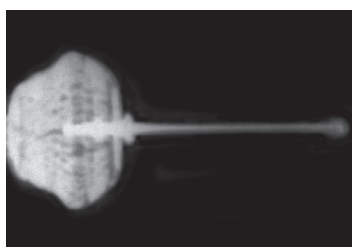


# Shaped Charge Jet Perforators

## PERFORMANCE SUMMARY



**JRC**

**JET RESEARCH CENTER®**

## DEEP-PENETRATING SHAPED CHARGES

Gun Size	Shot Density, spf (spm)	Phasing	JRC PIN	Charge Name	Penetration, in. (mm)	Entrance Hole, in. (mm)	Casing Size, in. (mm)	Target Strength, psi	Explosive Load, gram	Case Material	Data Type
<b>CAPSULE GUNS</b>											
1 <sup>1</sup> / <sub>16</sub>	4 (13)	0	100005450	1 <sup>1</sup> / <sub>16</sub> -in. DYNA STAR, RDX	10.5 (266.7)	0.39 (9.9)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,149	13.4	Steel	19B
1 <sup>1</sup> / <sub>16</sub>	8 (26)	0	101521848	080 MaxForce®, DEEP STAR, HMX	19.9 (505.5)	0.26 (6.6)	4 <sup>1</sup> / <sub>2</sub> (114.3)	7,170	8.0	Steel	19B
2 <sup>1</sup> / <sub>8</sub>	8 (26)	0	101210198	2 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM DEEP STAR, HMX	30.7 (779.8)	0.35 (8.9)	5 <sup>1</sup> / <sub>2</sub> (139.7)	5,189	15.9	Steel	RP43
2 <sup>1</sup> / <sub>8</sub>	8 (26)	0/45/90	101210198	2 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM DEEP STAR, HMX	20.6 (523.2)	0.30 (7.6)	5 <sup>1</sup> / <sub>2</sub> (139.7)	6,740	15.9	Steel	19B
2 <sup>1</sup> / <sub>8</sub>	6 (20)	0	100005448	2 <sup>1</sup> / <sub>8</sub> -in. DYNA STAR, RDX	16.6 (421.9)	0.42 (10.7)	5 <sup>1</sup> / <sub>2</sub> (139.7)	5,538	15.5	Steel	RP43
2 <sup>1</sup> / <sub>8</sub>	4 (13)	0	100005448	2 <sup>1</sup> / <sub>8</sub> -in. DYNA STAR, RDX	15.5 (393.7)	0.35 (8.9)	5 <sup>1</sup> / <sub>2</sub> (139.7)	5,292	15.5	Steel	19B
<b>PORTED GUNS</b>											
4	4 (13)	90	101288857	4-in. MILLENNIUM EXPRESS GSC RDX	27.18 (690.4)	0.51 (13.0)	5 <sup>1</sup> / <sub>2</sub> (139.7)	5600	19.5	Steel	QC
<b>SLICKWALL GUNS</b>											
3 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101618994	3 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM EXPRESS IS SDP RDX	37.9 (962.6)	0.38 (9.7)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,745	21.0	Steel	QC
3 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101366678	3 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM IS HMX	38.3 (972.8)	0.40 (10.2)	4 <sup>1</sup> / <sub>2</sub> (114.3)	6,200	21.0	Steel	QC
3 <sup>1</sup> / <sub>8</sub>	4 (13)	90	101204537	4-in. Basic MILLENNIUM EXPRESS RDX	16.7 (422.9)	0.50 (12.7)	5 <sup>1</sup> / <sub>2</sub> (139.7)	6,277	19.5	Steel	QC
4	4 (13)	90	101204537	4-in. Basic MILLENNIUM EXPRESS RDX	24.9 (633.5)	0.50 (12.7)	5 <sup>1</sup> / <sub>2</sub> (139.7)	6,277	19.5	Steel	QC
3 <sup>1</sup> / <sub>8</sub>	4 (13)	90	101310802	4-in. Twisted Strip MILLENNIUM EXPRESS RDX W/ TWIST LOCK	16.7 (422.9)	0.50 (12.7)	5 <sup>1</sup> / <sub>2</sub> (139.7)	6,277	19.5	Steel	QC
4	4 (13)	90	101310802	4-in. Twisted Strip MILLENNIUM EXPRESS RDX W/ TWIST LOCK	24.9 (633.5)	0.50 (12.7)	5 <sup>1</sup> / <sub>2</sub> (139.7)	6,277	19.5	Steel	QC
<b>SCALLOPED GUNS</b>											
1 <sup>1</sup> / <sub>16</sub>	4 (13)	0	100157028	1 <sup>1</sup> / <sub>16</sub> -in. MILLENNIUM, HMX, IS	11.3 (288.0)	0.21 (5.3)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,967	3.4	Steel	RP43
1 <sup>1</sup> / <sub>16</sub>	6 (20)	60	100157028	1 <sup>1</sup> / <sub>16</sub> -in. MILLENNIUM, HMX, IS	8.3 (210.8)	0.23 (5.8)	2 <sup>1</sup> / <sub>8</sub> (73.0)	6,949	3.4	Steel	19B
2	6 (20)	60	101208224	2-in. MILLENNIUM, HMX, IS	18.3 (464.8)	0.22 (5.6)	2 <sup>1</sup> / <sub>8</sub> (73.0)	6,019	6.8	Steel	19B
2	6 (20)	60	101603801	070 MaxForce®, HMX, IS	20.3 (515.6)	0.24 (6.1)	2 <sup>1</sup> / <sub>8</sub> (73.0)	5,697	7.0	Steel	19B
2 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101418095	2 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM II, HMX, IS	24.5 (622.3)	0.32 (8.1)	3 <sup>1</sup> / <sub>2</sub> (88.9)	5,996	11.1	Steel	19B
2 <sup>3</sup> / <sub>8</sub>	6 (20)	60	101233817	2 <sup>3</sup> / <sub>8</sub> -in. MILLENNIUM, HMX	26.0 (660.4)	0.30 (7.6)	4 <sup>1</sup> / <sub>2</sub> (114.3)	6,394	15.0	Steel	19B
2 <sup>3</sup> / <sub>8</sub>	6 (20)	60	101318485	2 <sup>3</sup> / <sub>8</sub> -in. MILLENNIUM, HNS	27.5 (699.8)	0.30 (7.6)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,694	15.1	Steel	QC
2 <sup>1</sup> / <sub>2</sub>	6 (20)	60	101826652	175 MaxForce®, HMX	38.6 (980.4)	0.37 (9.4)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,405	17.5	Steel	19B
2 <sup>1</sup> / <sub>2</sub> (HW)	6 (20)	60	101233817	2 <sup>3</sup> / <sub>8</sub> -in. MILLENNIUM, HMX	30.0 (762.0)	0.35 (8.9)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,124	15.0	Steel	19B'
2 <sup>1</sup> / <sub>2</sub>	6 (20)	60	101388406	2 <sup>1</sup> / <sub>2</sub> -in. MILLENNIUM, HMX	26.6 (676.4)	0.38 (9.7)	4 <sup>1</sup> / <sub>2</sub> (114.3)	6,522	17.5	Steel	QC
2 <sup>1</sup> / <sub>2</sub>	6 (20)	60	101388407	2 <sup>1</sup> / <sub>2</sub> -in. MILLENNIUM, HNS	22.8 (579.1)	0.28 (7.1)	4 <sup>1</sup> / <sub>2</sub> (114.3)	6,859	18.5	Steel	19B
3 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101366678	3 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM, HMX, IS	33.9 (861.1)	0.34 (8.7)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,598	21.0	Steel	19B
3 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101618994	3 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM EXPRESS, RDX, IS	37.9 (965.1)	0.38 (9.7)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,460	21.0	Steel	QC
3 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101233819	3 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM, HMX	37.5 (952.1)	0.45 (11.4)	4 <sup>1</sup> / <sub>2</sub> (114.3)	5,754	25.0	Steel	19B
3 <sup>1</sup> / <sub>8</sub>	6 (20)	60	101365876	3 <sup>1</sup> / <sub>8</sub> -in. MILLENNIUM, HNS	22.1 (561.3)	0.31 (7.9)	4 <sup>1</sup> / <sub>2</sub> (114.3)	6,578	25.0	Steel	19B
4	4 (13)	90	101210636	4-in. MILLENNIUM, HMX	43.4 (1102.4)	0.38 (9.7)	5 <sup>1</sup> / <sub>2</sub> (139.7)	6,365	39.0	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	5 (16)	60	101210636	4-in. MILLENNIUM, HMX	39.6 (1005.8)	0.37 (9.4)	7 (177.8)	6,775	39.0	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	12 (39)	150/30	101210674	4 <sup>1</sup> / <sub>2</sub> -in. MILLENNIUM, HMX	26.8 (680.7)	0.38 (9.7)	7 (177.8)	8,484	22.7	Steel	RP43
4 <sup>1</sup> / <sub>2</sub>	5 (16)	72	102054947	390 MaxForce®, HMX	61.6 (1564.6)	0.33 (8.4)	7 (177.8)	5,513	39.0	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	5 (16)	72	102624465	4 <sup>1</sup> / <sub>2</sub> -in. MILLENNIUM II, HMX	53.3 (1353.8)	0.43 (10.9)	7 (177.8)	5,420	39.0	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	5 (16)	60	101210636	4-in. MILLENNIUM, HMX	43.6 (1107.4)	0.35 (8.9)	7 (177.8)	5,518	39.0	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	12 (39)	150/30	101826652	175 MaxForce®, HMX	36.5 (927.1)	0.38 (9.6)	7 (177.8)	5,937	17.5	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	12 (39)	150/30	101210674	4 <sup>1</sup> / <sub>2</sub> -in. MILLENNIUM, HMX	24.4 (619.8)	0.38 (9.7)	7 (177.8)	6,322	22.7	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	4 (13)	180	101287306	4-in. SUPER DP, HNS	30.2 (767.1)	0.29 (7.4)	7 <sup>1</sup> / <sub>2</sub> (193.7)	6,349	39.0	Steel	19B
4 <sup>1</sup> / <sub>2</sub>	5 (16)	60	101287306	4-in. SUPER DP, HNS	31.2 (792.5)	0.33 (8.4)	7 (177.8)	7,559	39.0	Steel	19B
6 <sup>1</sup> / <sub>4</sub>	18 (59)	60/120	101972806	330 MaxForce®, HMX	37.4 (950.0)	0.40 (10.2)	9 <sup>1</sup> / <sub>2</sub> (244.5)	5,241	33.0	Steel	19B
7	12 (39)	135/45	102054947	390 MaxForce®, HMX	55.7 (1414.8)	0.32 (8.1)	9 <sup>1</sup> / <sub>2</sub> (244.5)	5,760	39.0	Steel	19B
7	12 (39)	135/45	101207997	7-in. MILLENNIUM, HMX	43.3 (1099.8)	0.36 (9.1)	9 <sup>1</sup> / <sub>2</sub> (244.5)	7,006	39.0	Steel	RP43
7	12 (39)	135/45	101702911	4 <sup>1</sup> / <sub>2</sub> -in. MILLENNIUM II, HMX	47.1 (1196.2)	0.43 (10.9)	9 <sup>1</sup> / <sub>2</sub> (244.5)	5,982	39.0	Steel	19B
7	12 (39)	135/45	101207997	7-in. MILLENNIUM, HMX	38.7 (983.0)	0.42 (10.7)	9 <sup>1</sup> / <sub>2</sub> (244.5)	6,397	39.0	Steel	19B

# MAXFORCE®-FRAC

Gun Size (in.)	Shot Density, spf (spm)	Phasing	JRC PIN	Charge Name	Penetration, in. (mm)	Entrance Hole, in. (mm)	Entrance Hole, Variance	Target Casing Specification	Explosive Load, gram	Data Type
2¼	6 (20)	60	102740045	150 MaxForce®-FRAC, HMX, IS	23.7 (601.9)	0.36 (9.1)	2.4%	4½-in. 13.5-lb P-110	15.0	Barrel-QC
2¼	6 (20)	60	102745134	150 MaxForce®-FRAC, RDX, IS	22.5 (571.5)	0.35 (8.9)	2.4%	4½-in. 13.5-lb P-110	15.0	Barrel-QC
3½	6 (20)	60	102127122	210 MaxForce®-FRAC, HMX, IS	17.8 (452.1)	0.49 (12.4)	5.8%	4½-in. 11.7-lb L-80	21.0	Barrel-QC
3½	6 (20)	60	102045430	210 MaxForce®-FRAC, RDX, IS	14.4 (365.8)	0.46 (11.7)	4.7%	4½-in. 11.7-lb L-80	21.0	Barrel-QC
3½	6 (20)	60	102732983	230 MaxForce®-FRAC, HMX, IS	36.2 (919.5)	0.42 (10.7)	3.0%	4½-in. 13.5-lb P-110	23.0	Barrel-QC
3½	6 (20)	60	102736069	230 MaxForce®-FRAC, RDX, IS	31.6 (802.6)	0.41 (10.4)	2.3%	4½-in. 13.5-lb P-110	23.0	Barrel-QC
3½	6 (20)	60	102127122	210 MaxForce®-FRAC, HMX, IS	--	0.45 (11.4)	11.7%	5½-in. 17-lb L-80	21.0	Barrel
3½	6 (20)	60	102045430	210 MaxForce®-FRAC, RDX, IS	--	0.43 (10.9)	13.1%	5½-in. 17-lb L-80	21.0	Barrel
3½	6 (20)	60	102732983	230 MaxForce®-FRAC, HMX, IS	--	0.40 (10.1)	4.3%	5½-in. 23-lb P-110	23.0	Barrel
3½	6 (20)	60	102736069	230 MaxForce®-FRAC, RDX, IS	--	0.40 (10.1)	3.5%	5½-in. 23-lb P-110	23.0	Barrel

# BIG HOLE

Gun Size (in.)	Shot Density, spf (spm)	Phasing	JRC PIN	Charge Name	Penetration, in. (mm)	Entrance Hole, in. (mm)	Casing Size, in. (mm)	Target Strength, psi	Explosive Load, gram	Case Material	Data Type
2¼	6 (20)	60	101206793	2¼-in. BH, RDX	5.5 (139.7)	0.67 (17.0)	4½ (114.3)	6,109	14.7	Steel	RP43
3½	10 (33)	135/45	101351605	3½-in. MIRAGE, HMX, LD	3.8 (96.5)	0.64 (16.3)	5 (127.0)	6,100	14.0	Zinc	QC
3½	12 (39)	135/45	101351605	3½-in. MIRAGE, HMX, LD	4.1 (105.4)	0.63 (16.0)	5½ (139.7)	6,100	14.0	Zinc	QC
4½	12 (39)	150/30	100005326	4½-in. BH OMNI, RDX, LD	5.5 (140.0)	0.65 (16.5)	7 (177.8)	7,346	22.7	Zinc	RP43
4½	12 (39)	150/30	100157006	4½-in. BH, HMX	7.0 (178.3)	0.75 (19.1)	7 (177.8)	5,723	25.0	Steel	QC
4½	12 (39)	150/30	100005311	4½-in. SUPER BH, RDX	6.3 (160.0)	0.93 (23.6)	7 (177.8)	6,982	28.0	Steel	RP43
4½	12 (39)	150/30	100156995	4½-in. SUPER HOLE, HMX	5.0 (127.3)	0.96 (24.4)	7 (177.8)	5,016	28.0	Steel	RP43
4½	12 (39)	26/129	100156995	4½-in. SUPER HOLE, HMX	6.0 (152.4)	0.90 (22.8)	7 (177.8)	6,009	28.0	Steel	19B¹
4½	12 (39)	150/30	101233690	4½-in. SUPER HOLE, HMX, LD	5.3 (134.6)	0.85 (21.6)	7 (177.8)	5,622	28.0	Zinc	RP43
4½	18 (59)	135/45	100156990	4½-in. BH, RDX	6.2 (157.0)	0.73 (18.5)	7 (177.8)	5,553	20.0	Steel	RP43
5	12 (39)	150/30	100005311	4½-in. SUPER HOLE, RDX	6.9 (175.3)	0.91 (23.1)	7 (177.8)	5,192	28.0	Steel	RP43
5	12 (39)	150/30	100005311	4½-in. SUPER HOLE, RDX	6.6 (168.9)	0.83 (21.1)	7½ (193.7)	7,877	28.0	Steel	RP43
5	12 (39)	150/30	100156995	4½-in. SUPER HOLE, HMX	6.0 (152.4)	1.00 (25.4)	7 (177.8)	6,487	28.0	Steel	QC
5	12 (39)	135	101307494	5-in. MIRAGE, RDX, LD	6.0 (152.4)	0.90 (22.9)	7½ (193.7)	6,551	32.0	Zinc	19B
5½	12 (39)	135	101307494	5-in. MIRAGE, RDX, LD	6.6 (167.6)	0.88 (22.4)	7½ (193.7)	5,576	32.0	Zinc	19B
5¾	18 (59)	60/120	101688614	5¾-in. MIRAGE, RDX, LD	6.5 (165.1)	0.94 (23.9)	8½ (219.1)	6,050	28.0	Zinc	QC
6½	12/14 (39/46)	135/45/138	101304878	6½-in. MIRAGE, RDX, LD	5.6 (142.2)	1.07 (27.2)	8½ (219.1)	7,043	47.0	Zinc	19B
6½	12/14 (39/46)	135/45/138	101304878	6½-in. MIRAGE, RDX, LD	6.8 (172.7)	0.91 (23.1)	9½ (244.5)	5,088	47.0	Zinc	19B
6½	12/14 (39/46)	135/45/138	101304878	6½-in. MIRAGE, RDX, LD	6.8 (172.7)	0.90 (22.8)	9½ (250.8)	6,949	47.0	Zinc	19B¹
6½	14 (46)	135	101304878	6½-in. MIRAGE, RDX, LD	6.6 (167.6)	0.72 (19.3)	10½ (257.2)	6,471	47.0	Zinc	19B¹
7	12/14 (39/46)	138	101329124	6½-in. MIRAGE, HMX, LD	6.9 (175.3)	1.00 (25.4)	9½ (244.5)	5,740	47.0	Zinc	19B
7	12/14 (39/46)	135/45/138	101304878	6½-in. MIRAGE, RDX, LD	6.1 (154.9)	1.07 (27.2)	9½ (244.5)	6,178	47.0	Zinc	19B
7	12/14 (39/46)	135/45/138	101213474	7-in. SUPER HOLE, RDX	5.8 (147.3)	1.29 (32.8)	9½ (244.5)	5,975	56.5	Steel	19B
7	18 (59)	60/120	101711688	7-in. MIRAGE, HMX, LD	7.6 (194.1)	1.03 (26.2)	9½ (250.8)	5,950	39.0	Zinc	QC
7	12/14 (39/46)	135/45/138	101228037	7-in. MIRAGE SUPER HOLE,	4.7 (119.4)	1.03 (26.2)	9½ (244.5)	5,746	39.0	Zinc	19B
7	18 (59)	60/120	101711688	7-in. MIRAGE, HMX, LD	7.6 (194.1)	1.12 (28.4)	9½ (250.8)	5,950	39.0	Zinc	QC
7	18 (59)	60/120	102599833	7-in. MIRAGE, RDX, LD	6.1 (155.0)	1.06 (26.9)	9½ (244.5)	5,950	39.0	Zinc	QC
7	18 (59)	60/120	101833421	7-in. MIRAGE, HMX, LD	6.5 (165.1)	1.09 (27.7)	9½ (244.5)	6,446	40.0	Zinc	19B
7	18 (59)	60/120	102351458	7-in. HMX BH	6.4 (162.6)	1.08 (27.4)	9½ (244.5)	6,474	39.0	Steel	19B

\*19B¹ is Registered Special API 19B Witnessed Test

Charge performance will vary due to well conditions.

For testing of perforating charges at wellbore conditions, contact the Jet Research Center.

IS = Industry Standard Design    SH = Super Hole  
 BH = Big Hole    HW = Heavy Wall Gun  
 LD = Low Debris

**PRODUCT SALES, RESEARCH, TESTING, AND MANUFACTURING FACILITY**

**JRC**

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