 - 1/2"         X206, X306, X406, M206, M306         42.0           215.9         8 - 3/8"         4 - 1/2"         Z206, Z306, Z406, M306         42.0           215.9         8 - 1/2"         4 - 1/2"         Z206, Z206, X2306         X206, M306, M406         45.0           222.3         8 - 3/8"         4 - 1/2"         Z206, Z06, X2306         X206, X306, X406, M206, M306         42.0           244.5         9 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, X406, M206, M306         45.0           244.5         9 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, X406, M206, M306         46.0           244.5         9 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, X406, M206, M306         46.0           270.4         1"         6 - 5/8"	155.6	6 - 1/8"	3 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		18.0
171.5         6         -3/4"         3         -1/2"         X206, X306, X406, M206, M306, M406         22.0           190.5         7         -1/2"         4         -1/2"         X206, X306, X406, M206, M306, M406         33.3           200.0         7         -7/8"         4         -1/2"         X206, X306, X406, M206, M306, M406         33.3           200.0         7         -7/8"         4         -1/2"         X206, X306, X406, M206, M306         40.0           215.9         8         -1/2"         Z206, Z306, Z406, X206, M206, M306         A30         44.3           215.9         8         -1/2"         Z206, Z306, Z406, X206, M206, M306, M406, M506, M306         45.0           222.1         8         -3/4"         4         -1/2"         Z206, Z06, X2306         X206, X409, M206, M306, M406, M406, M406         45.0           224.5         9         -5/8"         4         -1/2"         Z206, Z06, X2306         X206, X306, X406, M206, M306, M406         65.0           244.5         9         -5/8"         2.206, Z06, X2306         X206, X306, X406, M206, M306         65.0           279.4         11         6         5/8"         Z206, Z06, X2306         X206, X306, X406, M206, M306         10.0           304.8 <td>158.8</td> <td>6 - 1/4"</td> <td>3 - 1/2"</td> <td></td> <td>X20G, X30G, X40G, M20G, M30G, M40G</td> <td></td> <td>18.0</td>	158.8	6 - 1/4"	3 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		18.0
190.5       7 - 1/2"       4 - 1/2"       X206, X306, X406, M306, M406       32.3         193.7       7 - 5/8"       4 - 1/2"       X206, X306, X406, M306, M406       33.3         200.0       7 - 7/8"       4 - 1/2"       X206, X306, X406, X506, X606, X706, M306       34.8         212.7       8 - 3/8"       4 - 1/2"       X206, X306, X406, M306       42.0         215.9       8 - 1/2"       4 - 1/2"       Z206, Z306, Z406, M306, M406       44.3         211.8       8 - 5/8"       4 - 1/2"       Z206, Z306, Z406       M106, M206, M306, M406       45.0         222.3       8 - 3/4"       4 - 1/2"       Z206, Z306, Z406       X106, X206, X306, M206, M306       46.0         244.5       9 - 5/8"       6 - 5/8"       Z206, Z06, X2306       X206, X306, M206, M306, M406       65.0         250.8       9 - 7/8"       6 - 5/8"       Z206, Z06, X2306       X206, X306, X406, M206, M306, M406       67.0         264.9       10 - 5/8"       Z206, Z06, X2306       X206, X306, X406, M206, M306, M406       65.0         264.9       9 - 7/8"       6 - 5/8"       Z206, Z06, X2306       X206, X306, X406, M206, M306, M406       67.0         279.4       11"       6 - 5/8"       Z206, Z06, X2306       X206, X306, X406, M306       101.0       3	165.1	6 - 1/2"	3 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		20.0
193.7         7 5/8"         4 1/2"         X206, X306, X406, X306, M306, M406         33.3           200.0         7 7/8"         4 1/2"         X206, X306, X406, X506, X406, X706, M306, M406         34.8           212.7         83/8"         4 1/2"         X206, X306, X406, X506, M306, M406         42.0           215.9         81/2"         4 1/2"         Z206, Z306, Z306, X206, M306, M406         43.0         44.3           219.1         85/8"         4 1/2"         Z206, Z306, Z306, X206         X106, M206, M306, M406         45.0           222.3         83/4"         4 1/2"         Z206, Z06, X2306         X206, X306, M406, M306, M406         46.0           244.5         95/8"         4 1/2"         Z206, Z06, X2306         X206, X306, M406, M306, M406         62.0           250.8         97/8"         65/8"         Z206, Z06, X2306         X206, X306, M406, M306, M406         65.0           269.9         10-5/8"         65/8"         Z206, Z06, X2306         X206, X306, M406, M306, M406         65.0           279.4         11"         65/8"         Z206, Z06, X2306         X206, X306, M306, M406         101.0           304.8         12"         65/8"         Z206, Z06, X2306         X206, X306, X406, X506, M306	171.5	6 - 3/4"	3 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		22.0
200.0       7 - 7/8"       4 - 1/2"       X206, X306, X406, X506, X606, X706, M206, M306       34.8         212.7       8 - 3/8"       4 - 1/2"       X206, X306, M406       42.0         215.9       8 - 1/2"       4 - 1/2"       Z206, Z306, Z406, X206, M306, M406, M506       A30       44.3         219.1       8 - 5/8"       4 - 1/2"       Z206, Z306, X2306       X206, X306, M406, M206, M306       45.0         222.3       8 - 3/4"       4 - 1/2"       Z206, Z306, X2306       X206, X306, M206, M306       46.0         244.5       9 - 5/8"       4 - 5/8"       Z206, Z306, X2306       X206, X306, M206, M306, M406       65.0         244.5       9 - 5/8"       4 - 5/8"       Z206, Z06, X2306       X206, X306, M206, M306, M406       65.0         245.9       10-5/8"       6 - 5/8"       Z206, Z06, X2306       X206, X306, M206, M306, M406       67.0         279.4       11"       6 - 5/8"       Z206, Z06, X2306       X206, X306, M206, M306       101.0         304.8       12"       6 - 5/8"       Z206, Z06, X2306       X206, X306, M206, M306       101.0         304.8       12"       6 - 5/8"       Z206, Z06, X2306       X206, X306, M206, M306       101.0         304.8       12"       10 - 5/8"       Z106, Z206, Z306,	190.5	7 - 1/2"	4 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		32.3
200.0         7 - 7/8         4 - 1/2         M206, M306, M406         34.8           212.7         8 - 3/8"         4 - 1/2"         X206, X306, M206, M306         42.0           215.9         8 - 1/2"         4 - 1/2"         X206, X306, X206, X306, M306, M306         A3.0         44.3           219.1         8 - 5/8"         4 - 1/2"         Z206, Z306, Z306, Z406, M106, M206, M306, M406         45.0           222.3         8 - 3/4"         4 - 1/2"         Z206, Z306         X206, X306         X406, M306, M406         46.0           244.5         9 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306, M406         65.0           269.9         10 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306, M406         77.0           279.4         11"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306         101.0           304.8         12"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306         106.0           311.2         12-1/4"         6 - 5/8"         Z106, Z206, Z206         X206, X306, M206, M306         104.0           344.7         14 - 3/4"         7 - 5/8"         Z106, Z206, X206         X206, X306, M206, M306         101.0	193.7	7 - 5/8"	4 - 1/2"		X20G, X30G, X40G, M20G, M30G, M40G		33.3
215.9         8 - 1/2"         4 - 1/2"         Z206, Z306, Z306, Z406, X206, X306, X406, X506, X606, M106, M206, M306, M406, M506         A30         44.3           219.1         8 - 5/8"         4 - 1/2"         Z206, Z306         X206, X306, X406, M206, M306, M406         45.0           222.3         8 - 3/4"         4 - 1/2"         Z206, Z306         X206, X306, X406, M206, M306         46.0           244.5         9 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, X406, M206, M306, M406         62.0           250.8         9 - 7/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, X406, M206, M306, M406         65.0           269.9         10 - 5/8"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306, M406         77.0           279.4         11"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306         101.0           304.8         12"         6 - 5/8"         Z206, Z06, X2306         X206, X306, M206, M306         104.0           311.2         12.1/4"         6 - 5/8"         Z206, Z06, X2206         X056, X106, X206, M306, M406         430, A90         110.0           349.3         13 -3/4"         6 - 5/8"         Z106, Z206, Z206, Z206, X206         X06, X06, M306, M406         144.0           374.	200.0	7 - 7/8"	4 - 1/2"				34.8
215.9       8 - 1/2       4 - 1/2       XZ20G, XZ30G, XZ40G       M10G, M20G, M30G, M40G, M50G       A30       44.3         219.1       8 - 5/8       4 - 1/2       Z20G, Z30G, XZ40G       X20G, X30G, X40G, M20G, M30G, M40G       45.0         222.3       8 - 3/4       4 - 1/2       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       46.0         244.5       9 - 5/8       6 - 5/8       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       65.0         250.8       9 - 7/8       6 - 5/8       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       65.0         269.9       10 - 5/8       6 - 5/8       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G       80.0         279.4       11       6 - 5/8       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       80.0         295.3       11 - 5/8       6 - 5/8       Z20G, Z0G, XZ30G       X20G, X30G, M40G, M30G       101.0         304.8       12"       6 - 5/8"       Z10G, Z20G, Z30G, X20G, X30G, M20G, M30G, M40G       44.0         311.2       12 - 1/4"       6 - 5/8"       Z10G, Z20G, Z30G, X20G, X30G, X40G, M30G, M40G       44.0         349.3       13 - 3/4"       6 - 5/8"       Z10G, Z20G, Z30G, X20G, M10G, M20G       100.0         349.3       13 - 3/4"	212.7	8 - 3/8"	4 - 1/2"		X20G, X30G, M20G, M30G		42.0
222.3       8 - 3/4"       4 - 1/2"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       46.0         244.5       9 - 5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       62.0         250.8       9 - 7/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       65.0         269.9       10-5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       77.0         279.4       11"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       80.0         295.3       11-5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       101.0         304.8       12"       6 - 5/8"       Z20G, Z0G, Z30G, X20G       X20G, X30G, M20G, M30G       106.0         311.2       12-1/4"       6 - 5/8"       Z10G, Z0G, Z30G, X20G       X20G, X30G, M20G, M30G       A30, A90       110.0         349.3       13-3/4"       6 - 5/8"       Z10G, Z20G, MZ20G       X10G, X20G, M10G, M20G       A60, A90       182.0         393.7       15-1/2"       7 - 5/8" for 6-5/8"       Z10G, Z20G, MZ20G       X10G, X20G, M10G, M20G       A60, A90       182.0         393.7       15-1/2"       7 - 5/8" for 6-5/8"       Z10G, Z20G, MZ20G       X1	215.9	8 - 1/2"	4 - 1/2"			A30	44.3
244.5       9 - 5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       62.0         250.8       9 - 7/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       65.0         269.9       10-5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, X40G, M20G, M30G, M40G       77.0         279.4       11"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       80.0         295.3       11-5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       101.0         304.8       12"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       106.0         311.2       12-1/4"       6 - 5/8"       Z10G, Z20G, Z20G, Z20G, Z20G, XZ20G       X20G, X30G, M20G, M30G       106.0         349.3       13-3/4"       6 - 5/8"       Z10G, Z20G, Z20G, Z20G       X10G, X20G, M10G, M20G       144.0         374.7       14-3/4"       7-5/8" or 6-5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       146.0         381.0       15"       7 - 5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       190.0         406.4       16"       7 - 5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       194.0       194.0       1	219.1	8 - 5/8"	4 - 1/2"	Z20G, Z0G, XZ30G	X20G, X30G, X40G, M20G, M30G, M40G		45.0
250.8       9 - 7/8"       6 - 5/8"       Z206, Z06, X230G       X206, X306, X406, M206, M306, M40G       65.0         269.9       10 - 5/8"       6 - 5/8"       Z206, Z06, X230G       X206, X306, X406, M206, M306, M40G       77.0         279.4       11"       6 - 5/8"       Z206, Z06, X230G       X206, X306, X406, M206, M30G       80.0         295.3       11 - 5/8"       6 - 5/8"       Z206, Z06, X230G       X206, X306, M206, M30G       101.0         304.8       12"       6 - 5/8"       Z206, Z06, X230G       X206, X306, M206, M30G       106.0         311.2       12 - 1/4"       6 - 5/8"       Z206, Z06, X220G, X20G, X20G, X20G, X20G, M30G, M40G       A30, A90       110.0         349.3       13 - 3/4"       6 - 5/8"       Z106, Z206, MZ20G       X056, X106, X20G, M40G, M30G, M40G       A30, A90       110.0         349.3       13 - 3/4"       6 - 5/8"       Z106, Z206, MZ20G       X106, X206, M106, M20G       164.0         374.7       14 - 3/4"       7 - 5/8"       Z106, Z206, MZ20G       X106, X206, M106, M20G       164.0         381.0       15"       7 - 5/8"       Z106, Z206, MZ20G       X106, X206, M106, M20G       164.0         393.7       15 - 1/2"       7 - 5/8"       Z106, Z206, Z306, MZ20G       X106, X206, M106, M20G <t< td=""><td>222.3</td><td>8 - 3/4"</td><td>4 - 1/2"</td><td>Z20G, Z0G, XZ30G</td><td>X20G, X30G, M20G, M30G</td><td></td><td>46.0</td></t<>	222.3	8 - 3/4"	4 - 1/2"	Z20G, Z0G, XZ30G	X20G, X30G, M20G, M30G		46.0
269.9         10-5/8"         6 - 5/8"         Z20G, Z0G, XZ30G         X20G, X30G, X40G, M20G, M30G, M40G         77.0           279.4         11"         6 - 5/8"         Z20G, Z0G, XZ30G         X20G, X30G, X40G, M20G, M30G         80.0           295.3         11-5/8"         6 - 5/8"         Z20G, Z0G, XZ30G         X20G, X30G, M20G, M30G         101.0           304.8         12"         6 - 5/8"         Z20G, Z0G, XZ30G         X20G, X30G, M20G, M30G         106.0           311.2         12-1/4"         6 - 5/8"         Z20G, Z0G, XZ30G, XZ30G, X20G, X20G, X30G, M40G, M30G         A30, A90         110.0           349.3         13-3/4"         6 - 5/8"         Z10G, Z20G, Z30G, XZ30G, XZ30G, X20G, M10G, M20G, M30G, M40G         A30, A90         110.0           349.3         13-3/4"         6 - 5/8"         Z10G, Z20G, MZ20G         X10G, X20G, M10G, M20G         166.0           381.0         15"         7 - 5/8"         Z10G, Z20G, MZ20G         X10G, X20G, M10G, M20G         166.0           381.0         15"         7 - 5/8"         Z10G, Z20G, MZ20G         X10G, X20G, M10G, M20G         164.0           393.7         15-1/2"         7 - 5/8"         Z10G, Z20G, MZ20G         X10G, X20G, M10G, M20G         190.0           4444.5         17-1/2"         7 - 5/8"	244.5	9 - 5/8"	6 - 5/8"	Z20G, Z0G, XZ30G	X20G, X30G, X40G, M20G, M30G, M40G		62.0
279.4       11"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       80.0         295.3       11-5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       101.0         304.8       12"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       106.0         311.2       12".       6 - 5/8"       Z20G, Z0G, Z20G, Z20G, XZ30G       X05G, X10G, X20G, M30G, M40G       A30, A90       110.0         349.3       13-3/4"       6 - 5/8"       Z10G, Z20G, M220G       X05G, X10G, X20G, M30G, M40G       A30, A90       110.0         347.7       14-3/4"       7-5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       A60, A90       182.0         381.0       15"       7 - 5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       A60, A90       182.0         393.7       15-1/2"       7 - 5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       190.0         444.5       17-1/2"       7 - 5/8"       Z10G, Z20G, Z30G, X20G, M20G       X05G, X10G, X15G, X20G, M30G       265.0         508.0       20"       7-5/8"       Z10G, Z20G, Z30G, X20G, M20G       X05G, M10G, M20G       340.0         527.1       20-3/4"       7-5/8" for 6-5/8"       Z20G, Z30G, M220G       4	250.8	9 - 7/8"	6 - 5/8"	Z20G, Z0G, XZ30G	X20G, X30G, X40G, M20G, M30G, M40G		65.0
295.3       11-5/8"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       101.0         304.8       12"       6 - 5/8"       Z20G, Z0G, XZ30G       X20G, X30G, M20G, M30G       106.0         311.2       12-1/4"       6 - 5/8"       Z20G, Z0G, Z20G, Z20G, XZ30G       X05G, X10G, X20G, X30G, M40G, M30G       A30, A90       110.0         349.3       13-3/4"       6 - 5/8"       Z10G, Z20G, Z20G       X05G, M10G, M20G, M30G, M40G       A30, A90       110.0         349.3       13-3/4"       6 - 5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       144.0         374.7       14-3/4"       7-5/8" for 6-5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       166.0         381.0       15"       7 - 5/8"       Z10G, Z20G, M220G       X10G, X20G, M10G, M20G       A60, A90       182.0         393.7       15-1/2"       7 - 5/8"       Z10G, Z20G, Z30G, X20GG       X10G, X20G, M10G, M20G       190.0         444.5       17-1/2"       7 - 5/8"       Z10G, Z20G, Z30G, X205G, X205G, X205G, M210G, M10G, M15G, M20G, M30G       265.0       265.0         508.0       20"       7-5/8" for 6-5/8"       Z20G, Z30G, M220G       X05G, X10G, M20G, M30G       265.0       265.0         508.10       20"       7-5/8" for 6-5/8" </td <td>269.9</td> <td>10-5/8"</td> <td>6 - 5/8"</td> <td>Z20G, Z0G, XZ30G</td> <td>X20G, X30G, X40G, M20G, M30G, M40G</td> <td></td> <td>77.0</td>	269.9	10-5/8"	6 - 5/8"	Z20G, Z0G, XZ30G	X20G, X30G, X40G, M20G, M30G, M40G		77.0
304.8         12"         6 - 5/8"         Z20G, Z0G, XZ30G         X20G, X30G, M20G, M30G         106.0           311.2         12-1/4"         6 - 5/8"         Z10G, Z20G, Z30G, XZ30G, XZ40G         X05G, X10G, X20G, X30G, M40G, M50G, M40G         A30, A90         110.0           349.3         13-3/4"         6 - 5/8"         Z10G, Z20G, X20G         X10G, X20G, M10G, M20G         A30, A90         110.0           349.3         13-3/4"         6 - 5/8"         Z10G, Z20G, X20G         X10G, X20G, M10G, M20G         144.0           374.7         14-3/4"         7-5/8"         Z10G, Z20G, MZ20G         X10G, X20G, M10G, M20G         166.0           381.0         15"         7 - 5/8"         Z10G, Z20G, M220G         X10G, X20G, M10G, M20G         A60, A90         182.0           393.7         15-1/2"         7 - 5/8"         Z10G, Z20G, M220G         X10G, X20G, M10G, M20G         190.0           406.4         16"         7 - 5/8"         Z10G, Z20G, Z30G, XZ05G, XZ10G, XZ0G, M220G         X05G, X10G, X15G, X20G, M30G         265.0           508.0         20"         7-5/8"         Z10G, Z20G, Z30G, M220G         X05G, M10G, M15G, M20G, M30G         265.0           508.0         20"         7-5/8" for 6-5/8"         Z20G, Z30G, M220G         X05G, M10G, M15G, M20G, M30G         245.0	279.4	11"	6 - 5/8"	Z20G, Z0G, XZ30G	X20G, X30G, M20G, M30G		80.0
311.2       12-1/4"       6 - 5/8"       Z106,Z206,Z306, XZ056,X2106,X2206, XZ306,X2406       X056,X106,X206,X306,X406,X506, M056,M106,M206,M306,M406       A30,A90       110.0         349.3       13-3/4"       6 - 5/8"       Z106,Z206,X2206       X106,X206,M306,M406       A30,A90       110.0         349.3       13-3/4"       6 - 5/8"       Z106,Z206,X2206       X106,X206,M106,M206       144.0         374.7       14-3/4"       7-5/8" (or 6-5/8")       Z106,Z206,M2206       X106,X206,M106,M206       166.0         381.0       15"       7 - 5/8"       Z106,Z206,M2206       X106,X206,M106,M206       A60,A90       182.0         393.7       15-1/2"       7 - 5/8"       Z106,Z206,M2206       X106,X206,M106,M206       190.0         444.5       16"       7 - 5/8"       Z106,Z206,X2056, X2106,X206,M206       X106,X206,M106,M206       194.0         444.5       17-1/2"       7 - 5/8"       Z106,Z206,Z306,X2056, X2106,X206,M206       X056,X106,X156,X206,X306,M306       265.0         508.0       20"       7-5/8"       Z206,Z306,MZ206       X056,M106,M156,M206,M306       340.0       340.0         527.1       20-3/4"       7-5/8" for 6-5/8"       Z206,Z306,MZ206       406.0       340.0       340.0       340.0       340.0       340.0       340.0 <td>295.3</td> <td>11-5/8"</td> <td>6 - 5/8"</td> <td>Z20G, Z0G, XZ30G</td> <td>X20G, X30G, M20G, M30G</td> <td></td> <td>101.0</td>	295.3	11-5/8"	6 - 5/8"	Z20G, Z0G, XZ30G	X20G, X30G, M20G, M30G		101.0
311.2       12-1/4"       6 - 5/8"       XZ05G, XZ0G, XZ0G, XZ0G, M05G, M10G, M20G, M30G, M40G       A30, A90       110.0         349.3       13-3/4"       6 - 5/8"       Z10G, Z20G, XZ0G       X10G, X20G, M10G, M20G, M40G       A40, M40G       144.0         374.7       14-3/4"       7-5/8" for 6-5/8"       Z10G, Z20G, MZ20G       X10G, X20G, M10G, M20G       166.0         381.0       15"       7 - 5/8"       Z10G, Z20G, MZ20G       X10G, X20G, M10G, M20G       A60, A90       182.0         393.7       15-1/2"       7 - 5/8"       Z10G, Z20G, MZ20G       X10G, X20G, M10G, M20G       A60, A90       182.0         444.5       16"       7 - 5/8"       Z10G, Z20G, MZ20G       X10G, X20G, M10G, M20G       190.0         444.5       17-1/2"       7 - 5/8"       Z10G, Z20G, Z20G, MZ20G       X10G, X20G, M10G, M20G, M30G       265.0         508.0       20"       7-5/8" for 6-5/8"1       Z20G, Z30G, MZ20G       X05G, M10G, M15G, M20G, M30G       265.0         508.0       20"       7-5/8" for 6-5/8"1       Z20G, Z30G, MZ20G       406.0       340.0         527.1       20-3/4"       7-5/8" for 6-5/8"1       Z20G, Z30G, MZ20G       406.0       340.0         588.2       22"       7-5/8" for 6-5/8"1       Z20G, Z30G, MZ20G       434.0	304.8	12"	6 - 5/8"	Z20G, Z0G, XZ30G	X20G, X30G, M20G, M30G		106.0
374.7       14-3/4"       7-5/8" for 6-5/8"1       Z106, Z206, MZ206       X106, X206, M106, M206       166.0         381.0       15"       7 - 5/8"       Z106, Z206, MZ206       X106, X206, M106, M206       A60, A90       182.0         393.7       15-1/2"       7 - 5/8"       Z106, Z206, MZ206       X106, X206, M106, M206       A60, A90       182.0         406.4       16"       7 - 5/8"       Z106, Z206, MZ06       X106, X206, M106, M206       190.0         404.5       17-1/2"       7 - 5/8"       Z106, Z206, Z306, XZ056, XZ06, MZ06, MZ06, M106, M206       194.0         444.5       17-1/2"       7 - 5/8"       Z106, Z206, Z306, XZ056, XZ066, MZ106, M156, X206, M306       265.0         508.0       20"       7-5/8" for 6-5/8"1       Z206, Z306, MZ206       X056, X106, M156, M206, M306       265.0         508.0       20"       7-5/8" for 6-5/8"1       Z206, Z306, MZ206       340.0       340.0         527.1       20-3/4"       7-5/8" for 6-5/8"1       Z206, Z306, MZ206       406.0       343.0         588.8       22"       7-5/8" for 6-5/8"1       Z206, Z306, MZ206       434.0         584.2       23"       7-5/8" for 6-5/8"1       Z206, Z306, MZ206       459.0         609.6       24"       7-5/8" for 6-5/8"1	311.2	12-1/4"	6 - 5/8"	XZ05G,XZ10G, XZ20G,		A30, A90	110.0
381.0       15"       7 - 5/8"       Z10G, Z20G, MZ0G       X10G, X20G, M10G, M20G       A60, A90       182.0         393.7       15-1/2"       7 - 5/8"       Z10G, Z20G, MZ0G       X10G, X20G, M10G, M20G       190.0         406.4       16"       7 - 5/8"       Z10G, Z20G, Z20G, MZ0G       X10G, X20G, M10G, M20G       194.0         444.5       17-1/2"       7 - 5/8"       Z10G, Z20G, Z30G, XZ0G, MZ05G, MZ10G, MZ20G       X05G, X10G, X15G, X20G, X30G, MZ05G, M10G, M15G, M20G, M30G       265.0         508.0       20"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       340.0         527.1       20-3/4"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       406.0         558.8       22"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       434.0         584.2       23"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       435.0         609.6       24"       7-5/8" (or 6-5/8")       Z10G, Z20G, Z30G, MZ05G, MZ10G, MZ20G       540.0	349.3	13-3/4"	6 - 5/8"	Z10G, Z20G, XZ20G	X10G, X20G, M10G, M20G		144.0
393.7         15-1/2"         7 - 5/8"         Z10G, Z20G, MZ20G         X10G, X20G, M10G, M20G         190.0           406.4         16"         7 - 5/8"         Z10G, Z20G, MZ0G         X10G, X20G, M10G, M20G         194.0           444.5         17-1/2"         7 - 5/8"         Z10G, Z20G, Z30G, XZ05G, XZ10G, XZ0G, MZ05G, MZ10G, MZ20G         X05G, X10G, X15G, X20G, X30G, M05G, M10G, M15G, M20G, M30G         265.0           508.0         20"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         340.0           527.1         20-3/4"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         406.0           558.8         22"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         434.0           584.2         23"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         459.0           609.6         24"         7-5/8" (or 6-5/8")         Z10G, Z20G, Z30G, MZ10G, MZ20G         540.0	374.7	14-3/4"	7-5/8" (or 6-5/8")	Z10G, Z20G, MZ20G	X10G, X20G, M10G, M20G		166.0
406.4         16"         7 - 5/8"         Z10G, Z20G, MZ0G         X10G, X20G, M10G, M20G         194.0           444.5         17-1/2"         7 - 5/8"         Z10G, Z20G, Z30G, XZ05G, XZ10G, XZ0G, MZ0G, MZ0G, MZ0G, MZ0G, MZ0G, MZ0G, M30G         265.0           508.0         20"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         M05G, M10G, M15G, M20G, M30G         340.0           527.1         20-3/4"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         406.0           558.8         22"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         434.0           584.2         23"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         459.0           609.6         24"         7-5/8" (or 6-5/8")         Z10G, Z20G, Z30G, MZ05G, MZ10G, MZ20G         540.0	381.0	15″	7 - 5/8″	Z10G, Z20G, MZ20G	X10G, X20G, M10G, M20G	A60, A90	182.0
444.5         17-1/2"         7 - 5/8"         Z106, Z206, Z306, XZ056, XZ106, XZ06, M256, M056, M106, M156, M206, M306         265.0           508.0         20"         7-5/8" (or 6-5/8")         Z206, Z306, MZ206         M056, M106, M156, M206, M306         265.0           508.0         20"         7-5/8" (or 6-5/8")         Z206, Z306, MZ206         340.0         340.0           527.1         20-3/4"         7-5/8" (or 6-5/8")         Z206, Z306, MZ206         406.0         340.0           558.8         22"         7-5/8" (or 6-5/8")         Z206, Z306, MZ206         434.0         343.0           584.2         23"         7-5/8" (or 6-5/8")         Z206, Z306, MZ206         435.0         459.0           609.6         24"         7-5/8" (or 6-5/8")         Z106, Z206, Z306, MZ206         540.0	393.7	15-1/2"	7 - 5/8"	Z10G, Z20G, MZ20G	X10G, X20G, M10G, M20G		190.0
444.5       17-1/2"       7 - 5/8"       XZ10G, XZ0G, MZ05G, MZ10G, MZ0G       A056, A106, A106, A20G, A306, M05G, M10G, M15G, M20G, M30G       265.0         508.0       20"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       340.0         527.1       20-3/4"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       406.0         558.8       22"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       434.0         584.2       23"       7-5/8" (or 6-5/8")       Z20G, Z30G, MZ20G       459.0         609.6       24"       7-5/8" (or 6-5/8")       Z10G, Z20G, Z30G, MZ05G, MZ10G, MZ20G       540.0	406.4	16"	7 - 5/8"	Z10G, Z20G, MZ20G	X10G, X20G, M10G, M20G		194.0
527.1         20-3/4"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         406.0           558.8         22"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         434.0           584.2         23"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         459.0           609.6         24"         7-5/8" (or 6-5/8")         Z10G, Z20G, Z30G, MZ20G         540.0	444.5	17-1/2"	7 - 5/8"	XZ10G, XZ20G,			265.0
558.8         22"         7-5/8" [or 6-5/8"]         Z206, Z306, MZ206         434.0           584.2         23"         7-5/8" [or 6-5/8"]         Z206, Z306, MZ206         459.0           609.6         24"         7-5/8" [or 6-5/8"]         Z106, Z206, Z306, MZ206         540.0	508.0	20"	7-5/8" (or 6-5/8")	Z20G, Z30G, MZ20G			340.0
584.2         23"         7-5/8" (or 6-5/8")         Z20G, Z30G, MZ20G         459.0           609.6         24"         7-5/8" (or 6-5/8")         Z10G, Z20G, Z30G, MZ20G         540.0	527.1	20-3/4"	7-5/8" (or 6-5/8")	Z20G, Z30G, MZ20G			406.0
609.6 24" 7-5/8" (or 6-5/8") Z10G, Z30G, MZ05G, MZ10G, MZ20G 540.0	558.8	22"	7-5/8" (or 6-5/8")	Z20G, Z30G, MZ20G			434.0
609.6 24 /-5/8 [or 6-5/8] MZ05G, MZ10G, MZ20G 540.0	584.2	23″	7-5/8" (or 6-5/8")	Z20G, Z30G, MZ20G			459.0
660.4 26" 7-5/8" (or 6-5/8") Z20G, MZ20G 560.0	609.6	24"	7-5/8" (or 6-5/8")				540.0
	660.4	26"	7-5/8" (or 6-5/8")	Z20G, MZ20G			560.0

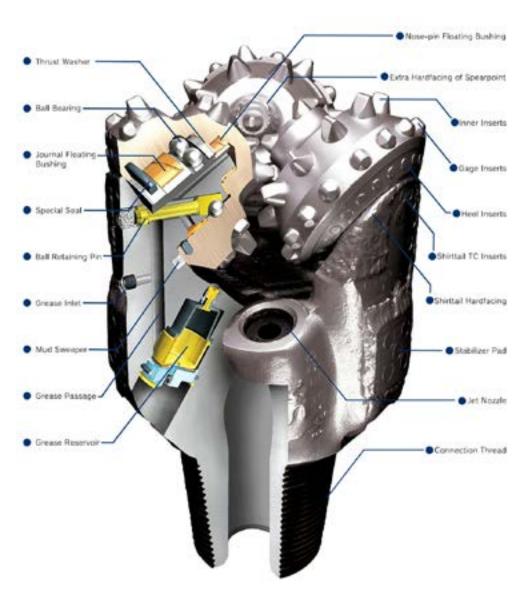
Bit S	bize	Connection thread	Make-u	p torque
in	mm	API Reg	ft.lbs	N.m
3-3/4" - 4-1/2"	95.2 - 114.3	2 - 3/8"	3000 - 3500	4000 - 4700
4 - 5/8" - 5"	117.5 - 127.0	2 - 7/8"	4500 - 5500	6100 - 7500
5 - 1/8" - 7-3/8"	130.2 - 187.3	3 - 1/2"	7000 - 9000	9500 - 12000
7- 1/2" - 9-3/8"	190.5 - 238.1	4 - 1/2"	12000 - 16000	16000 - 22000
9 - 1/2" - 14-3/4"	241.3 - 374.7	6 - 5/8"	28000 - 32000	38000 - 43000
14 - 5/8" - 26"	371.5 - 660.4	7 - 5/8"	34000 - 40000	46000 - 54000

# **Rock Bits Design**

# M - Series (X - Series) Sealed Journal Bearing Bits Design

The TSK M - Series (X - Series), floating bearings are made of special copper alloy and silver plated having the lowest heat generation property as well as superior anti - galling property.

TSK has been developing new seals made of HNBR.



# Type 05 IADC: 415, 417 05

# Application:

For drilling in very soft formations with low compressive strength.

### Tooth profile and arrangement:

The teeth have the largest tip diameter of all other bit types and the tallest and widest teeth can achieve higher ROP (Rate of Penetration).

The teeth are spaced widely and unevenly. The cones have a large offset.





# Type 10 IADC: 435, 437

# Application:

For drilling in soft formations with low compressive strength.

### Tooth profile and arrangement:

The teeth normally have smaller tip diameter and are shorter than type 05 bit, but taller and wider teeth can also achieve higher ROP.

The teeth are also spaced widely and unevenly. The cones have a large offset.



# **Type 15** IADC: 445, 447

### Application:

For drilling in soft formations with low compressive strength.

### Tooth profile and arrangement:

The main teeth are normally with smaller tip diameter and are shorter than type 10 bit, but have the same sharpness.

The teeth are also spaced widely and unevenly. The cones have a large offset.





# **Type 20** IADC: 515, 517

# Application:

For drilling in soft to medium formations with low compressive strength.

# Tooth profile and arrangement:

The main teeth normally have smaller tip diameter and are shorter than type 15 bit.

The teeth are also spaced unevenly and the cones have a large offset.



# **Type 30** IADC: 532, 535, 537

### Application:

This type is generally used for drilling in medium formations with low compressive strength, but it also performs well in semi-abrassive formations.

### Tooth profile and arrangement:

The tip diameter is similar to type 20 bit, but in order to avoid tip damaged during drilling, teeth height is set low.

The teeth are also spaced unevenly and the cones have moderate degree of offset.



# Type 40 IADC: 612, 615, 617

### Application:

For drilling in medium hard formations with high compressive strength.

### Tooth profile and arrangement:

To minimize tip damage during crushing by main teeth in medium hard formations, teeth have a smaller diameter and lower height than type 30 bit.

The teeth are also spaced unevenly and the cones have moderate degree of offset.





### IADC: 622, 625, 627 Type 50

# Application:

For drilling in semi-abrasive, medium hard formations with high compressive strength.

# Tooth profile and arrangement:

The teeth height is kept low to prevent tip damage during continous crushing under heavy WOB (Weight on Blt) conditions.

The teeth are also spaced unevenly but the cones have no offset.



### IADC: 632, 635, 637 Type 60

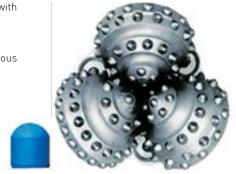
### Application:

For drilling in semi-abrasive, medium hard formations with high compressive strength.

# Tooth profile and arrangement:

The main teeth have a conical shape to allow continuous crushing under heavy WOB conditions.

The cones have no offset.



### Type 70 IADC: 732, 737

### Application:

For drilling in abrasive and hard formations.

# Tooth profile and arrangement:

The main teeth have a double conical shape to allow continuous crushing under heavy WOB conditions.

There is no cone offset.





# Application:

For drilling in abrasive and extremely hard formations.

### Tooth profile and arrangement:

Both main and gage teeth have round shape to allow continuous crushing under heavy WOB conditions in order to prevent tip damage.

There is no cone offset.





# Steel Tooth Bits Products

# Type SS IADC: 111, 113, 114, 115, 116, 117

### Application:

For drilling in very soft formations with low compressive strength.

### Tooth profile and arrangement:

The SS type has the tallest and widest tooth. The wide tooth spacing and a large offset allows a higher ROP (Rate of Penetration).

# Remarks:

Hardfacing areas are shown in blue in the diagram below. The gage faces and the inner teeth back faces are also hardfaced.



# **Type S** IADC: 121, 123, 124, 125, 126, 127

### Application:

For drilling in soft formations with low compressive strength.

### Tooth profile and arrangement:

This type has a similar tooth size to type SS bit. The wide tooth spacing and a large offset allows a higher ROP.

This type has slightly more teeth than SS type.

# Remarks:

Hardfacing areas are shown in blue in the diagram below. The gage faces and the inner teeth back faces are also hardfaced.



# **Type MSS** IADC: 131, 133, 134, 135, 136, 137

# Application:

For drilling in soft formations with low compressive strength.

# Tooth profile and arrangement:

This type has a moderate tooth height and interruption on the inner and outer sides of the gage teeth. In addition, the gage teeth are reinforced by T-shape to obtain a stronger gage face than SS or S type. Tooth spacing is also adjusted for optional drilling of these types of formations.

# Remarks:

Hardfacing areas are shown in blue in the diagram below.

The gage faces and the inner teeth back faces are also hardfaced.

# **Type MS** IADC: 211, 213, 214, 215, 216, 217

### Application:

For drilling in medium formations with high compressive strength.

# Tooth profile and arrangement:

This type has a moderate tooth size and closer tooth spacing. The gage teeth are reinforced by T-shape to obtain a stronger gage face.

# Remarks:

Hardfacing areas are shown in blue in the diagram below. The gage faces and the inner teeth back faces are also hardfaced.



# **Type MH** IADC: 231, 233, 234, 235, 236, 237

# Application:

For drilling in medium hard formations with high compressive strength.

### Tooth profile and arrangement:

This type has a moderate tooth size and closer tooth spacing. The gage teeth are reinforced by T-shaped to obtain a stronger gage face.

# Remarks:

Hardfacing areas are shown in blue in the diagram below.

The gage faces and the inner teeth back faces are also hardfaced.





# Application:

For drilling in semi-abrasive and hard formations.

# Tooth profile and arrangement:

This type has more and shorter teeth and also closer tooth spacing.

The gage teeth are reinforced by T-shape to obtain a stronger gage face.

# Remarks:

As there is tendency for hardfacing on teeth to chip or break-off during crushing in hard and abrasive formations under heavy WOB conditions, the main teeth and sides of gage teeth are not hardfaced. However the gage faces are hardfaced.





# **Type H** IADC: 321, 323, 324, 325, 326. 327

# Application:

For drilling in abrasive and hard formations.

# Tooth profile and arrangement:

While the size and numbers of teeth are the same as type HS, a web connects 2 or 3 gage teeth to obtain a large hardfacing area.

# Remarks:

For the same reason as type HS, only the gage faces are hardfaced. However the inner teeth are not hardfaced.





# **Type HS** IADC: 341, 343, 344, 345, 346, 347

# Application:

For drilling in abrasive and extremely hard formations.

# Tooth profile and arrangement:

While gage teeth are the same as type H, the inner teeth have a curve shape for drilling of these types of formations.

# Remarks:

For the same reason as type HS, only the gage faces are hardfaced. However the inner teeth are not hardfaced.





# Stabilizers







Hole Size	Body Diameter	Overal Length	Blade Length	Blade Width
7-3/8 - 7-7/8	5-3/4-6-1/	47	10	1-3/4
8-3/8-9	6-7	47	10	1-3/4
9-3/8-9-7/8	6-3/4-8	55	12	1-3/4
10-5/8-11	7-8	55	12	1-3/4
11-1/2-12-1/4	7-9-5/8	55	12	1-3/4
14-3/4-15	7-3/4-10	63	15	2-3/16
17-17-1/2	7-3/4-11	63	18	2-3/8
22	8-11	67	18	2-1/2
26	8-11	67	18	2-1/2

All dimension are in inches.

Welded Blade Stabilizer

Integral Blade Stabilizer

Sleeve Type Stabilizer

# Hole opener



		Tool Joint		
Hole Diameter (in)	Pilot Diameter (in)	Box or Pin	Box	
47	26	8-5/8 & 7-5/8REG	7-5/8REG	
42	26	8-5/8 & 7-5/8REG	7-5/8REG	
36	26	8-5/8 & 7-5/8REG	7-5/8REG	
26	17	8-5/8 & 7-5/8REG	7-5/8REG	
17 - 1/2	10 - 5/8	7-5/8REG	6-5/8REG	
17	10 - 5/8	7-5/8REG	6-5/8REG	
14 - 3/4	10 - 5/8	7-5/8REG	6-5/8REG	
12 - 1/4	8 - 1/2	6-5/8REG	4 - 1/2REG	
12	8 - 1/2	6-5/8REG	4 - 1/2REG	
10 - 5/8	8 - 1/2	6-5/8REG	4 - 1/2REG	
8 -5/8	5 - 5/8	4-1/2REG	3 - 1/2REG	
8 - 1/2	5 - 5/8	4-1/2REG	3 - 1/2REG	
7 -5/8	5 - 5/8	4-1/2REG	3 - 1/2REG	









Bracket Type

Pin Type (Replaceable Cutters) Type S

Туре М

Туре Н

Type K-30

# **Roller Cutter**

On the strength of our wide experience of manufacturing Rock Bits, we have developed and are also supplying a Roller Cutter for Shield Tunneling Machines, etc.

These are manufactured under strict quality control system, and these products are being supplied to major Heavy Engineering Enterprises.



# Special Features of TIX-TSK Roller Cutter

1. In principle, production of Roller Cutter is on order to order basis and in this regard any enquiry will be highly appreciated.

2. The Tungsten Carbide material used for hardfacing has been developed by ourselves using the experience gained in making Rock Bits. It has an excellent reputation for wear resistance and durability and is much appreciated by its users.

3. The unit is normally supplied with a floating (metal) seal, but depending on design requirements, our own developed rectangular (rubber) seal can be supplied. This uses HNBR material, and has a better wear resistance performance.

# **Roller Cutter**

# For Shield Tunneling Machine & For T.B.M.

# Tungsten Carbide Insert Disk Cutter



Ring Replaceable Disk Cutter



# Cone Type Center Cutter



# Ring Replaceable Center Cutter



# For Tunneling Machine

Disk Type (Tungsten Carbide Insert Type)



Tungsten Carbide Insert Type



# Disk Type (Steel Tooth Hardfacing Type)



# Cone Cutter



Single Cone Type 2 and 3 Cone Type are available.



IPS - Integradora de Perforaciones y Servicios - 2016 / 2017