Wireline Hardware **Logging Instruments** **EBFire®** **TCP Systems** **Gun Systems**

V.9.1

Brochures

Cement Bond Tools
ControlFire®
Detectors (Highly Integrated), & MWD
Free Point
PerfECTA®
Spectra®
Spectra® Cutter Summary Chart
T-Set® Setting Tools

HUNTING
Hunting Titan

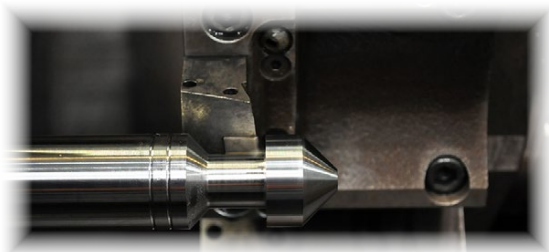
Right Tools. Right Location. Right Time.

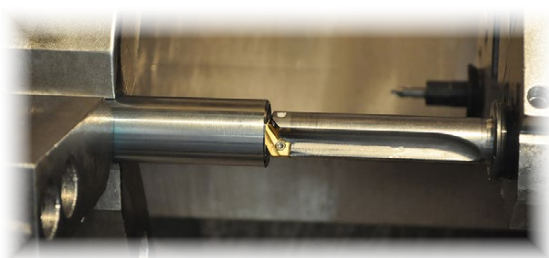
Petitioner GR Energy Services - Ex. 1009, p. Cover

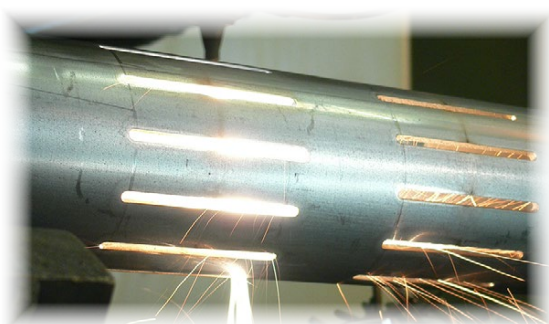
Back to Hunting Titan

Wireline Hardware (*Select Links below*)









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APPLICATIONS

- Cased hole wireline support
- Perforating
- Production logging
- Wireline steering tool services



FEATURES

- Compatible with all types of armored wireline cable
- Built in weak point and standard slickline fishing head
- High current tractor conversion kits available
- H_2S resistant models available
- Can be manufactured for 500°F (260°C) operations upon request
- Customization available for specific requirements

BENEFITS

- Interchangeable parts allow multiple use with different types of cable
- Reduced operating costs

Cable heads play a vital role in all logging and perforating operations as they provide mechanical and electrical connections between the wireline cable and tool string. A weak point inside the cable head bears the entire load of the tool string weight.

Hunting Titan cable heads are constructed of high quality, high strength steel (H_2S resistant upon request) ensuring mechanical durability. The electric bulkhead protects the electrical connections from all types of corrosive wellbore fluids. Contact assemblies can be changed out for high power loads demanded by tractor operations. Cable mechanical integrity is guaranteed by the high quality weak point incorporated inside the head ensuring clean release of a stuck tool string. Standard slickline fishing heads built into Hunting Titan cable heads allow for quick and easy fishing operations.

A four piece logging head can be ordered upon request that allows the attachment of standard weight bars into the logging head.

HARDWARE SPECIFICATIONS

O.D. (in)[mm]	Type	Max. Temp.† (°F)[°C]	Max. Pressure (psi)[MPa]	Length (in)[mm]	Weight (lbm)[kg]	Max. Voltage (VDC)	Max. Current (mA)	Max. Tension (lbf)[kN]	Thread
1 [25]	Clamp Ring Type	400 [204]	20,000 [138]	11.3 [287]	1.9 [0.9]	600	2,000	24,000 [107]	13/16”-16 GO Pin
1-7/16 [37]	Cone Type II	400 [204]	20,000 [138]	12.4 [315]	3.6 [1.6]	600	2,000	42,000 [187]	1-3/16”-12 GO Pin
1-11/16 [43]	Cone Type II	400 [204]	20,000 [138]	12.4 [315]	5.4 [2.4]	600	2,000	42,000 [187]	1-3/16”-12 GO Pin

† Viton O-rings need to be used above 325°F (163°C)

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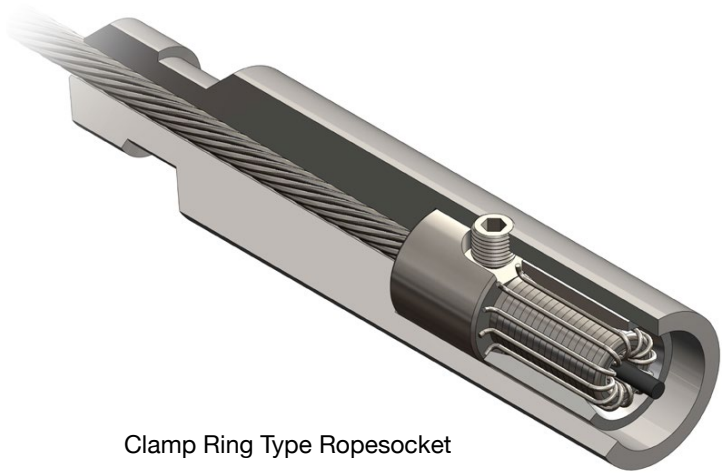
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ASSEMBLY PART NUMBERS

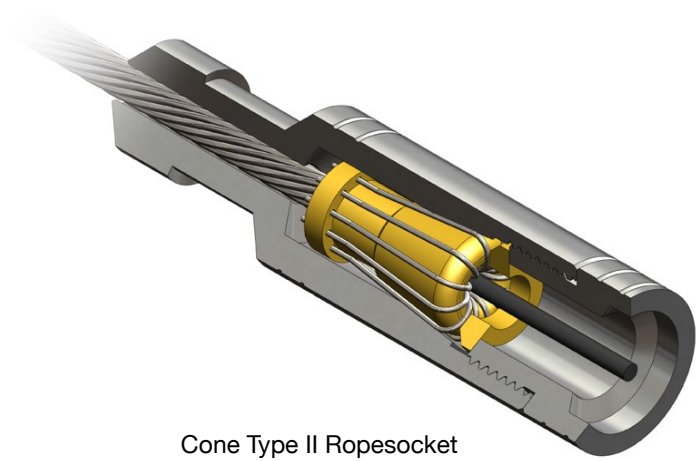
The following table lists the assembly part numbers of electrical cable heads that are compatible with the most common electric wireline diameters. Contact your local Hunting Titan representative for the availability of cable heads not listed.

O.D. (in)[mm]	Type	Contact Kit	Electric Wireline Diameter (in)[mm]				
			7/32 [6]	0.288 [7]	5/16 [8]	15/32 [12]	0.474 [12]
1 [25]	Clamp Ring	3901-000-002	3910-*22-030§ 3910-*22-035‡	3910-*28-040	3910-*31-043	-	-
1-7/16 [37]	Cone Type II	3903-000-002	3916-*22-030§ 3916-*22-035‡	3916-*28-040	3916-*31-043	3916-*47-049	3916-*474-065
	4 Piece Cone Type II†		3946-*22-030§ 3946-*22-035‡	3946-*28-040	3946-*31-043	3946-*47-049	3946-*474-065
1-11/16 [43]	Cone Type II	3903-000-002	5916-*22-030§ 5916-*22-035‡	5916-*28-040	5916-*31-043	5916-*47-049	5916-*474-065
	4 Piece Cone Type II†		5946-*22-030§ 5946-*22-035‡	5946-*28-040	5946-*31-043	5946-*47-049	5946-*474-065

* Use “0” for standard service; “N” for H_2S service
† Weight bars need to be ordered separately
§ 0.030” strand diameter
‡ 0.035” strand diameter



Clamp Ring Type Ropesocket

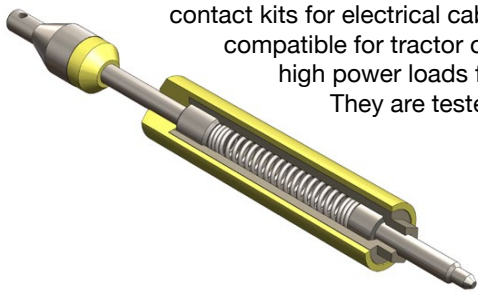


Cone Type II Ropesocket

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ACCESSORIES

Contact kits are available to make repair and maintenance of your cable heads rapid and simple. Hunting Titan also supplies contact kits for electrical cable heads that are compatible for tractor operations which require high power loads for long periods of time. They are tested to 600V and 6,000mA.



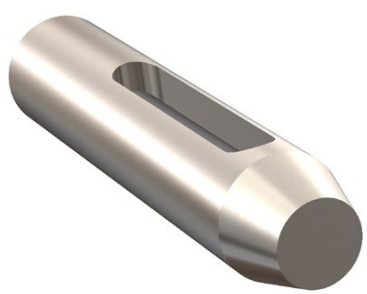
Cable Head Size (in)[mm]	Conventional Contact Kit	Tractor Contact Kit
1 [25]	3901-000-002	-
1-7/16 [37]	3903-000-002	3903-000-502
1-11/16 [43]	3903-000-002	3903-000-502

Protect your wireline cable from damage during rig-up and rig–down operations by using a gooseneck. Hunting Titan goosenecks are specifically designed to fit all cable heads and provide the optimal radius to eliminate cable deformation while maintaining an easy to use compact size.

Part Number: 1051-GNK-050



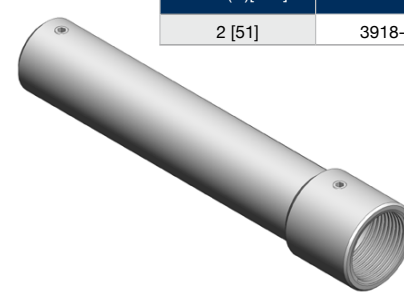
Correct weakpoint construction is critical to perform any wireline operation safely. The ropesocket alignment tool ensures correct position and alignment of the clamp ring over the ropesocket inside the cable head.



Cable Head Size (in)[mm]	Part Number
1 [25]	3910-000-005
1-7/16 [37]	3914-000-005
1-11/16 [43]	3914-000-005

The 2” (51 mm) fishing neck assembly can be easily slid over any 1-7/16” (37 mm) logging head. This provides a large smooth surface for fishing grapples to latch onto.

O.D. (in)[mm]	Part Number	Lower Head Connection
2 [51]	3918-000-000	2”-6 Acme Box



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APPLICATIONS

- Perforating
- Plug / packer setting operations

FEATURES

- Utilize spinning collars

BENEFITS

- Avoid having to turn entire toolstring during makeup
- Available in all Hunting Titan distribution warehouses worldwide

Quick Change Assemblies are typically used to connect collar locating tools with perforating guns or plug setting tools. By incorporating spinning collars, there is no need to rotate the full toolstring when connecting guns to the electrical cable head. Different types of electrical connections are available to suit the needs of particular operations.

HARDWARE SPECIFICATIONS

O.D. (in)[mm]	Assembly Part Number†	Contact Kit	Max. Temp.‡ (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)	Max. Tension (lbf)[kN]	Upper Head Connection	Lower Head Connection
2-3/4 [70]	0271-100-040	0256-100-032	400 [204]	20,000 [138]	600	2,000	126,000 [560]	1-5/8”-6 Acme Pin	2-3/8”-6 Acme GO Box
	0260-100-040	0260-100-032					126,000 [560]	1-5/8”-6 Acme Pin	2-3/8”-6 Acme SIE Box
3-1/8 [79]	0256-100-040	0256-100-032	400 [204]	20,000 [138]	600	2,000	126,000 [560]	1-5/8”-6 Acme Pin	2-3/4”-6 Acme GO Box
	0256-000-070	0256-000-052					126,000 [560]	1-3/16”-12 GO Box	2-3/4”-6 Acme GO Box
	0260-100-000	0260-100-032					126,000 [560]	1-5/8-6” Acme Pin	2-3/8”-6 Acme SIE Box

† Detonator blocks, firing head seal blocks and contact block assemblies need to be purchased separately

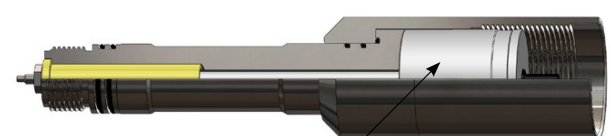
‡ Viton O-rings need to be used above 325°F (163°C)

ACCESSORIES

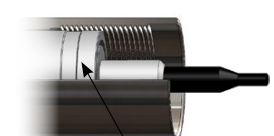
O.D. (in)[mm]	Detonator Block		Firing Head Seal Block Teardrop Connection§
	Block	Pig Tail Assembly	
2-3/4 [70]	0271-000-013	0256-000-010	0271-000-020
3-1/8 [79]	0256-000-013	0256-000-010	0256-000-020

§ Contact kit 3903-000-002

Detonator blocks and firing head seal blocks are used to house electrical connections to the firing head inside the GO style Quick Change Assembly. Pig tail and teardrop connection types are available.



Detonator block with pig tail assembly

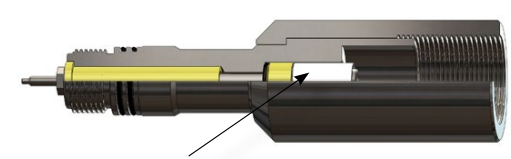


Firing head seal block with teardrop connection



SIE style Quick Change Assemblies utilize a contact block assembly (0260-000-040) that accepts connections to firing heads using blasting plug assemblies.

Type	Part Number	Thread
Contact nut with contact eyelet	0330-000-080	1” – UNC-2A
Contact nut with button	0330-000-180	1” – UNC-2A
Acorn nut with teardrop connector	0330-000-190	1” – UNC-2A



Contact block assembly 0260-000-040

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Thru-tubing guns need to be small enough to pass through a completion string, but large enough to accommodate perforating charges that will penetrate the casing, cement and formation damaged zone. Magnetic decentralizers allow the gun to stick to the casing minimizing standoff distance, which in turn maximizes perforating charge performance.

Hunting Titan magnetic decentralizers come in a range of sizes to suit all thru-tubing gun sizes. The magnets used have excellent temperature stability which guarantees that perforating guns will always be attached to the casing wall. Phasing subs are also available such that the shooting phase of a thru-tubing gun will be in alignment with the decentralizer magnets.



APPLICATIONS

- Thru-tubing perforating

FEATURES

- Alnico 5 alloy used to make strong magnets that have excellent stability at high temperatures
- Phasing subs align magnets with shooting phase of perforating gun
- Simple robust design

BENEFITS

- Strong magnetic force available at all downhole operating temperatures
- Perforation performance maximized

HARDWARE SPECIFICATIONS

O.D. (in)[mm]	Type	Max. Temp.† (°F)[°C]	Max. Pressure (psi)[MPa]	Length (in)[mm]	Weight (lbm)[kg]	Max. Voltage (VDC)	Max. Current (mA)	Max. Tension (lbf)[kN]	Upper Head Connection	Lower Head Connection‡
Upper Magnetic Decentralizer										
1-3/8 [35]	Upper	400 [204]	20,000 [138]	13.1 [333]	4.9 [2.2]	600	2,000	50,000 [222]	1-3/16”-12 GO Box§	1-3/16”-12 GO Pin
1-9/16 [40]	Upper	400 [204]	20,000 [138]	13.1 [333]	6.3 [2.9]	600	2,000	50,000 [222]	1-3/16”-12 GO Box§	1-3/16”-12 GO Pin
1-11/16 [43]	Upper	400 [204]	20,000 [138]	13.1 [333]	7.5 [3.4]	600	2,000	50,000 [222]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
2 [51]	Upper	400 [204]	20,000 [138]	13.1 [333]	10.8 [4.9]	600	2,000	50,000 [222]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
2-1/8 [54]	Upper	400 [204]	20,000 [138]	13.1 [333]	12.1 [5.5]	600	2,000	50,000 [222]	1-3/16”-12 GO Box§	1-3/16”-12 GO Pin
2-1/2 [64]	Upper	400 [204]	20,000 [138]	15.0 [381]	18.4 [8.3]	600	2,000	72,000 [320]	1-3/16”-12 GO Box	1-3/16”-12 GO Box
Lower Magnetic Decentralizer										
1-3/8 [35]	Set Screw Type	400 [204]	20,000 [138]	12.0 [305]	4.3 [2.0]	-	-	24,000 [107]	1” Set Screw Box	-
	Threaded Type			11.3 [287]	4.6 [2.1]			62,000 [276]	1-3/16”-12 Go Pin	-
1-9/16 [40]	Set Screw Type	400 [204]	20,000 [138]	12.0 [305]	5.5 [2.5]	-	-	35,000 [156]	1-1/8” Set Screw Box	-
	Threaded Type			11.3 [287]	5.9 [2.7]			62,000 [276]	1-3/16”-12 Go Pin	-
1-11/16 [43]	Set Screw Type	400 [204]	20,000 [138]	12.0 [305]	6.5 [2.9]	-	-	35,000 [156]	1-1/8” Set Screw Box	-
	Threaded Type			11.3 [287]	6.7 [3.0]			62,000 [276]	1-3/16”-12 Go Pin	-
2 [51]	Set Screw Type	400 [204]	20,000 [138]	12.0 [305]	9.5 [4.3]	-	-	35,000 [156]	1-1/8” Set Screw Box	-
	Threaded Type			11.3 [287]	9.6 [4.4]			62,000 [276]	1-3/16”-12 Go Pin	-
2-1/8 [54]	Set Screw Type	400 [204]	20,000 [138]	12.0 [305]	10.5 [4.8]	-	-	35,000 [156]	1-1/8” Set Screw Box	-
	Threaded Type			11.3 [287]	10.7 [4.6]			62,000 [276]	1-3/16”-12 Go Pin	-
2-1/2 [64]	Set Screw Type	400 [204]	20,000 [138]	13.0 [330]	15.5 [7.0]	-	-	55,000 [245]	1-1/2” Set Screw Box	-

† Viton O-rings need to be used above 325°F (163°C)
‡ Various pin connections are available. See assembly part number table for more details
§ Version with 1-3/16”-12 GO Pin available. See assembly part number table for details

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ASSEMBLY PART NUMBERS

Type	Contact Kit	O.D. (in)[mm]					
		1-3/8 [35]	1-9/16 [40]	1-11/16 [43]	2 [51]	2-1/8 [54]	2-1/2 [64]
Upper	5396-000-002† 5396-000-012‡ 5396-000-042§	5394-000-000† 5394-000-010‡ 5394-000-040§ 5394-000-080††	5396-000-000† 5396-000-010‡ 5396-000-040§ 5396-000-080††	5396-000-200† 5396-000-110‡ 5396-000-140§	5398-000-000† 5398-000-010‡ 5398-000-040§ 5398-000-080††	5398-000-200† 5398-000-210‡ 5398-000-140§	5392-000-000‡‡
Lower - Set Screw Type	-	5395-000-000	5397-000-000	5397-000-100	5399-000-000	5399-000-100	5393-000-000
Lower - Threaded Type	-	5395-000-040	5397-000-040	5397-000-140	5399-000-040	5399-000-140	-

† Teardrop connector pin on lower head
‡ Banana plug pin on lower head
§ Spring contact pin on lower head
†† Spring contact pin on upper head and teardrop connector pin on lower head
‡‡ Contact kit 5392-000-002



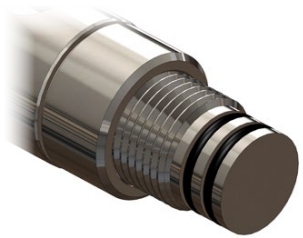
Teardrop connector pin for upper decentralizer



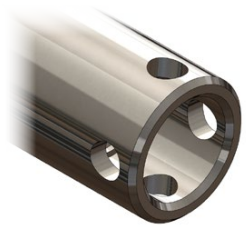
Banana plug for upper decentralizer



Spring contact for upper decentralizer



Threaded type upper connection for lower decentralizer



Set screw type upper connection for lower decentralizer

ADAPTERS

O.D (in)[mm]	Type	Part Number	Contact Kit	Upper Head Connection	Lower Head Connection
1-7/16 [37]	Double sealed phasing sub assembly for 2-1/2" upper magnetic decentralizer	3903-000-040	3903-000-042	1-3/16"-12 GO Pin	1-3/16"-12 GO teardrop connector
	Phasing sub assembly for 2-1/2" upper magnetic decentralizer	3903-000-050	3903-000-052	1-3/16"-12 GO Pin	1-3/16"-12 GO banana plug

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Mechanical Centralizers and Decentralizers

Production logging toolstrings generally require some form of centralization to allow proper flow measurements. Cement bond tools require excellent centralization in order to measure accurate cement bond properties. Hunting Titan's centralizers use multi-arm bowpsrings that provide strong centralization when fully open, yet are collapsible to allow passage through completion strings and narrow restrictions.

Centralization of pipe cutters are critical to perform successful and clean cuts. Hunting Titan's rugged centralizers are ideal for these applications.

Collapsible decentralizers are also available for tools requiring eccentering onto casing walls.

APPLICATIONS

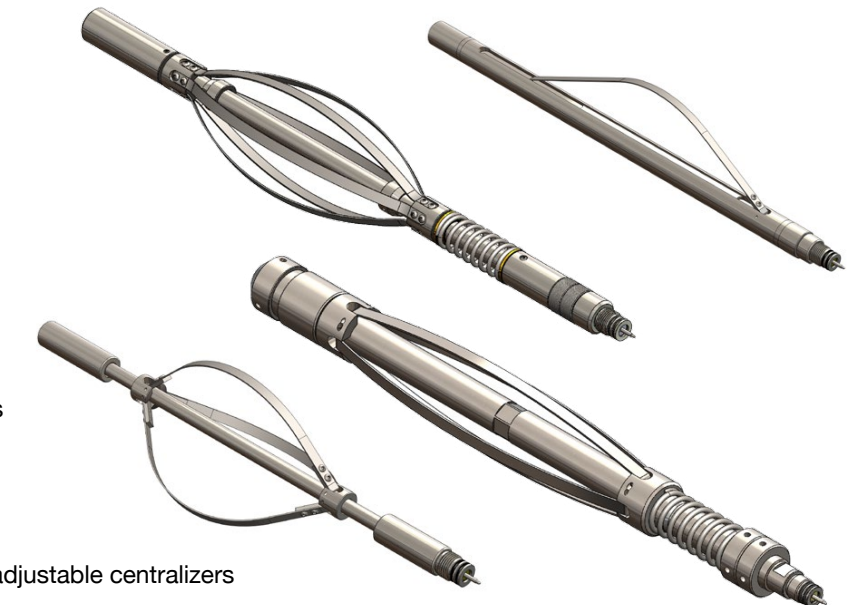
- Pipe recovery
- Production / Cased hole logging
- Thru-tubing perforating
- Wireline steering tool services

FEATURES

- Strong steel mandrel and arms
- Options for adjustable centralizers
- H_2S resistant options available

BENEFITS

- Can vary centralization forces on adjustable centralizers
- Very rigid tools with strong, yet collapsible centralizer arms



HARDWARE SPECIFICATIONS

O.D. (in)[mm]	1-3/8 [35]	1-11/16 [43]				2-3/4 [70]	3-1/8 [79]
Part Number	5419-000-000	5419-168-100	5419-168-200	5419-168-300	5452-000-010	5419-275-100	5419-312-S600
Type	Centralizer (Bow Spring)	Centralizer (Bow Spring Adjustable)	Centralizer (Bow Spring)	Centralizer (Bow Spring Bottom only)	Decentralizer (Bow Spring)	Centralizer (Bow Spring Adjustable)	Centralizer (Bow Spring Adjustable)
Number of Arms	3	6	3	3	1	4	6
Max. Temp. (°F)[°C]†	400 [204]	400 [204]	400 [204]	400 [204]	400 [204]	400 [204]	400 [204]
Max. Pressure (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]
Length (in)[mm]	26.3 [668]	32.9 [836]	29.5 [749]	29.1 [739]	33.0 [838]	34.3 [871]	41.0 [1041]
Weight (lbm)[kg]	6.1 [2.8]	13.9 [6.3]	10.5 [4.8]	10.1 [4.6]	18.5 [8.4]	30.9 [14.0]	48.1 [21.8]
Min. Restriction (in)[mm]	1.56 [40]	2.50 [64]	1.81 [46]	1.81 [46]	1.81 [46]	2.88 [73]	3.50 [89]
Max. Casing Size (in)[mm]	7.00 [178]	9.625 [244]	8.625 [219]	8.625 [219]	7.00 [178]	11.75 [298]	14.5 [368]
Max. Voltage (VDC)	600	600	600	-	600	600	600
Max. Current (mA)	2,000	2,000	2,000	-	2,000	2,000	2,000
Max. Tension (lbf)[kN]	10,000 [44]	35,000 [156]	25,000 [111]	28,000 [125]	56,000 [249]	56,000 [249]	57,000 [254]
Contact Kit Part Number	5419-000-002	5419-0168-112	5419-168-212	-	5452-000-002	5419-275-102	5419-312-KIT
Upper Head Connection	1-3/16"-12 GO Box	1-3/16"-12 GO Box	1-3/16"-12 GO Box	1-3/16"-12 GO Box	1-3/16"-12 GO Box	1-3/16"-12 GO Box	1-3/16"-12 GO Box
Lower Head Connection	1-3/16"-12 GO Pin	1-3/16"-12 GO Pin	1-3/16"-12 GO Pin	-	1-3/16"-12 GO Pin	1-3/16"-12 GO Pin	1-3/16"-12 GO Pin

† Viton O-rings need to be used above 325°F (163°C)

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Tools and completion equipment, that have an outer diameter close to the internal diameter of casing or tubing, require special attention to ensure a clear path for running operations. Small amounts of debris can cause catastrophic damage to equipment, or worse, getting the equipment stuck in hole resulting in costly and complex fishing operations.

A wireline junk basket combined with a gauge ring performs two tasks in a quick single run. As the junk basket runs in the well, debris is collected from the bottom opening and trapped inside the tool. The gauge ring helps to scrape off any debris (such as cement or scale) on casing or tubing walls ensuring a clear, clean path is maintained. When the tool is moving back up, the basket is sealed against the rod trapping debris. The gauge ring size is always selected to be slightly larger than the outer diameter of any equipment subsequently run in hole.

This tool combination is generally run with a gamma ray or casing collar locator to verify smooth tool movement and allow for depth control.

APPLICATIONS

- Remove debris from inside casing and tubing
- Gauging the hole to ensure clear path for tools, perforating guns and completion equipment

FEATURES

- Simple design with gauge ring and junk basket combined into one tool
- Large debris “marble catcher” available
- Set screws guarantee that all components are fully secured
- Multiple size gauge rings offered and customization possible upon request

BENEFITS

- Wireline operations are more time efficient than pipe conveyed junk baskets
- Reduced rig time as only one trip required
- Reduced operating costs by utilizing multiple sized interchangeable gauge rings on the same tool
- Set screws offer added safety of no tool components being left in hole



HARDWARE SPECIFICATIONS

O.D.† (in)[mm]	Type	Assembly Part Number	Length (ft)[m]	Weight‡ (lbm)[kg]	Max. Tension (lbf)[kN]	Upper Head Connection§
1-11/16 [43]	Junk Basket	7101-000-000	5.39 [1.64]	14.7 [6.7]	11,000 [49]	3/8”-18 NPT Pin
2-3/4 [70]	Junk Basket	7102-000-000	6.00 [1.83]	36.1 [16.4]	30,000 [133]	3/4”-14 NPT Pin
	Marble Catcher	7227-000-000	3.61 [1.10]	16.8 [7.6]	30,000 [133]	
3-1/2 [89]	Junk Basket	7003-000-000	6.00 [1.83]	43.5 [19.7]	30,000 [133]	3/4”-14 NPT Pin
	Marble Catcher	7236-000-000	3.44 [1.05]	22.4 [10.2]	30,000 [133]	
4 [102]	Junk Basket	7104-000-000	6.07 [1.85]	52.1 [23.6]	30,000 [133]	3/4”-14 NPT Pin
5 [127]	Junk Basket	7105-000-000	6.00 [1.83]	60.0 [27.2]	30,000 [133]	3/4”-14 NPT Pin
	Marble Catcher	7250-000-000	3.85 [1.17]	50.9 [23.1]	60,000 [267]	1-5/8”-6 Acme Pin

† Diameter of basket. Overall diameter depends on gauge ring size

‡ Does not include gauge ring

§ All junk baskets and marble catchers require an additional adapter to connect to other tools

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Petitioner GR Energy Services - Ex. 1009, p. 9

ADAPTERS

	Part Number	Upper Head Adapter
1-11/16” Junk Basket	7101-000-007	1-3/16”-12 GO Box
2-3/4” to 5” Junk Basket 2-3/4” and 3-1/2” Marble Catcher	7103-000-005	1-3/16”-12 GO Box
	7103-000-006	3-1/8” O.D. GO Quick-Change Assembly
	7103-000-008	3-1/8” O.D. SIE Quick-Change Assembly
	7103-000-013	3/4” Sucker Rod Pin
	7236-000-007	1-5/8”-6 Acme Pin
5” Marble Catcher	7250-000-021	3-1/8” O.D. GO Quick-Change Assembly
		Lower Head Adapter
2-3/4” and 3-1/2” Junk Basket	7003-0AD-B20	Adapter collar (fits #20 gauge ring)
	7003-0AD-B25	Adapter collar (fits #25 gauge ring)
4” Junk Basket	7104-0AD-B25	Adapter collar (fits #25 gauge ring)

JUNK BASKET GAUGE RINGS

1-11/16”

Gauge Ring (in)[mm]	Part Number
1.750 [44.5]	7101-G01-750
2.000 [50.8]	7101-G02-000
2.250 [57.2]	7101-G02-250
2.500 [63.5]	7101-G02-500
2.750 [69.9]	7101-G02-750
3.000 [76.2]	7101-G03-000



GO box adapter



SIE Quick-Change adapter



Acme pin adapter



GO Quick-Change adapter



Sucker rod adapter



Adapter collar

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JUNK BASKET GAUGE RINGS

2-3/4" and 3.5"

Gauge Ring (in)[mm]	Part Number
3.000 [76.2]†	7102-G03-000
3.250 [82.6]†	7102-G03-250
3.500 [88.9]†	7102-G03-500
3.750 [95.3]	7003-G03-750
4.000 [101.6]	7003-G04-000
4.250 [108.0]	7003-G04-250
4.500 [114.3]	7003-G04-500
4.750 [120.7]	7003-G04-750
5.000 [127.0]	7003-G05-000
5.250 [133.4]	7003-G05-250
5.500 [139.7]	7003-G05-500
5.750 [146.1]	7003-G05-750
6.000 [152.4]	7003-G06-000
6.250 [158.8]	7003-G06-250
6.500 [165.1]	7003-G06-500
6.750 [171.5]	7003-G06-750
7.000 [177.8]	7003-G07-000
7.250 [184.2]	7003-G07-250
7.500 [190.5]	7003-G07-750

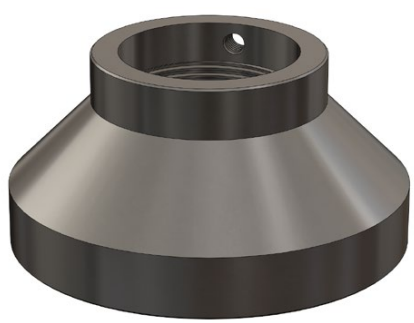
† Only available for 2-3/4"

4"

Gauge Ring (in)[mm]	Part Number
4.000 [101.6]	7104-G04-000
4.250 [108.0]	7104-G04-250
4.500 [114.3]	7104-G04-500
4.750 [120.7]	7104-G04-750
5.000 [127.0]	7104-G05-000
5.250 [133.4]	7104-G05-250
5.500 [139.7]	7104-G05-500
5.750 [146.1]	7104-G05-750
6.000 [152.4]	7104-G06-000
6.250 [158.8]	7104-G06-250
6.500 [165.1]	7104-G06-500
6.750 [171.5]	7104-G06-750
7.000 [177.8]	7104-G07-000
7.250 [184.2]	7104-G07-250
7.500 [190.5]	7104-G07-500
7.750 [196.9]	7104-G07-750
8.000 [203.2]	7104-G08-000
8.250 [210.0]	7104-G08-250
8.500 [215.9]	7104-G08-500

5"

Gauge Ring (in)[mm]	Part Number
5.500 [139.7]	7105-G05-500
5.750 [146.1]	7105-G05-750
6.000 [152.4]	7105-G06-000
6.250 [158.8]	7105-G06-250
6.500 [165.1]	7105-G06-500
6.750 [171.5]	7105-G06-750
7.000 [177.8]	7105-G07-000
7.250 [184.2]	7105-G07-250
7.500 [190.5]	7105-G07-500
7.750 [196.9]	7105-G07-750
8.000 [203.2]	7105-G08-000
8.250 [210.0]	7105-G08-250
8.500 [215.9]	7105-G08-500
8.750 [222.3]	7105-G08-750
9.000 [228.6]	7105-G09-000
9.250 [235.0]	7105-G09-250
9.500 [241.3]	7105-G09-500
9.750 [247.7]	7105-G09-750
10.000 [254.0]	7105-G10-000
11.000 [279.4]	7105-G11-000
12.000 [304.8]	7105-G12-000
13.000 [330.2]	7105-G13-000
14.000 [355.6]	7105-G14-000



MARBLE CATCHER GAUGE RINGS

2-3/4"

Gauge Ring (in)[mm]	Part Number
3.500 [88.9]	7227-G03-500
3.750 [95.3]	7227-G03-750
4.000 [101.6]	7227-G04-000
4.250 [108.0]	7227-G04-250
4.500 [114.3]	7227-G04-500
4.750 [120.7]	7227-G04-750
5.000 [127.0]	7227-G05-000

3.5"

Gauge Ring (in)[mm]	Part Number
3.500 [88.9]	7236-G03-500
3.750 [95.3]	7236-G03-750
4.000 [101.6]	7236-G04-000
4.250 [108.0]	7236-G04-250
4.500 [114.3]	7236-G04-500
4.750 [120.7]	7236-G04-750
5.000 [127.0]	7236-G05-000
5.250 [133.4]	7236-G05-250
5.500 [139.7]	7236-G05-500
6.000 [152.4]	7236-G06-000
6.250 [158.8]	7236-G06-250
6.500 [165.1]	7236-G06-500
6.750 [171.5]	7236-G06-750
7.000 [177.8]	7236-G07-000

5"

Gauge Ring (in)[mm]	Part Number
Uses same gauge rings as 5" junk basket	

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APPLICATIONS

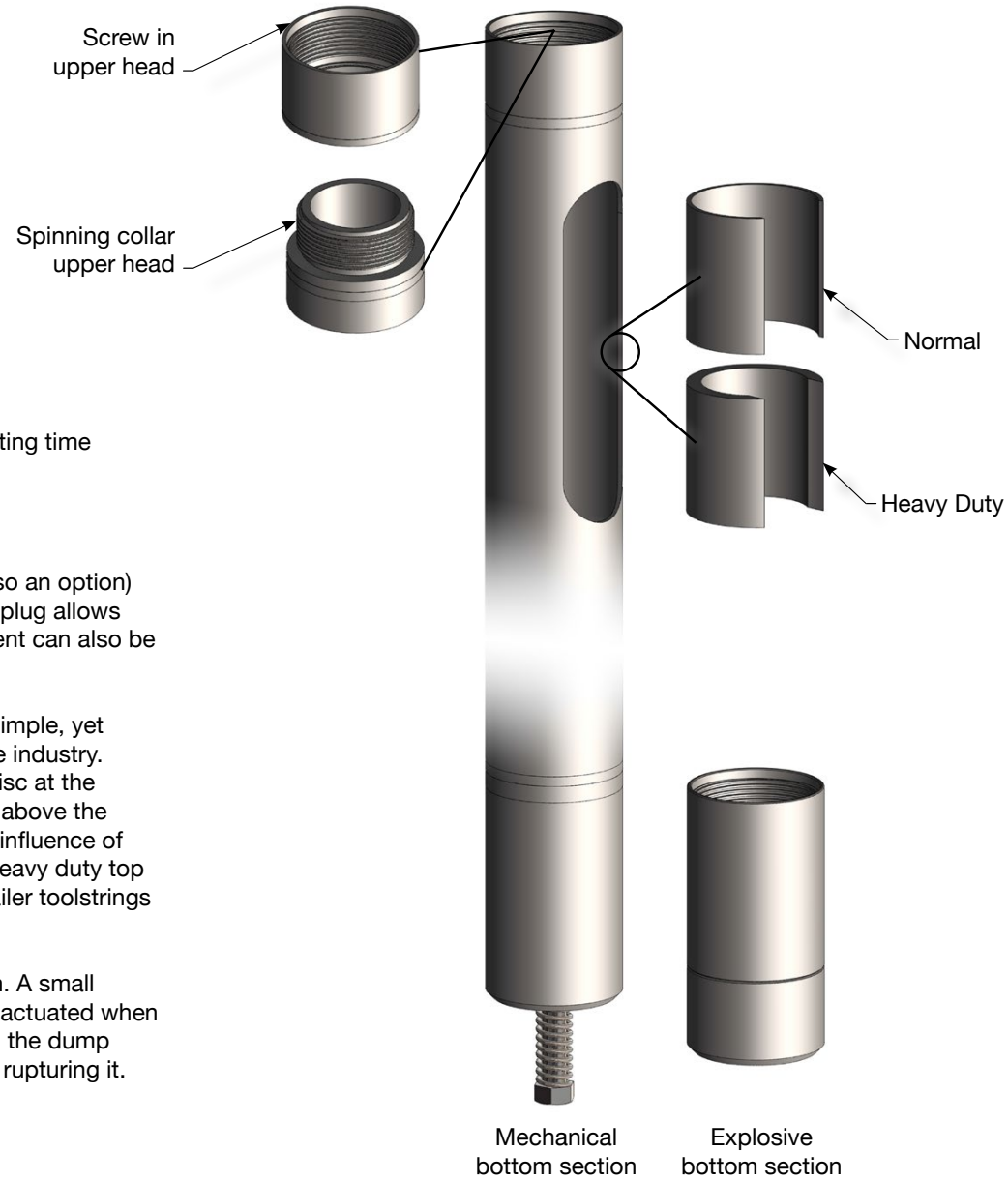
- Dump cement or sand onto a bridge plug

FEATURES

- Gravity activated system
- Strengthened upper window sections
- Ballistic or mechanical actuation

BENEFITS

- Cost effective and low maintenance
- Explosives not always necessary
- Full toolstrings can be rigged up in one piece reducing operating time



Dump bailers are primarily used for dumping cement (sand is also an option) on pre-existing bridge plugs. Placing cement on top of a bridge plug allows for a larger pressure differential to be placed across it. The cement can also be used to plug off unwanted water producing perforations.

Hunting Titan dump bailers are gravity activated systems. This simple, yet effective, design is the most common type of system used in the industry. Cement is simply poured into the dump bailer. A glass rupture disc at the bottom of the chambers holds the cement inside the tool. Once above the bridge plug, the glass disc is broken and the cement, under the influence of gravity, falls freely onto the plug. Options are also available for heavy duty top section windows. These provide extra support for long dump bailer toolstrings at the filler window, which is the weakest part of the string.

Two types of activation systems are available from Hunting Titan. A small blasting cap can be placed on top of the glass rupture disc and actuated when required. The other method uses a mechanical striker pin. When the dump bailer hits a bridge plug with force, the pin strikes the glass disc rupturing it.

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HARDWARE SPECIFICATIONS

O.D. (in)[mm]	Type	Component Part Number	Volume (Gal)[L]	Length (ft)[m]	Weight (lbm)[kg]	Max. Tension (lbf)[kN]	Upper Head Connection
1-3/8 [35]	10' Screw In Top Section	7109-0TS-010	0.56 [2.1]	10.27 [3.13]	12.4 [5.6]	13,000 [58]	1-3/16"-12 GO Box
	2' Screw In Heavy Duty Top Section	7109-0TS-002	0.04 [0.2]	2.00 [0.61]	4.6 [2.1]	15,000 [67]	
	5' Extension	7109-0ES-005	0.30 [1.1]	5.27 [1.61]	6.7 [3.0]	15,000 [67]	-
	10' Extension	7109-0ES-010	0.60 [2.3]	10.27 [3.13]	12.3 [5.6]	15,000 [67]	-
1-1/2 [38]	10' Screw In Top Section	7110-0TS-010	0.67 [2.5]	10.21 [3.11]	13.4 [6.1]	14,000 [62]	1-3/16"-12 GO Box
	2' Screw In Heavy Duty Top Section	7110-0TS-002	0.08 [0.3]	2.21 [067]	4.8 [2.2]	17,000 [76]	
	5' Extension	7110-0ES-005	0.37 [1.4]	5.27 [1.61]	7.5 [3.4]	17,000 [76]	-
	10' Extension	7110-0ES-010	0.73 [2.8]	10.27 [3.13]	13.8 [6.3]	17,000 [76]	-
1-11/16 [43]	10' Screw In Top Section	7111-0TS-010	0.88 [3.3]	10.20 [3.11]	15.1 [6.8]	15,600 [69]	1-3/16"-12 GO Box
	2' Screw In Heavy Duty Top Section	7111-0TS-002	0.10 [0.4]	2.21 [067]	6.4 [2.9]	18,700 [83]	
	5' Extension	7111-0ES-005	0.48 [1.8]	5.27 [1.61]	8.4 [3.8]	18,700 [83]	-
	10' Extension	7111-0ES-010	0.95 [3.6]	10.27 [3.13]	15.6 [7.1]	18,700 [83]	-
2 [51]	10' Screw In Top Section	7120-0TS-010	1.21 [4.6]	10.19 [3.11]	23.4 [10.6]	24,000 [107]	1-3/16"-12 GO Box
	2' Screw In Heavy Duty Top Section	7120-0TS-002	0.14 [0.5]	2.19 [0.67]	9.2 [4.2]	29,500 [131]	
	5' Extension	7120-0ES-005	0.68 [2.6]	5.29 [1.61]	11.9 [5.4]	29,500 [131]	-
	10' Extension	7120-0ES-010	1.34 [5.1]	10.29 [3.14]	22.0 [10.0]	29,500 [131]	-
2-1/2 [64]	10' Screw In Top Section	7125-0TS-010	1.92 [7.3]	10.19 [3.11]	34.0 [15.4]	32,900 [146]	1-3/16"-12 GO Box
	2' Screw In Heavy Duty Top Section	7125-0TS-002	0.24 [0.9]	2.22 [0.68]	11.7 [5.3]	46,000 [205]	
	5' Extension	7125-0ES-005	1.06 [4.0]	5.27 [1.61]	18.6 [8.4]	46,000 [205]	-
	10' Extension	7125-0ES-010	2.10 [7.9]	10.27 [3.13]	34.3 [15.6]	46,000 [205]	-
3 [76]	10' Spinning Collar Top Section	7130-0TS-010	2.89 [10.9]	10.16 [3.10]	38.7 [17.6]	37,300 [166]	*
	2' Spinning Collar Heavy Duty Top Section	7130-0TS-002	0.29 [1.1]	2.00 [0.61]	17.0 [7.7]	37,300 [166]	
	5' Extension	7130-0ES-005	1.60 [6.1]	5.25 [1.60]	21.2 [9.6]	37,300 [166]	-
	10' Extension	7130-0ES-010	3.15 [11.9]	10.25 [3.12]	39.5 [17.9]	37,300 [166]	-
	10' Screw In Top Section	7130-0TS-S10	2.88 [10.9]	10.25 [3.12]	38.9 [17.6]	37,300 [166]	*
	2' Screw In Heavy Duty Top Section	7130-0TS-S02	0.29 [1.1]	2.10 [0.64]	17.0 [7.7]	37,300 [166]	
3-1/2 [89]	10' Spinning Collar Top Section	7136-0TS-010	4.04 [15.3]	10.09 [3.08]	46.5 [21.1]	46,900 [209]	*
	2' Spinning Collar Heavy Duty Top Section	7136-0TS-002	0.39 [1.5]	2.00 [0.61]	25.0 [11.3]	71,000 [316]	
	5' Extension	7136-0ES-005	2.21 [8.4]	5.23 [1.59]	25.7 [11.7]	71,000 [316]	
	10' Extension	7136-0ES-010	4.38 [16.6]	10.23 [3.12]	47.2 [21.4]	71,000 [316]	
	10' Screw In Top Section	7136-0TS-S10	3.99 [15.1]	10.23 [3.12	46.5 [21.1]	46,900 [209]	*
	2' Screw In Heavy Duty Top Section	7136-0TS-S02	0.39 [1.5]	2.10 [0.64]	23.7 [10.8]	71,000 [316]	
4 [102]	10' Spinning Collar Top Section	7140-0TS-010	5.40 [20.4]	10.14 [3.09]	55.1 [25.0]	57,100 [254]	*
	2' Spinning Collar Heavy Duty Top Section	7140-0TS-002	0.37 [1.4]	1.73 [0.53	32.4 [14.7]	91,200 [406]	
	5' Extension	7140-0ES-005	2.99 [11.3]	5.31 [1.62]	31.7 [14.4]	91,200 [406]	-
	10' Extension	7140-0ES-010	5.87 [22.2]	10.31 [3.14]	56.8 [25.8]	91,200 [406]	-
	10' Screw In Top Section	7140-0TS-S10	5.36 [20.3]	10.31 [3.14]	57.5 [26.1]	57,100 [254]	*
	2' Screw In Heavy Duty Top Section	7140-0TS-S02	0.38 [1.4]	1.83 [0.56]	32.3 [14.7]	91,200 [406]	
5 [127]	10' Spinning Collar Top Section	7150-0TS-010	8.65 [32.7]	10.18 [3.10]	73.9 [33.5]	74,400 [331]	*
	2' Spinning Collar Heavy Duty Top Section	7150-0TS-002	0.62 [2.3]	1.71 [0.52]	44.0 [20.0]	91,200 [406]	
	5' Extension	7150-0ES-005	4.77 [18.1]	5.34 [1.63]	43.4 [19.7]	134,000 [596]	-
	10' Extension	7150-0ES-010	9.39 [35.5]	10.34 [3.15]	74.5 [33.8]	134,000 [596]	-
	10' Screw In Top Section	7150-0TS-S10	8.61 [32.6]	10.32 [3.15]	77.3 [35.1]	74,400 [331]	*
	2' Screw In Heavy Duty Top Section	7150-0TS-S02	0.60 [2.3]	1.82 [0.55]	43.9 [19.9]	91,200 [406]	

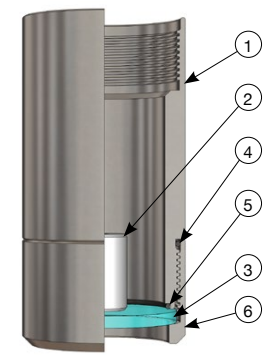
* Multiple types of connection adapters available for the 3, 3-1/2, 4 and 5" dump bailers

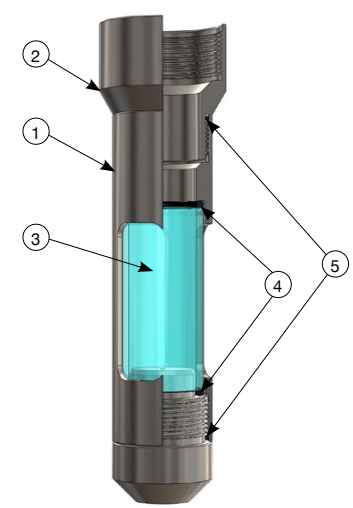
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ADAPTERS FOR 3”(76MM) O.D. AND GREATER DUMP BAILERS

O.D. (in)[mm]	Bailer Type	Assembly Part Number	Contact Kit Part Number	Upper Head Adapter
3 [76]	Spinning Collar Upper Head	7130-000-001	7136-000-002	Spinning collar sub with 1-3/16”-12 GO Box (teardrop contact assembly)
		7130-000-018	-	Spinning collar sub with 1-3/16”-12 GO Box (no contact assembly)
		7130-000-070	7130-000-072	Spinning collar sub for 3-1/8” O.D. SIE Quick-Change assembly with acorn nut on upper head
		7130-000-090	0330-000-080	Spinning collar sub for 3-1/8” O.D. SIE Quick-Change assembly with blast plug 0330-000-080 (not included)
		7130-000-014	-	Spinning collar sub for 3/4” sucker rod pin
	Screw In Upper Head	7130-000-150	7136-000-152	3-1/8” O.D. GO style Quick-Change assembly
		7130-000-155	-	Top sub using firing head seal block 0256-000-020 (not included) for 3-1/8” O.D. GO style Quick-Change assembly
		7130-000-170	-	3-1/8” O.D. SIE Quick-Change assembly with acorn nut on upper head
		7130-000-101	0330-000-190	3-1/8” O.D. SIE Quick-Change assembly with blast plug assembly 0330-000-190 (not included)
3-1/2 [89] 4 [102] 5 [127]	Spinning Collar Upper Head	7136-000-001	7136-000-002	Spinning collar sub with 1-3/16”-12 GO Box (teardrop contact assembly)
		7136-000-018	-	Spinning collar sub with 1-3/16”-12 GO Box (no contact assembly)
		7136-000-070	7136-000-072	Spinning collar sub for 3-1/8” O.D. SIE Quick-Change assembly with acorn nut on upper head
		7136-000-090	0330-000-080	Spinning collar sub for 3-1/8” O.D. SIE Quick-Change assembly with blast plug 0330-000-080 (not included)
		7136-000-014	-	Spinning collar sub for 3/4” sucker rod pin
	Screw In Upper Head	7136-000-150	7136-000-152	3-1/8” O.D. GO style Quick-Change assembly
		7136-000-155	-	Top sub using firing head seal block 0256-000-020 (not included) for 3-1/8” O.D. GO style Quick-Change assembly
		7136-000-170	-	3-1/8” O.D. SIE Quick-Change assembly with acorn nut on upper head
		7136-000-101	0330-000-190	3-1/8” O.D. SIE Quick-Change assembly with blast plug assembly 0330-000-190 (not included)





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BOTTOM SECTION PART NUMBERS

Explosive Bottom Section

←	1	2	3	4	5	6
O.D. (in)[mm]	Cap Chamber (Optional)	Blasting Cap Weight†	Glass Disc†	O-Ring†§	O-Ring†	Lower Spinning Collar
1-3/8 [35]	7109-000-029	7110-000-039	7109-000-028	0111-022-070	-	7109-000-027
1-1/2 [38]	7110-000-029	7110-000-039	7110-000-028	0111-024-070	-	7110-000-027
1-11/16 [43]	7111-000-029	7110-000-039	7111-000-028	0111-027-070	-	7111-000-027
2 [51]	7120-000-029	7136-000-039	7120-000-028	0111-129-070	-	7120-000-027
2-1/2 [64]	7125-000-029	7136-000-039	7125-000-028	0111-137-070	-	7125-000-027
2-3/4 [70]	7127-000-029	7136-000-039	7127-000-028	0111-141-070	-	7127-000-027
3 [76]	7130-000-129	7136-000-039	7130-000-028	0111-230-070	0111-227-070	7130-000-027
3-1/2 [89]	7136-000-129	7136-000-039	7136-000-028	0111-234-070	0111-231-070	7136-000-027
4 [102]	7140-000-129	7136-000-039	7140-000-028	0111-237-070	0111-232-070	7140-000-027
5 [127]	7150-000-029	7136-000-039	7150-000-028	0111-245-070	0111-240-070	7150-000-027

† Expendable items

§ Same o-ring part numbers used in respective bailer connections

←	1	2	3‡	4‡	5
O.D. (in)[mm]	Glass Chamber Assembly	Adapter†	Glass Tube†	Glass Seal Rings†	O-Ring
2-3/4 [70]	7127-000-050	-	7127-000-058	0111-328-070	0111-141-070
3 [76]	7127-000-050	7130-000-121	7127-000-058	0111-328-070	0111-141-070
3-1/2 [89]	7127-000-050	7136-000-121	7127-000-058	0111-328-070	0111-141-070
4 [102]	7127-000-050	7140-000-121	7127-000-058	0111-328-070	0111-141-070
5 [127]	7127-000-050	7150-000-121	7127-000-058	0111-328-070	0111-141-070

† Expendable items

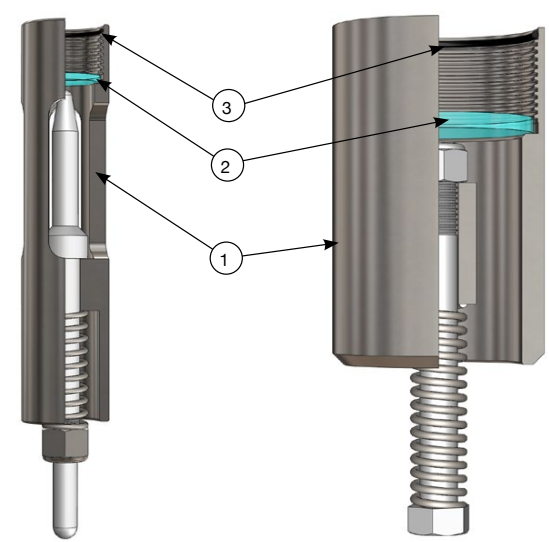
‡ Items 3 and 4 included in glass chamber assembly (item 1)

Mechanical Bottom Section

↓	1	2	3
O.D. (in)[mm]	Glass Breaker Assembly	Glass Disc†	O-Ring†§
1-11/16 [43]	7111-000-030	7111-000-028	0111-027-070
2 [51]	7120-000-030	7120-000-028	0111-129-070
2-1/2 [64]	7125-000-030	7125-000-028	0111-137-070
2-3/4 [70]	7127-000-030	7127-000-028	0111-141-070
3 [76]	7130-000-030	7130-000-028	0111-230-070
3-1/2 [89]	7136-000-030	7136-000-028	0111-234-070
4 [102]	7140-000-030	7140-000-028	0111-237-070
5 [127]	7150-000-030	7150-000-028	0111-245-070

† Expendable items

§ Same o-ring part numbers used in respective bailer connections



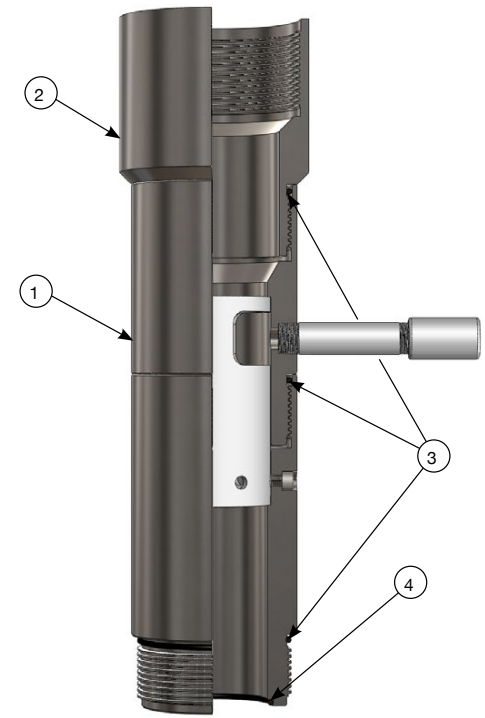
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ACCESSORIES

There may be instances where the dump bailer cannot be lowered into the hole for top filling. Filler subs are available which can be placed between the dump bailer and explosive or mechanical bottom section.

→	1	2	3	4
O.D. (in)[mm]	Filler Assembly	Adapter†	O-Ring†	O-Ring†
1-11/16 [43]	7111-000-140	-	0111-027-070	0111-211-070
2 [51]	7120-000-140	-	0111-030-070	0111-216-070
2-1/2 [64]	7120-000-140	7125-000-121	0111-030-070	0111-216-070
2-3/4 [70]	7127-000-140	-	0111-141-070	0111-225-070
3 [76]	7127-000-140	7130-000-121	0111-141-070	0111-225-070
3-1/2 [89]	7136-000-140	-	0111-234-070	0111-228-070
4 [102]	7136-000-140	7140-000-125	0111-234-070	0111-228-070
5 [127]	7136-000-140	7150-000-125	0111-234-070	0111-228-070

† Expendable items





SIE style Quick Change assembly connections, for 3” (76 mm) O.D. or greater dump bailers, utilize blasting plug assemblies. These are only required when using explosive bottom sections.

Type	Part Number	Thread
Contact nut with contact eyelet	0330-000-080	1” – UNC-2A
Contact nut with button	0330-000-180	1” – UNC-2A
Acorn nut with teardrop connector	0330-000-190	1” – UNC-2A

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Sinker bars offer several uses in cased hole wireline operations. They help increase the weight of wireline equipment such that they can overcome friction in deviated wells. Small perforating guns and production tools have low weights and are susceptible to being displaced out of hole in high flowing wells or high wellhead pressure. The addition of sinker bars can avoid such problems.



Hunting Titan sinker bars are produced from high quality materials guaranteed to last and withstand the rough treatment usually experienced by this type of equipment.

APPLICATIONS

- Production logging
- Perforating
- Remedial cased hole work

FEATURES

- Option for “over the line” sinker bar
- Lead and tungsten weights protected by strong steel casing

BENEFITS

- Over the line sinker bars do not require any electrical connections
- Saves rig time by conducting wireline services in highly deviated wells
- Available at Hunting Titan distribution warehouses worldwide

HARDWARE SPECIFICATIONS

O.D. (in)[mm]	Type	Max. Temp.† (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)	Max. Tension (lbf)[kN]	Upper Head Connection	Lower Head Connection
Standard Sinker Bars								
1 [25]	Steel	400 [204]	20,000 [138]	600	2,000	21,000 [93]	13/16”-16 GO Box	13/16”-16 GO Pin
	Tungsten Filled							
1-3/8 [35]	Steel	400 [204]	20,000 [138]	600	2,000	59,000 [262]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
	Lead Filled							
	Tungsten Filled							
1-7/16 [37]	Steel	400 [204]	20,000 [138]	600	2,000	60,000 [267]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
	Lead Filled							
	Tungsten Filled							
1-11/16 [43]	Steel	400 [204]	20,000 [138]	600	2,000	63,000 [280]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
	Lead Filled							
	Tungsten Filled							
2 [51]	Steel	400 [204]	20,000 [138]	600	2,000	63,000 [280]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
	Lead Filled							
	Tungsten Filled							
2-3/4 [70]	Steel	400 [204]	20,000 [138]	600	2,000	120,000 [534]	*	*
	Tungsten Filled							
3-1/8 [79]	Steel	400 [204]	20,000 [138]	600	2,000	120,000 [534]	*	*
	Tungsten Filled							
Eccentered Weights								
2-3/4 [70]	Steel	400 [204]	20,000 [138]	600	2,000	120,000 [534]	*	*
3-1/8 [79]	Steel	400 [204]	20,000 [138]	600	2,000	120,000 [534]	*	*
Over The Line Sinker Bars								
1-3/8 [35]	Steel	-	-	-	-	42,000 [187]	Standard fishing neck	Cable Head
1-11/16 [43]	Steel	-	-	-	-	42,000 [187]	Standard fishing neck	Cable Head
2 [51]	Steel	-	-	-	-	42,000 [187]	Standard fishing neck	Cable Head
2-3/4 [70]	Steel	-	-	-	-	180,000 [801]	2”-6 Acme Pin	2”-6 Acme Box
	Tungsten Filled	-	-	-	-	180,000 [801]	2”-6 Acme Pin	2”-6 Acme Box
3-1/8 [79]	Steel	-	-	-	-	180,000 [801]	2”-6 Acme Pin	2”-6 Acme Box
	Tungsten Filled	-	-	-	-	180,000 [801]	2”-6 Acme Pin	2”-6 Acme Box

* Multiple types of connections are available for the 2-3/4” and 3-1/8” sinker bars and eccentered weights.

† Viton O-rings need to be used above 325°F (163°C)

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STANDARD SINKER BAR AND ECCENTERED WEIGHTS ASSEMBLY PART NUMBERS

O.D. (in)[mm]	Type	Contact Kit	3ft (0.91m)		5ft (1.52m)		7ft (2.13m)	
			Assembly Part Number	Weight (lbm)[kg]	Assembly Part Number	Weight (lbm)[kg]	Assembly Part Number	Weight (lbm)[kg]
Standard Sinker Bars								
1 [25]	Steel	3921-002-00#† 3932-002-00#‡	3922-001-003† 3932-001-003‡	6 [3]	3922-001-005† 3932-001-005‡	11 [5]	3922-001-007† 3932-001-007‡	16 [7]
	Tungsten Filled		3923-001-003† 3931-001-003‡	12 [5]	3923-001-005† 3931-001-005‡	20 [9]	3923-001-007† 3931-001-007‡	29 [13]
1-3/8 [35]	Steel	3924-002-00#† 3927-002-00#‡	3926-006-003† 3929-006-003‡	13 [6]	3926-006-005† 3929-006-005‡	22 [10]	3926-006-007† 3929-006-007‡	32 [15]
	Lead Filled		3924-006-003† 3927-006-003‡	16 [7]	3924-006-005† 3927-006-005‡	27 [12]	3924-006-007† 3927-006-007‡	39 [18]
	Tungsten Filled		3925-006-003† 3928-006-003‡	22 [10]	3925-006-005† 3928-006-005‡	38 [17]	3925-006-007† 3928-006-007‡	54 [25]
1-7/16 [37]	Steel	3924-002-00#† 3927-002-00#‡	3926-007-003† 3929-007-003‡	15 [7]	3926-007-005† 3929-007-005‡	25 [11]	3926-007-007† 3929-007-007‡	35 [16]
	Lead Filled		3924-007-003† 3927-007-003‡	17 [8]	3924-007-005† 3927-007-005‡	30 [14]	3924-007-007† 3927-007-007‡	43 [20]
	Tungsten Filled		3925-007-003† 3928-007-003‡	23 [10]	3925-007-005† 3928-007-005‡	40 [18]	3925-007-007† 3928-007-007‡	57 [26]
1-11/16 [43]	Steel	3924-002-00#† 3927-102-00#‡	3926-011-003† 3929-011-003‡	21 [10]	3926-011-005† 3929-011-005‡	35 [16]	3926-011-007† 3929-011-007‡	49 [22]
	Lead Filled		3924-011-003† 3927-011-003‡	25 [11]	3924-011-005† 3927-011-005‡	43 [20]	3924-011-007† 3927-011-007‡	61 [28]
	Tungsten Filled		3925-011-003† 3928-011-003‡	35 [16]	3925-011-005† 3928-011-005‡	60 [27]	3925-011-007† 3928-011-007‡	84 [38]
2 [51]	Steel	3924-002-00#† 3927-102-00#‡	3926-016-003† 3929-016-003‡	30 [14]	3926-016-005† 3929-016-005‡	50 [23]	3926-011-007† 3929-011-007‡	70 [32]
	Lead Filled		3924-016-003† 3927-016-003‡	38 [17]	3924-016-005† 3927-016-005‡	65 [29]	3924-016-007† 3927-016-007‡	92 [42]
	Tungsten Filled		3925-016-003† 3928-016-003‡	52 [24]	3925-016-005† 3928-016-005‡	88 [40]	3925-016-007† 3928-016-007‡	124 [52]
2-3/4 [70]	Steel	3890-102-00#	3885-100-003	39 [18]	3885-100-005	75 [34]	3885-100-007	112 [51]
	Tungsten Filled		3885-300-003	53 [24]	3885-300-005	105 [48]	3885-300-007	158 [72]
3-1/8 [79]	Steel	3890-102-00#	3890-100-003	53 [24]	3890-100-005	101 [46]	3890-100-007	149 [68]
	Tungsten Filled		3890-300-003	66 [30]	3890-100-005	130 [59]	3890-300-007	194 [88]
Eccentered Weights								
2-3/4 [70]	Steel	4126-312-302	-	-	4126-275-300-5	55 [25]	-	-
3-1/8 [79]	Steel	4126-312-302	-	-	4126-312-300-5	71 [32]	-	-



Spring contact



Banana plug

Use “3” for 3ft bar; “5” for 5ft bar; “7” for 7ft bar; “0” for contact kit without the contact rod

† Spring contact on lower head connection

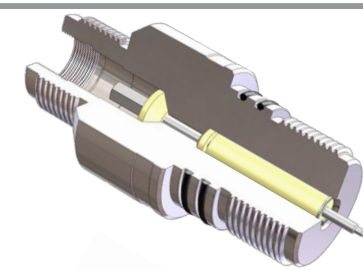
‡ Banana plug contact on lower head connection

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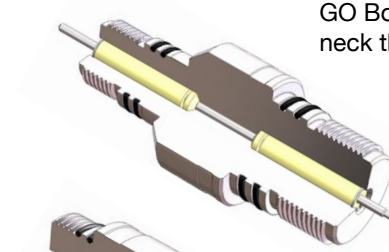
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ADAPTERS FOR STANDARD AND ECCENTERED SINKER BARS

O.D. (in)[mm]	Assembly Part Number	Contact Kit	Upper Contact Head Assembly	Weight (lbm)[kg]
2-3/4 [70]	3885-000-080	0318-000-022	1-3/16”-12 GO Box with 2”-6 Acme fishing neck thread	7 [3]
	3885-000-150	3885-000-152	1-5/8”-6 Acme Pin	8 [4]
	3885-000-070	3890-000-222	2-3/4” O.D. CCL Assembly	8 [4]
	3885-000-110	3890-000-112	2-3/4” O.D. GO Quick-Change Assembly	11 [5]
	3885-000-140	3890-000-142	2-3/4” O.D. SIE Quick-Change Assembly	10 [5]
	3885-000-020	3885-000-022	Tandem connector sub assembly	10 [5]
	3885-000-120	3890-000-352	Lock collar tandem connector sub assembly	12 [5]
3-1/8 [79]	3890-000-170	0318-000-022	1-3/16”-12 GO Box with 2”-6 Acme fishing neck thread	8 [4]
	3890-000-240	3890-000-242	1-5/8”-6 Acme Pin	9 [4]
	3890-000-340	3890-000-222	2-3/4” O.D. CCL Assembly	9 [4]
	3890-000-110	3890-000-112	3-1/8” O.D. GO Quick-Change Assembly	13 [6]
	3890-000-220	3890-000-222	3-1/8” O.D. CCL Assembly	10 [5]
	3890-000-140	3890-000-142	3-1/8” O.D. SIE Quick-Change Assembly	11 [5]
	3890-000-150	3933-000-002	Tandem connector sub assembly	9 [4]
	3890-000-350	3890-000-352	Lock collar tandem connector sub assembly	12 [5]
Lower Contact Head Assembly				
2-3/4 [70]	3885-000-050	0318-000-022	1-5/8”-6 Acme Box	9 [4]
	3885-000-060	3885-000-062	2-3/4” O.D. CCL Assembly	7 [3]
3-1/8 [79]	3890-000-120	0318-000-122	1-5/8”-6 Acme Box	11 [5]
	3890-000-330	3885-000-062	2-3/4” O.D. CCL Assembly	9 [4]
	3890-000-130	5401-000-032	3-1/8” O.D. CCL Assembly	7 [3]



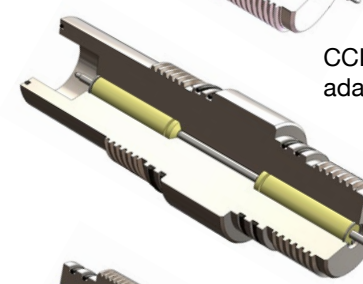
GO Box with fishing neck thread adapter



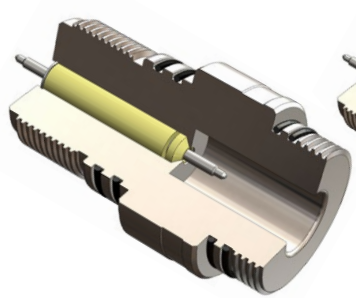
Acme pin adapter



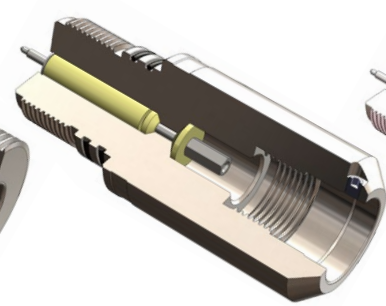
CCL assembly adapter (upper head)



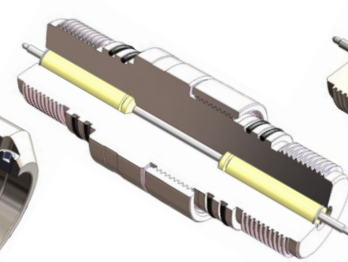
GO Quick-Change assembly adapter



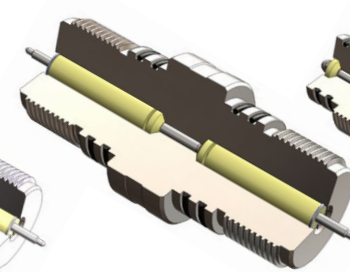
CCL assembly adapter (lower head)



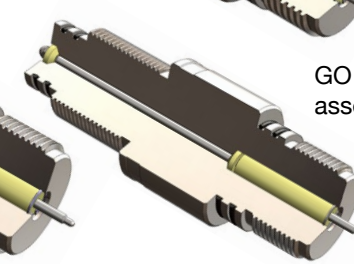
Acme box adapter



Lock collar tandem connector



Tandem connector



SIE Quick-Change assembly adapter

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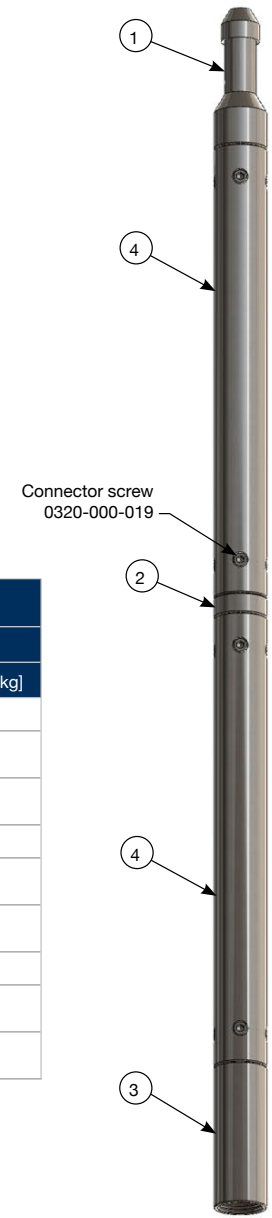
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OVER THE LINE SINKER BAR PART NUMBERS

This series of over the line sinker bars features a bolt together assembly. As many weight bars can be bolted together as necessary.

The fishing neck utilizes a standard slickline profile. The lower sub allows a cone type II ropesocket to be built into it and screws directly into any of Hunting Titan's 1-7/16" (37mm) and 1-11/16" (43mm) logging cable head bodies.

O.D. (in)[mm]	Line Size (in)[mm]	① Fishing Neck	② Tandem Adapter	③ Lower Sub Cone Style II
1-3/8 [35]	7/32 [6]	1049-001-218	1049-002-218	1049-008-218
	0.288 [7]	1049-001-288	1049-002-288	1049-008-288
	5/16 [8]	1049-001-312	1049-002-312	1049-008-312
	15/32 [12]	1049-001-468	1049-002-468	1049-008-468
	0.474 [12]	1049-001-474	1049-002-474	1049-008-474
1-11/16 [43]	7/32 [6]	1050-001-218	1050-002-218	1050-008-218
	0.288 [7]	1050-001-288	1050-002-288	1050-008-288
	5/16 [8]	1050-001-312	1050-002-312	1050-008-312
	15/32 [12]	1050-001-468	1050-002-468	1050-008-468
	0.474 [12]	1050-001-474	1050-002-474	1050-008-474
2 [51]	7/32 [6]	1051-001-218	1051-002-218	1051-008-218
	0.288 [7]	1051-001-288	1051-002-288	1051-008-288
	5/16 [8]	1051-001-312	1051-002-312	1051-008-312
	15/32 [12]	1051-001-468	1051-002-468	1051-008-468
	0.474 [12]	1051-001-474	1051-002-474	1051-008-474



O.D. (in)[mm]	Type	④ Body							
		4ft (1.22m)	Weight (lb)[kg]	5ft (1.52m)	Weight (lb)[kg]	6ft (1.83m)	Weight (lb)[kg]	7ft (2.13m)	Weight (lb)[kg]
1-3/8 [35]	Steel	1049-375-S04†	17 [8]	1049-375-S05†	22 [10]	1049-375-S06†	27 [12]	1049-375-S07†	31 [14]
	Lead Filled	1052-375-L04† 1052-500-L04‡	21 [10]	1052-375-L05† 1052-500-L05‡	27 [12]	1052-375-L06† 1052-500-L06‡	32 [15]	1052-375-L07† 1052-500-L07‡	39 [18]
	Tungsten Filled	1055-375-T04† 1055-500-T04‡	28 [13]	1055-375-T05† 1055-500-T05‡	35 [16]	1055-375-T06† 1055-500-T06‡	43 [20]	1055-375-T07† 1055-500-T07‡	50 [23]
1-11/16 [43]	Steel	1050-437-S04§	27 [12]	1050-437-S05§	34 [15]	1050-437-S06§	41 [19]	1050-437-S07§	48 [22]
	Lead Filled	1053-375-L04† 1053-500-L04‡	33 [15]	1053-375-L05† 1053-500-L05‡	42 [19]	1053-375-L06† 1053-500-L06‡	51 [23]	1053-375-L07† 1053-500-L07‡	60 [27]
	Tungsten Filled	1056-375-T04† 1056-500-T04‡	44 [20]	1056-375-T05† 1056-500-T05‡	56 [25]	1056-375-T06† 1056-500-T06‡	68 [31]	1056-375-T07† 1056-500-T07‡	80 [36]
2 [51]	Steel	1051-500-S04‡	38 [17]	1051-500-S05‡	48 [22]	1051-500-S06‡	58 [26]	1051-500-S07‡	68 [31]
	Lead Filled	1054-375-L04† 1054-500-L04‡	48 [22]	1054-375-L05† 1054-500-L05‡	61 [28]	1054-375-L06† 1054-500-L06‡	75 [34]	1054-375-L07† 1054-500-L07‡	88 [40]
	Tungsten Filled	1057-375-T04† 1057-500-T04‡	65 [29]	1057-375-T05† 1057-500-T05‡	83 [38]	1057-375-T06† 1057-500-T06‡	101 [46]	1057-375-T07† 1057-500-T07‡	119 [54]

† Diameter of cable hole = 3/8" (10mm)
‡ Diameter of cable hole = 1/2" (13mm)
§ Diameter of cable hole = 7/16" (11mm)

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OVER THE LINE SINKER BAR PART NUMBERS

This large diameter series of over the line sinker bars features a screw together assembly. As many weight bars can be screwed together as necessary.

They utilize a 2” fishing neck which is attached to the top of the weight bar. A complete Hunting Titan 1-7/16” (37mm) electrical cable head assembly fits inside the lower end of the weight bar and secured with an adapter.

O.D. (in)[mm]	Type	①	②						③	
		Fishing Neck	Body						Adapter	Lower Head Connection
			3ft (0.91m)		5ft (1.52m)		7ft (2.13m)			
			Part Number	Weight (lb)[kg]	Part Number	Weight (lb)[kg]	Part Number	Weight (lb)[kg]		
2-3/4 [70]	Steel	3884-275-001	3884-275-103	51 [23]	3884-275-105	87 [39]	3884-275-107	124 [56]	0268-000-010	2-3/4” O.D. CCL Assembly
	Tungsten Filled		3884-275-203	71 [32]	3884-275-205	144 [65]	3884-275-207	216 [98]		
3-1/8 [79]	Steel	3884-275-001	3884-312-103	67 [30]	3884-312-105	116 [53]	3884-312-107	164 [74]	0257-200-003	3-1/8” O.D. CCL Assembly
	Tungsten Filled		3884-312-203	88 [40]	3884-312-205	172 [78]	3884-312-207	256 [116]		

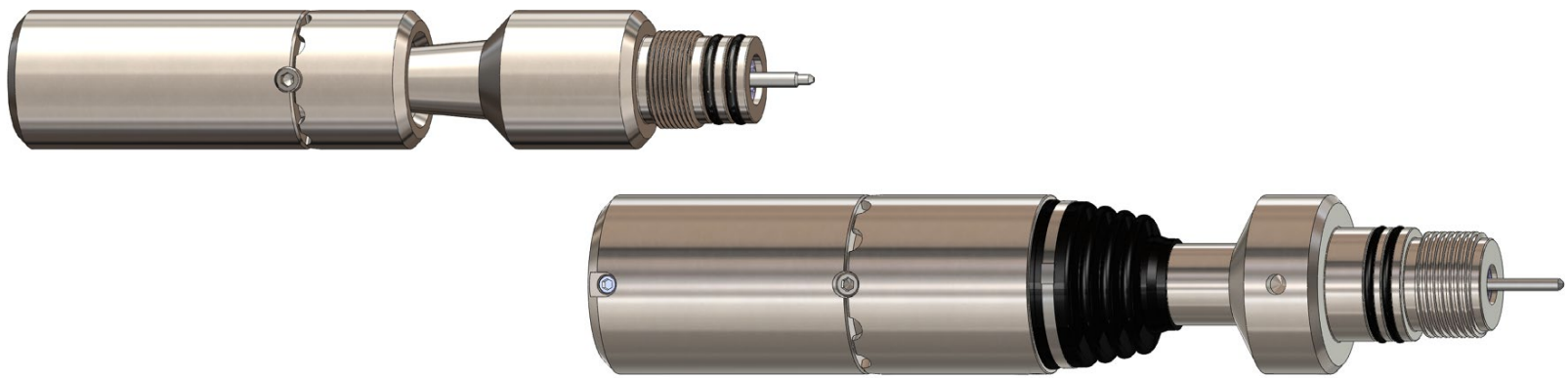


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Hunting Titan knuckle joints use nickel coated ball joints to increase the flexibility of wireline toolstrings by 10°. This reduces the effective rigid length allowing easier passage through dog leg sections of deviated wells.

When combined in tandem, they not only allow more toolstring flexibility, but decouple centered and eccentered tools. This ensures high quality data in highly deviated and horizontal wells.

Unique electrical contacts at the ball joint guarantee undisrupted power transmission at any angle of bend and hydrostatic pressure.



APPLICATIONS

- Production logging
- Remedial cased hole support

FEATURES

- NEDOX® coated ball joints radically reduces wear and tear
- Knuckle shaft tapered to increase bending strength
- Can be combined in tandem

BENEFITS

- Longer life components reduce running costs
- Allows combination of centered and eccentered logging tools

HARDWARE SPECIFICATIONS

O.D. (in)[mm]	1 [25]	1-7/16 [37]	1-11/16 [43]	2-3/4 [70]
Part Number	3906-000-100	3906-000-060	3906-000-000	3906-000-320
Max. Temp. (°F)[°C]†	400 [204]	400 [204]	400 [204]	400 [204]
Max. Pressure (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]
Length (in)[mm]	6.5 [165]	7.0 [178]	7.9 [200]	11.6 [295]
Weight (lbm)[kg]	1.1 [0.5]	2.3 [1.0]	3.9 [1.8]	14.4 [6.5]
Max. Voltage (VDC)	600	600	600	600
Max. Current (mA)	2,000	2,000	2,000	2,000
Knuckle Movement	10°	10°	10°	10°
Max. Tension (lbf)[kN]	15,000 [67]	30,000 [133]	50,000 [222]	123,000 [547]
Contact Kit	3906-000-102	3906-000-052	3906-000-002	3906-000-322
Upper Head Connection	13/16”-16 GO Box	1-3/16”-12 GO Box	1-3/16”-12 GO Box	1-5/8”-6 Acme Box
Lower Head Connection	13/16”-16 GO Pin	1-3/16”-12 GO Pin	1-3/16”-12 GO Pin	1-5/8”-6 Acme Pin

† Viton O-rings need to be used above 325°F (163°C)

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Hunting Titan roller adapters can be placed in a wireline toolstring when in deviated wells. They significantly reduce friction allowing tools to be deployed in higher deviations than traditionally possible. Interchangeable roller wheels are connected to the tool using high strength steel permitting aggressive usage with heavy toolstrings.

APPLICATIONS

- Cased hole wireline support
- Production logging
- Perforating

FEATURES

- Interchangeable roller wheels
- Ideal for long toolstrings in deviated wells
- Roller wheel sizes can be customized upon request

BENEFITS

- One size tool can be used for multiple casing sizes
- Reduced rig time utilizing wireline conveyance





HARDWARE SPECIFICATIONS

Tool O.D. (in)[mm]	O.D.with Rollers (in)[mm]	Assembly Part Number	Max. Temp.† (°F)[°C]	Max. Pressure (psi)[MPa]	Length (in)[mm]	Weight (lbm)[kg]	Max. Voltage (VDC)	Max. Current (mA)	Max. Tension (lbf)[kN	Upper Head Connection	Lower Head Connection
1-11/16 [43]	1.75 [44]	1200-168-175-1	400 [204]	20,000 [138]	15.5 [394]	8.2 [3.7]	600	2,000	70,000 [311]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
	2.00 [51]	1200-168-200-1									
	2.25 [57]	1200-168-225-1									
2 [51]	2.25 [57]	1200-200-225-1	400 [204]	20,000 [138]	22.5 [572]	17.5 [7.9]	600	2,000	70,000 [311]	1-3/16”-12 GO Box	1-3/16”-12 GO Pin
	2.50 [64]	1200-200-250-1									
	2.75 [70]	1200-200-275-1									
	3.00 [76]	1200-200-300-1									
	3.25 [83]	1200-200-325-1									
3-1/8 [79]	3.38 [86]	1200-312-000-1	400 [204]	20,000 [138]	9.6 [244]	18.4 [8.3]	600	2,000	120,000 [534]	1-5/8”-6 Acme Box	1-5/8”-6 Acme Pin
	3.63 [92]	1200-312-000-3									
	3.88 [99]	1200-312-000-5									

† Viton O-rings need to be used above 325°F (163°C)

ACCESSORIES

Spare roller wheels can be ordered individually. 3 are required for the 1-11/16” (43mm) and 2” (51mm) tools. 8 are required for the 3-1/8” (79mm) tool.



1-11/16” (43 mm)

Roller O.D. (in)[mm]	Part Numbers
1.75 [44]	1200-168-175
2.00 [51]	1200-168-200
2.25 [57]	1200-168-225

2” (51 mm)

Roller O.D. (in)[mm]	Part Numbers
2.25 [57]	1200-200-225
2.50 [64]	1200-200-250
2.75 [70]	1200-200-275
3.00 [76]	1200-200-300
3.25 [83]	1200-200-325

3-1/8” (79 mm)

Roller O.D. (in)[mm]	Part Numbers
1.00 [25]	0363-000-302-1.00
1.25 [32]	0363-000-302-1.25
1.50 [38]	0363-000-302-1.50

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The following table lists the most common type of slickline crossovers and couplings. Contact your local Hunting Titan representative for availability of adapters not catalogued.



SLICKLINE CROSSOVER AND COUPLING SPECIFICATIONS

Description	Part Number	Max. Temp. (°F)[°C]†	Max. Pressure (psi)[MPa]	Upper Head Connection ‡	Lower Head Connection‡
1 ” GO Connector to Sucker Rod Crossovers	1014-000-013	400 [204]	20,000 [138]	5/8” Sucker Rod Pin	13/16”-16 GO Box
	1014-000-014			5/8” Sucker Rod Pin	13/16”-16 GO Pin
	1014-000-015			5/8” Sucker Rod Box	13/16”-16 GO Box
	1014-000-016			5/8” Sucker Rod Box	13/16”-16 GO Pin
GO Connector to Sucker Rod Crossovers	1015-000-013	400 [204]	20,000 [138]	5/8” Sucker Rod Pin	1-3/16”-12 GO Box
	1015-000-014			5/8” Sucker Rod Pin	1-3/16”-12 GO Pin
	1015-000-015			5/8” Sucker Rod Box	1-3/16”-12 GO Box
	1015-000-016			5/8” Sucker Rod Box	1-3/16”-12 GO Pin
	1015-000-023			3/4” Sucker Rod Pin	1-3/16”-12 GO Box
	1015-000-024			3/4” Sucker Rod Pin	1-3/16”-12 GO Pin
	1015-000-025			3/4” Sucker Rod Box	1-3/16”-12 GO Box
	1015-000-026			3/4” Sucker Rod Box	1-3/16”-12 GO Pin
	1015-000-033			7/8” Sucker Rod Pin	1-3/16”-12 GO Box
	1015-000-034			7/8” Sucker Rod Pin	1-3/16”-12 GO Pin
	1015-000-035			7/8” Sucker Rod Box	1-3/16”-12 GO Box
	1015-000-036			7/8” Sucker Rod Box	1-3/16”-12 GO Pin
Sucker Rod Crossover	1016-000-013	-	-	5/8” Sucker Rod Pin	3/4” Sucker Rod Box
	1016-000-014			5/8” Sucker Rod Pin	3/4” Sucker Rod Pin
	1016-000-015			5/8” Sucker Rod Box	3/4” Sucker Rod Box
	1016-000-016			5/8” Sucker Rod Box	3/4” Sucker Rod Pin
	1016-000-023			5/8” Sucker Rod Pin	7/8” Sucker Rod Box
	1016-000-024			5/8” Sucker Rod Pin	7/8” Sucker Rod Pin
	1016-000-025			5/8” Sucker Rod Box	7/8” Sucker Rod Box
	1016-000-026			5/8” Sucker Rod Box	7/8” Sucker Rod Pin
	1016-000-033			3/4” Sucker Rod Pin	7/8” Sucker Rod Box
	1016-000-034			3/4” Sucker Rod Pin	7/8” Sucker Rod Pin
	1016-000-035			3/4” Sucker Rod Box	7/8” Sucker Rod Box
	1016-000-036			3/4” Sucker Rod Box	7/8” Sucker Rod Pin
Sucker Rod Couplings	1016-000-047	-	-	5/8” Sucker Rod Box	5/8” Sucker Rod Box
	1016-000-048			3/4” Sucker Rod Box	3/4” Sucker Rod Box
	1016-000-049			7/8” Sucker Rod Box	7/8” Sucker Rod Box
	1016-000-057			5/8” Sucker Rod Pin	5/8” Sucker Rod Pin
	1016-000-058			3/4” Sucker Rod Pin	3/4” Sucker Rod Pin
	1016-000-059			7/8” Sucker Rod Pin	3/4” Sucker Rod Box

† Viton O-rings need to be used above 325°F (163°C)

‡ 5/8” Sucker rod pin or box has 15/16”-10 thread, 3/4” has 1-1/16”-10 thread, 7/8” has 1-3/16”-10 thread

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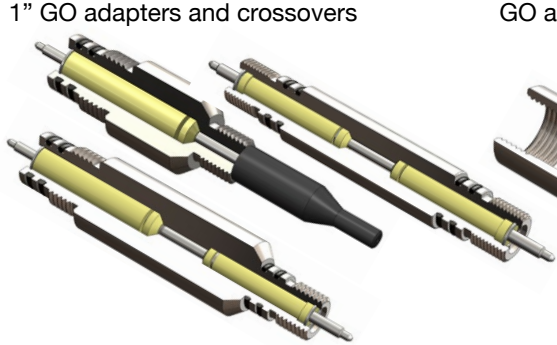
Hunting Titan provides the world's largest variety of wireline crossovers and adapters. The following table displays only a handful of the most common types. Contact your local Hunting Titan representative for availability of crossovers and adapters not catalogued.

WIRELINE CROSSOVER AND ADAPTER SPECIFICATIONS

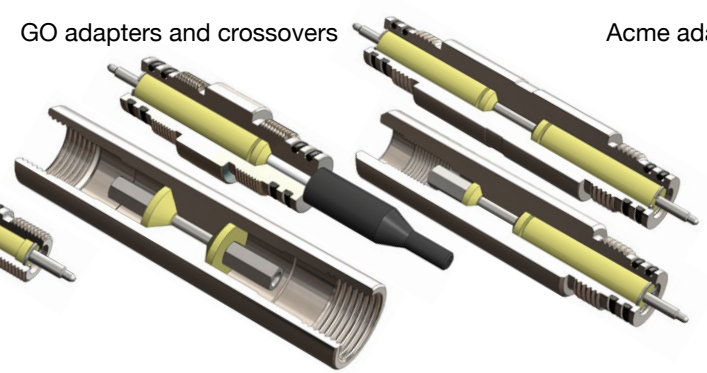
Description	Type†	O.D. (in)[mm]	Assembly Part Number	Contact Kit	Upper Head Connection	Lower Head Connection
1" GO Connections	Adapter	1 [25]	3902-000-060	3902-000-062	13/16"-16 GO Pin	13/16"-16 GO Pin
	Adapter		3902-000-110	3902-000-112	13/16"-16 GO Box	13/16"-16 GO Box
	Crossover	1-7/16 [37]	3902-000-040	3902-000-042	13/16"-16 GO Pin	1-3/16"-12 GO Box
	Crossover		3902-000-050	3902-000-052	13/16"-16 GO Box	1-3/16"-12 GO Pin
	Crossover (teardrop not sealed)		3902-000-070	3902-000-072	13/16"-16 GO Teardrop connector	1-3/16"-12 GO Pin
	Crossover		3902-000-080	3902-000-082	13/16"-16 GO Pin	1-3/16"-12 GO Pin
	Crossover (teardrop not sealed)		3902-000-090	3902-000-092	13/16"-16 GO Pin	1-3/16"-12 GO Teardrop connector
GO Connections	Double sealed adapter	1-7/16 [37]	3903-000-030	3903-000-032	1-3/16"-12 GO Pin	1-3/16"-12 GO Teardrop connector
	Double sealed phasing adapter		3903-000-040	3903-000-042	1-3/16"-12 GO Pin	1-3/16"-12 GO Teardrop connector
	Phasing adapter		3903-000-050	3903-000-052	1-3/16"-12 GO Pin	1-3/16"-12 GO banana plug
	Adapter		3933-000-000	3933-000-002	1-3/16"-12 GO Pin	1-3/16"-12 GO Pin
	Adapter		3934-000-000	3934-000-002	1-3/16"-12 GO Box	1-3/16"-12 GO Box
Acme Connections	Adapter	1-13/16 [46]	0252-000-000	0252-000-002	1-5/8"-6 Acme Pin	1-5/8"-6 Acme Pin
	Double sealed adapter		0253-000-060	0253-000-062	1-5/8"-6 Acme Pin	1-5/8"-6 Acme Teardrop connector
	Crossover (teardrop not sealed)	1-7/8 [48]	0253-000-000	0253-000-002	1-5/8"-6 Acme Pin	1-3/16"-12 GO Teardrop connector
	Crossover		0254-000-000	0254-000-002	1-5/8"-6 Acme Pin	1-3/16"-12 GO Pin
	Crossover		0255-000-000	0255-000-002	1-5/8"-6 Acme Pin	1-3/16"-12 GO Box
	Crossover	2-1/2 [64]	0252-000-030	0252-000-032	1-5/8"-6 Acme Box	1-3/16"-12 GO Box
	Crossover		0252-000-040	0255-000-002	1-5/8"-6 Acme Box	1-3/16"-12 GO Pin
	Adapter	3-1/8 [79]	0252-000-100	0252-000-032	1-5/8"-6 Acme Box	1-5/8"-6 Acme Box

† All adapters and crossovers rated to 400 °F (204 °C), 20,000 psi (138 MPa), 600 VDC and 2,000 mA. Viton O-rings need to be used above 325°F (163°C)

1" GO adapters and crossovers



GO adapters and crossovers



Acme adapters and crossovers



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HUNTING
Hunting Titan

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EBFire® switches are designed to allow multiple, independently fired, perforating guns in a single trip. They are disposable and polarity discriminating which allows sequential firing control. Two main types of switches are available depending on the nature of perforating operations being conducted. They are the pressure switch and dual diode switch.

PRESSURE SWITCH

Pressure switches work by utilizing pressure shock waves generated by the detonation of perforating guns. The shock wave actuates an arming piston by pushing it to make contact with the proceeding detonator. A diode is connected to each switch such that all the guns do not initiate at once – only one gun will initiate per firing sequence. Therefore positive (+) and negative (-) pressure switches are available to control firing selectivity. It is very important that they are correctly placed within the gun string such that each gun is selected and fired at the correct depth. A diagram on the following page shows an example of how the positive (+) and negative (-) switches can be setup.

This type of switch can only be used in hollow steel carrier perforating guns. Any length of gun and any number of switches can be used at any one time, the only limitations being rig height, surface equipment setup and wireline cable strength.

DUAL DIODE SWITCH

The dual diode switch is designed such that no outside influence is required to fire either of the perforating guns. This allows a setting tool to be fired below a perforating gun, fire the second gun in the string in the event of rathole issues, or if there are problems with the lower gun. Two diodes are used inside the switch to discriminate between a positive (+) firing and negative (-) firing.

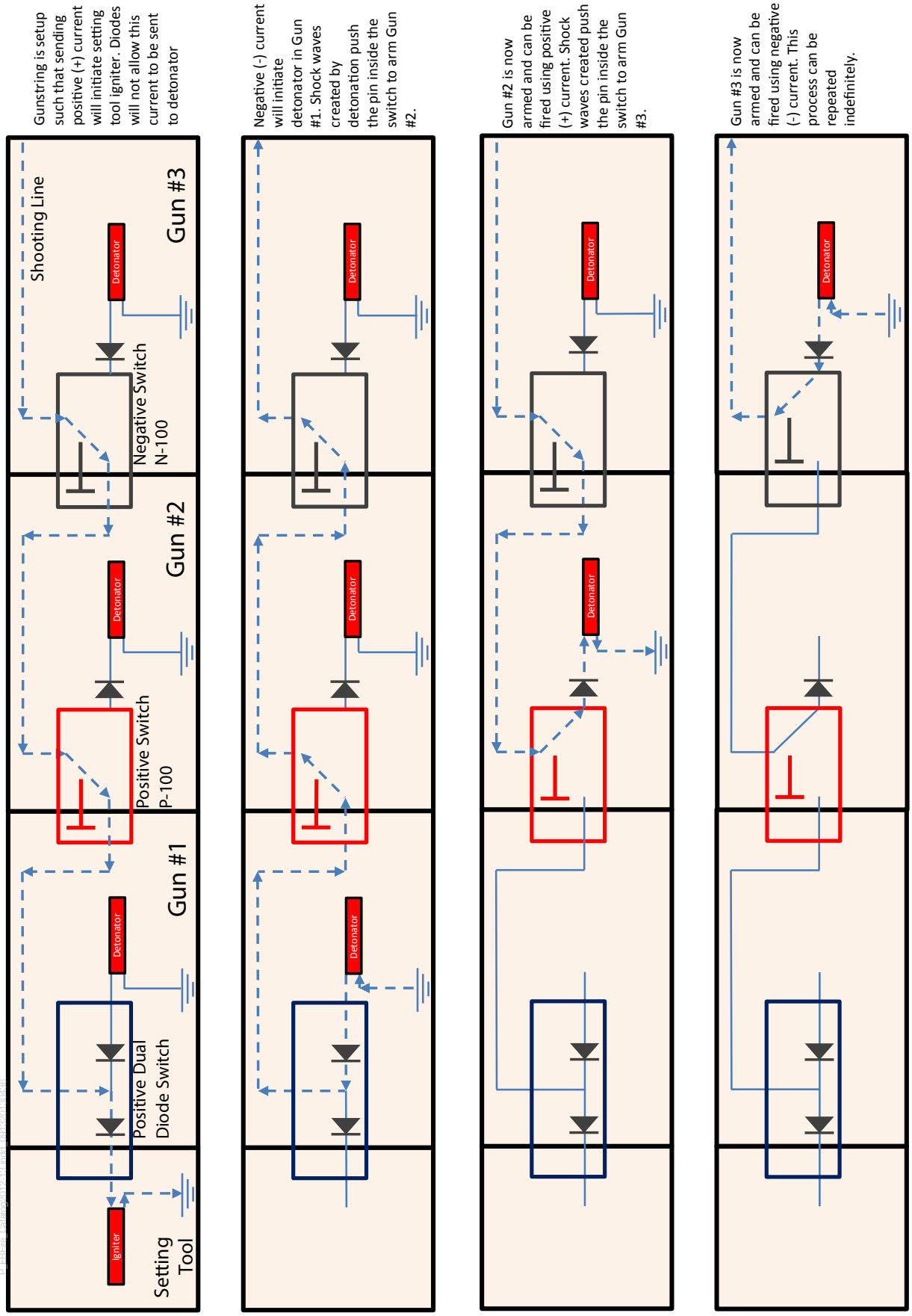
As the dual diode switch uses a hardwired circuit, it is always in contact (and armed) with both the upper and lower detonator. Only one dual diode can be used in a gunstring and it **must** be placed between the first two detonators fired in the gunstring. If more than two guns are used, then the dual diode must be placed between the first two detonators to be fired and pressure switches used between the upper guns in the gunstring.

The polarity of the upper and lower detonator connections cannot be changed by the operator. The white wire must always be connected to the gun firing lead. If the upper detonator and gun firing lead are reversed, then both detonators will be fired at once.

The diagram on the following page shows how a dual diode, in combination with pressure switches can be used in a gunstring.

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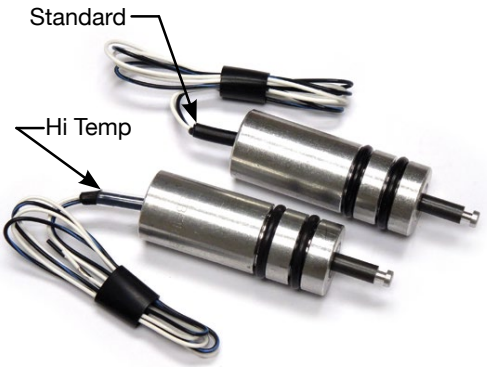


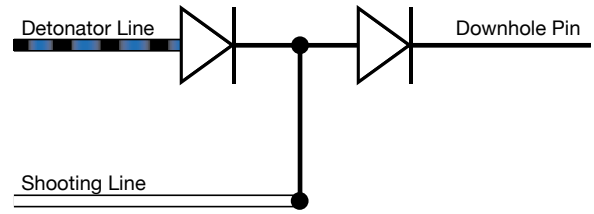
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Hard wired dual diode positive polarity switch packaged inside pressure bulkhead body. Passes positive (+) current to lower gun detonator and negative (-) current to upper gun detonator. **The polarity of the upper and lower detonator connections cannot be changed by the operator. The white wire on a dual diode must always be connected to the shooting line. If the upper detonator and shooting line are reversed, both detonators will be fired at once.**

DISTINGUISHING FEATURES

Shooting line color: White
Detonator line color: Black/Blue
Downhole pin: Anodized aluminum has a black pin, plastic has a brass pin
Temperature rating: 350°F switches have black heat shrink coming out of the switch body
450°F switches have a clear coating on the black heat shrink





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBDD-P 350 DEGREE PL	350 [177]	15,000 [103]	600	2,000
9400-EBDD-P 350 DEGREE AL	350 [177]	15,000 [103]	600	2,000
9400-EBDD-P 450 PL	450 [232]	15,000 [103]	600	2,000
9400-EBDD-P 450 AL	450 [232]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, downhole pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White wire (+ polarity)*	Downhole pin (- polarity)*	0.5-0.7 V
White wire (+ polarity)*	Black/Blue wire (- polarity)*	∞ V
White wire (- polarity)*	Black/Blue wire (+ polarity)*	0.5-0.7 V
White wire (- polarity)*	Downhole pin (+ polarity)*	∞ V
Downhole pin	Switch (or gun) body	> 20 MΩ

** If meter does not allow switching polarity, then alternate meter probes on switch leads*

All detonator checks should be carried out using API RP-67 recommendations.

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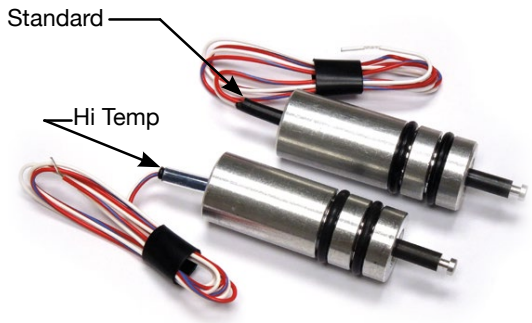
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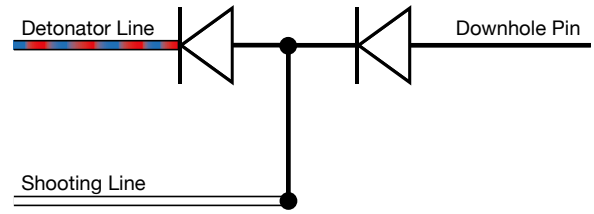
EBDD-N Negative (-) Dual Diode Switch

Hard wired dual diode negative polarity switch packaged inside pressure bulkhead body. Passes negative (-) current to lower gun detonator and positive (+) current to upper gun detonator. **The polarity of the upper and lower detonator connections cannot be changed by the operator. The white wire on a dual diode must always be connected to the shooting line. If the upper detonator and shooting are reversed, both detonators will be fired at once.**

DISTINGUISHING FEATURES

Shooting line color: White
Detonator line color: Red/Blue
Downhole pin: Anodized aluminum has a black pin, plastic has a brass pin
Temperature rating: 350°F switches have black heat shrink coming out of the switch body
450°F switches have a clear coating on the black heat shrink





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBDD-N 350 DEGREE PL	350 [177]	15,000 [103]	600	2,000
9400-EBDD-N 350 DEGREE AL	350 [177]	15,000 [103]	600	2,000
9400-EBDD-N 450 PL	450 [232]	15,000 [103]	600	2,000
9400-EBDD-N 450 AL	450 [232]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, downhole pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White wire (- polarity)*	Downhole pin (+ polarity)*	0.5-0.7 V
White wire (- polarity)*	Red/Blue wire (+ polarity)*	∞ V
White wire (+ polarity)*	Red/Blue wire (- polarity)*	0.5-0.7 V
White wire (+ polarity)*	Downhole pin (- polarity)*	∞ V
Downhole pin	Switch (or gun) body	> 20 MΩ

** If meter does not allow switching polarity, then alternate meter probes on switch leads*

All detonator checks should be carried out using API RP-67 recommendations.

P_EBPre_Catalog2012-13.indd_09132013043

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Dual diode switches are made with two types of sealing elements/pistons. Conventional style dual diodes consist of an aluminum sealing piston which is anodized to provide electrical insulation. These can be identified by the black anodizing visible on the downhole pin.

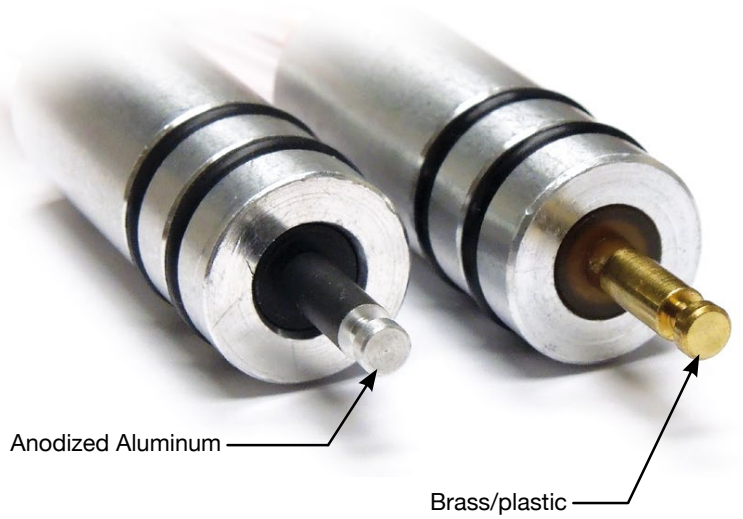
Alternate dual diodes utilize plastic sealing elements/pistons with brass downhole pins. These can be easily identified by brass colored downhole pin and plastic insulation.

Both styles have the same temperature and pressure ratings. The main difference is that the anodizing on the aluminum sealing piston is not a pure insulator and will, on occasion, show a small amount of electrical leakage (<500,000 Ω insulation). This normally is not an issue and is of little concern in standard wireline operations.

The plastic sealing piston is a pure insulator. It has also demonstrated to give better results when using the “dump fire” technique of shooting detonators and igniters.

It is recommended to use the EBRN-250 retainer nut with the EBDD-P/N. The smaller hole in the retainer nut provides mechanical support to prevent the internal switch components from being blown out when the upper gun is fired.

In summary, Hunting Titan continues to manufacture both styles of dual diode switches. Both styles have the same temperature and pressure ratings. The new technology incorporated into the plastic sealing element/piston has shown itself to be rugged and reliable.



P_EBFire_Catalog2012-13.indd_09132013043

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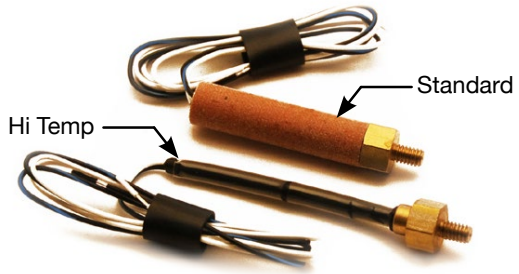
EBPS-P Positive (+) Plug Shoot Switch

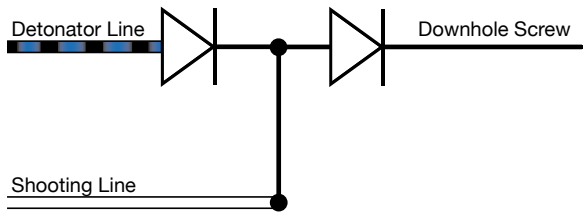
Hard wired dual diode positive switch that connects into a plug shoot adapter. Passes positive (+) current to lower setting tool igniter and negative (-) current to upper gun detonator. **The polarity of the upper and lower detonator connections cannot be changed by the operator. The white wire on a dual diode must always be connected to the shootin line. If the upper detonator and shooting line are reversed, both detonators will be fired at once.**

Installation is accomplished using the hex nut. The cardboard tube cannot be used for tightening.

DISTINGUISHING FEATURES

Shooting line color: White
Detonator line color: Black/Blue
Temperature rating: 350°F switch has a cardboard housing
450°F switch does not have a housing





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBPS-P 350 DEGREE	350 [177]	N/A	600	2,000
9400-EBPS-P 450 DEGREE	450 [232]	N/A	600	2,000

MECHANICAL INSPECTION

Ensure switch body, thread connection and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White wire (+ polarity)*	Downhole screw (- polarity)*	0.5-0.7 V
White wire (+ polarity)*	Black/Blue wire (- polarity)*	∞ V
White wire (- polarity)*	Black/Blue wire (+ polarity)*	0.5-.7 V
White wire (- polarity)*	Downhole screw (+ polarity)*	∞ V

** If meter does not allow switching polarity, then alternate meter probes on switch leads*

All detonator checks should be carried out using API RP-67 recommendations.

P_EBPre_Catalog2012-13.indd_09132013043

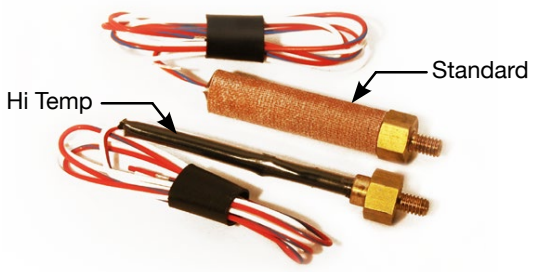
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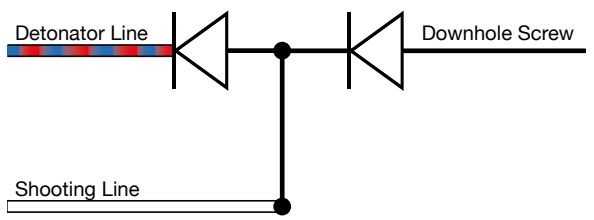
Hard wired dual diode negative switch that connects into a plug shoot adapter. Passes negative (-) current to lower setting tool igniter and positive (+) current to upper gun detonator. **The polarity of the upper and lower detonator connections cannot be changed by the operator. The white wire on a dual diode must always be connected to the shooting line. If the upper detonator and shooting line are reversed, both detonators will be fired at once.**

Installation is accomplished using the hex nut. The cardboard tube cannot be used for tightening.

DISTINGUISHING FEATURES

Shooting line color: White
Detonator line color: Red/Blue
Temperature rating: 350°F switch has a cardboard housing
450°F switch does not have a housing





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBPS-N 350 DEGREE	350 [177]	N/A	600	2,000
9400-EBPS-N 450 DEGREE	450 [232]	N/A	600	2,000

MECHANICAL INSPECTION

Ensure switch body, thread connection and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White wire (- polarity)*	Downhole screw (+ polarity)*	0.5-0.7 V
White wire (- polarity)*	Red/Blue wire (+ polarity)*	∞ V
White wire (+ polarity)*	Red/Blue wire (- polarity)*	0.5-.07 V
White wire (+ polarity)*	Downhole screw (- polarity)*	∞ V

** If meter does not allow switching polarity, then alternate meter probes on switch leads*

All detonator checks should be carried out using API RP-67 recommendations.

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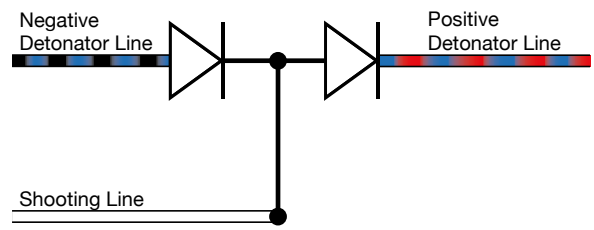
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Hard wired dual diode switch that is used with a dart sealing system. Passes positive (+) current to the red/blue gun detonator and negative (-)current to the black/blue gun detonator. Unlike the EBDD-P/N and EBPS-P/N, the operator can choose which detonator line goes to the upper and lower gun to match polarity order desired. This is the only dual diode product to which this applies. **The white wire must always be connected to the shooting line.**

DISTINGUISHING FEATURES

Shooting line color: White
Detonator line color: Red/Blue passes positive current
Black/Blue passes negative current





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBDP	350 [177]	N/A	600	2,000

MECHANICAL INSPECTION

Ensure wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White wire (+ polarity)*	Red/Blue wire (- polarity)*	0.5-0.7 V
White wire (+ polarity)*	Black/Blue wire (- polarity)*	∞ V
White wire (- polarity)*	Black/Blue wire (+ polarity)*	0.5-0.7 V
White wire (- polarity)*	Red/Blue wire (+ polarity)*	∞ V

** If meter does not allow switching polarity, then alternate meter probes on switch leads*

All detonator checks should be carried out using API RP-67 recommendations.

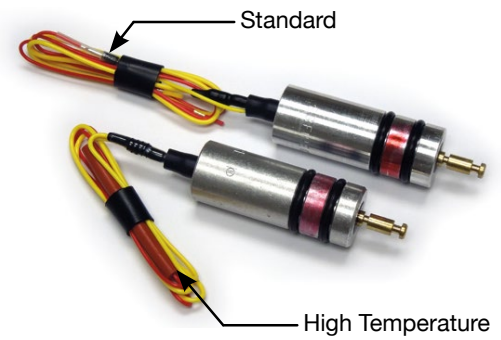
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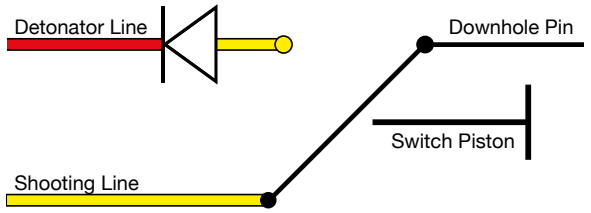
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Pressure shock wave actuated positive switch will pass positive (+) current to the detonator but will block negative (-) current from the detonator.

DISTINGUISHING FEATURES

Shooting line color: Yellow
Detonator line color: Red
Temperature rating: 350°F switches have clear heat shrink covering the diodes
450°F switches have an orange silicone boot covering the diodes





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-P-100 350 DEGREE	350 [177]	15,000 [103]	600	2,000
9400-P-100 450 DEGREE	450 [232]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, arming pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
Yellow wire	Downhole pin	< 1 Ω
Yellow wire	Switch (or gun) body	> 20 MΩ
Yellow wire (both polarities)*	Red wire	> 20 MΩ
Red wire (both polarities)*	Switch (or gun) body	> 20 MΩ

** If meter does not allow switching polarity, then alternate meter probes on switch leads*

All detonator checks should be carried out using API RP-67 recommendations.

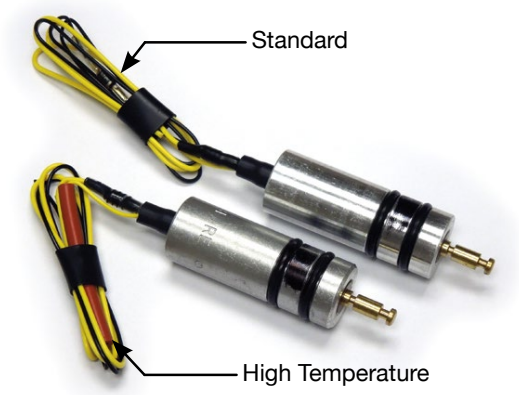
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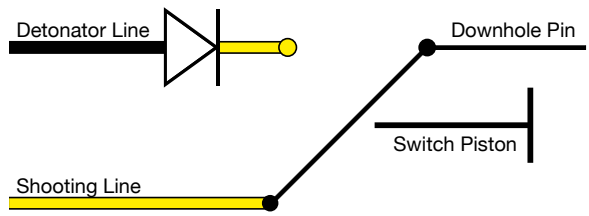
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Petitioner GR Energy Services - Ex. 1009, p. 36

Pressure shock wave actuated negative switch will pass negative (-) current to the detonator but will block positive (+) current from the detonator.

DISTINGUISHING FEATURES

Shooting line color: Yellow
Detonator line color: Black
Temperature rating: 350°F switches have clear heat shrink covering the diodes
450°F switches have an orange silicone boot covering the diodes





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-N-100 350 DEGREE	350 [177]	15,000 [103]	600	2,000
9400-N-100 450 DEGREE	450 [232]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, arming pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
Yellow wire	Downhole pin	< 1 Ω
Yellow wire	Switch (or gun) body	> 20 MΩ
Yellow wire (both polarities)*	Black wire	> 20 MΩ
Black wire (both polarities)*	Switch (or gun) body	> 20 MΩ

* If meter does not allow switching polarity, then alternate meter probes on switch leads

All detonator checks should be carried out using API RP-67 recommendations.

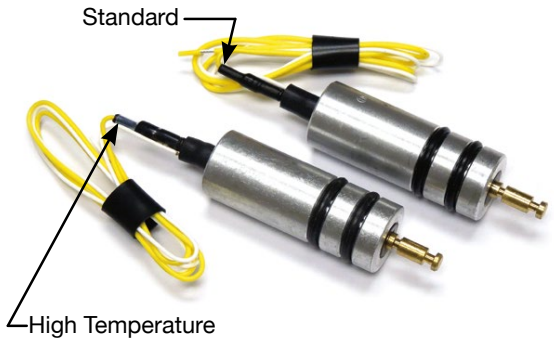
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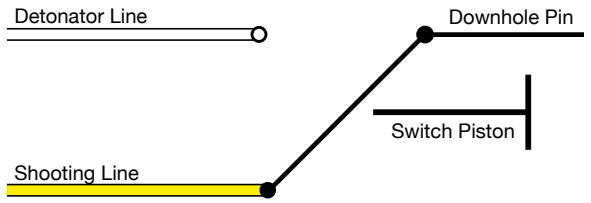
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Pressure shock wave actuated switch. Does not discriminate between positive (+) and negative (-) currents. Used in conjunction with detonating systems that already contain polarity sensitive circuitry.

DISTINGUISHING FEATURES

Shooting line color: Yellow
Detonator line color: White
Temperature rating: 350°F switches have black heat shrink coming out of the switch body
450°F switches have a clear coating on the black heat shrink





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
EBMONO-Y	350 [177]	15,000 [103]	600	2,000
EBMONO-Y 450 DEGREE	450 [232]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, arming pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the switch).

ELECTRICAL CHECKS

From	To	Multimeter Reading
Yellow wire	Downhole pin	< 1 Ω
Yellow wire	Switch (or gun) body	> 20 MΩ
Yellow wire	White wire	> 20 MΩ
White wire	Switch (or gun) body	> 20 MΩ

All detonator checks should be carried out using API RP-67 recommendations.

P_EBFire_Catalog2012-13.indd_09132013130436

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Petitioner GR Energy Services - Ex. 1009, p. 38

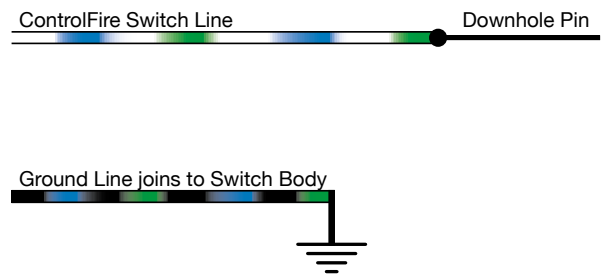
This is not a switch in the sense of providing selective firing. It is used as a thru-wiring pressure bulkhead when combined with the ControlFire® system. The ControlFire package in each gun provides selectively that is controlled at surface by computer.

It is recommended to use the 9400-EBRN-WG retainer nut to ensure a good ground. Tandem adapters are the recommended grounding points

DISTINGUISHING FEATURES

Shooting line color: White/Blue/Green
Ground line color: Black/Blue/Green





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBTW-WG	350 [177]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, downhole pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the feed thru).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White/Blue/Green wire	Downhole pin	< 1 Ω
Black/Blue/Green wire	Switch (or gun) body	< 1 Ω
White/Blue/Green wire	Black/Blue/Green wire	> 20 MΩ

All detonator checks should be carried out using API RP-67 recommendations.

P_EBFire_Catalog2012-13.indd_09132013043

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This is not a switch in the sense of providing selective firing. It is used as a thru-wiring pressure bulkhead when combined with the ControlFire® system. The ControlFire package in each gun provides selectively that is controlled at surface by computer.

It is recommended to use 9400-EBRN-250.

DISTINGUISHING FEATURES

Shooting line color: White/Blue/Green
Ground line color: N/A





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current(mA)
9400-EBTW	350 [177]	15,000 [103]	600	2,000

MECHANICAL INSPECTION

Ensure O-rings (size 113), switch body, downhole pin and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the feed thru).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White/Blue/Green wire	Downhole pin	< 1 Ω
White/Blue/Green wire	Switch (or gun) body	> 20 MΩ

All detonator checks should be carried out using API RP-67 recommendations.

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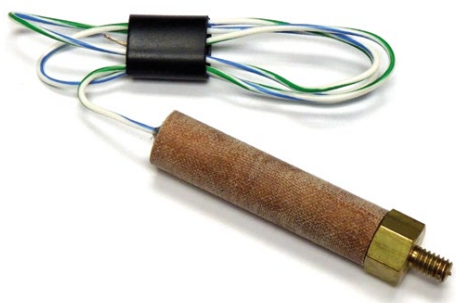
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This is not a switch in the sense of providing selective firing. It is used as thru-wiring when combined with the ControlFire® system and a plug shoot adapter. The ControlFire package in the setting tool and each gun provides selectively that is controlled at surface by computer.

Installation is accomplished using the hex nut. The cardboard tube cannot be used for tightening.

DISTINGUISHING FEATURES

Shooting line color: White/Blue/Green
Ground line color: N/A





SPECIFICATIONS

Part Number	Max. Temp. (°F)[°C]	Max. Pressure (psi)[MPa]	Max. Voltage (VDC)	Max. Current (mA)
9400-EBPS-TW	350 [177]	N/A	600	2,000

MECHANICAL INSPECTION

Ensure switch body, thread connection and wiring insulation show no signs of damage. It is not recommended to pull or twist on anything (excessive pulling will damage the feed thru).

ELECTRICAL CHECKS

From	To	Multimeter Reading
White/Blue/Green wire	Downhole screw	< 1 Ω

All detonator checks should be carried out using API RP-67 recommendations.

P_EBFire_Catalog2012-13.indd_09132013043

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Hunting Titan manufactures a series of retainer nuts. Each of them have a separate function and are explained in the table below.



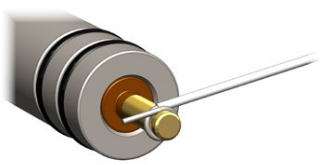
Switch Type	Part Number	Distinguishing Features	Reasons for Use
Pressure Switch Family	9400-EBRN	• Beveled face • 3/8” (9.5mm) hole	Dimensions optimized for perforating guns having a shot density less than or equal to 4 spf
	9400-EBRN-F	• Flat face • 3/8” (9.5mm) hole	Protects switches from internal damage when using high shot density guns. Use for shot densities greater than 4 spf
EBDD EBTW Family	9400-EBRN-WG	• Beveled face • 1/4” (6.4mm) hole • Black/Blue/Green ground wire	The smaller hole provides mechanical support to prevent the internal switch components from being blown out when the upper gun is fired. Having the ground wire on the retainer nut is a personal choice depending on whether the electronic grounding will be made above or below the tandem adapter
	9400-EBRN 250	• Beveled face • 1/4” (6.4mm) hole	
EBDP	9000-900-229	• Flat face • Beveled rear • 5/16” (7.9mm) hole	Used as a dart retainer. It seals the upper assembly from damage after the gun below is fired by driving the dart into the sealing seat.

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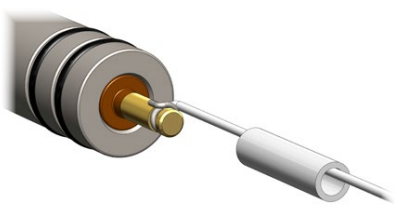
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1. Switches should be mechanically and electrically checked before proceeding with installation. Tandem adapters should also be checked ensuring the switch bore is clean and free of debris. A light coat of grease on the switch body and O-rings will help with switch removal.
2. Straighten out the wires and feed them through the tandem adapter body. Making sure there is no slack in the wires, slide the switch body into the bore up to the O-rings. Using any rigid tool, gently push or tap the switch body until it is fully seated inside the bore. Do not hit or press on the downhole pin of pressure switches. This will activate the switch. Pay particular attention that the wires do not become pinched behind the switch body.
3. It is recommended to carry out the electrical checks on the switch again to verify that no damage has occurred during installation.
4. Connect the shooting wire (yellow or white) on the uphole end of the switch to the shooting line running through the upper gun. The detonator line on the uphole end of the switch should be appropriately positioned in the tandem adapter such that it is easily accessible during arming. When using the EBTW-WG, connect the ground line (black) to the tandem adapter body. Check insulation and continuity according to the type of switch being used.
5. Place a length (½" or longer) of white silicone tubing (9400-EBWST) on the wire to be attached to the switch downhole pin.
6. Strip ¾" insulation off the wire.
7. Start with wire at 90° to the downhole pin. Place bare wire in the groove at end of pin, with the end of the insulation touching the pin.
8. Wrap bare wire around groove in pin one full turn, crossing standing end (the long body) of wire away from the switch body (downhole side).
9. Rotate wire 90° such that the long insulated body of the wire is pointing straight downhole and the short bare wire is lying along the length of the pin, pointing at the switch body. Make sure that the bare wire is not long enough to reach the switch body and cause a short circuit.
10. Slide the white silicone tubing over the pin and wire, pinning the short bare wire down to the pin.

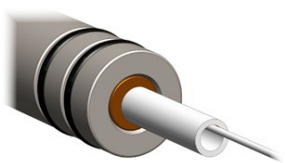
Done properly, this knot gives the smallest possible profile and is very reliable. Pulled to breaking, the wire typically breaks below the tie point. A touch of non-conductive grease on the tubing will help the retainer slide over the tubing if needed.



Make knot



Tighten knot



Slide silicone tube over pin

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Care and attention in loading and assembly will ensure good performance. The following points are guidelines that will assist in safe and efficient perforating operations:

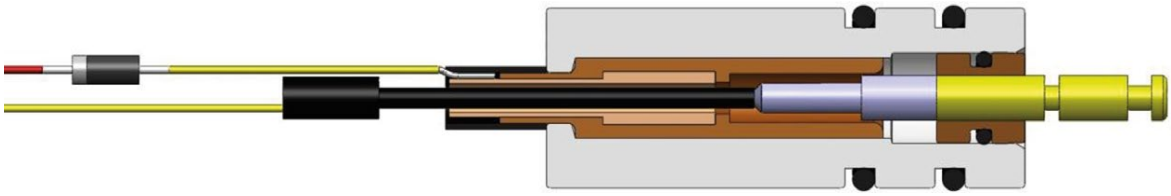
- **Explosive safety.** Always use an approved explosive safety meter. Detonators and igniters should only be installed once the gunstring has been assembled and all switches installed correctly.
- **Misfire safety.** In the event of a misfire, break off the last fired gun and perform necessary electrical checks on remaining gunstring. Make sure to note the polarity of the last switch in gunstring.
- **Switch grounding.** Switches and detonators should always be grounded to the mass of the gun body, specifically the adapters. This is the only way to ensure that a continuous ground is maintained throughout the entire gunstring with a certain connection to the armor on the wireline cable. Charge tubes are not a reliable ground.
- **Piston protection.** Be careful in transporting and making up guns so as to avoid bumping the end of the switch. If the piston gets moved in, do not use the switch.
- **Wires twisting on pressure switches.** Ensure the two wires on the uphole end are not twisted or bound together in any way. When the switch actuates, one of these wires moves and may break the other one if they are twisted together. See Appendix A for details on pressure switch actuation.
- **Correct retainer nuts.** Using the incorrect retainer nuts can lead to misfires.
- **Use direct current.** All switches must be fired using direct current (DC). Using alternating current (AC) will fire all the guns at once.
- **Polarity sensitivity.** For pressure switches, its polarity is defined by which polarity it will pass to the detonator above it after function. Pressure switch thru wires are not polarity sensitive. For dual diodes, it is the polarity it will pass to the detonator below it.
- **Wire color coding.** Pressure switches use yellow through wires, dual diodes use white through wires. Detonator wires are red (+) or black (-). Positive and negative must alternate. The blue stripes on dual diode detonator wires help differentiate them from pressure switches.
- **Charge to switch spacing**. For efficient pressure switch operation, the top charge should be 3-6 inches away from the switch for shot densities less than or equal to 4 spf. Spacing for shot densities greater than 4 spf can be increased up to 12 inches. For dual diodes, charge to switch spacing is not critical to switch function.
- **Gun marking.** When loading guns, it is helpful to mark them positive or negative depending on the switch used. Red (+) and black (-) paint is a useful method of identification.
- **Chasing threads. When chasing EB gland threads, it is recommended to place a used switch in the bore such that the O-ring sealing surface cannot be accidently damaged.** 7/8”-12 chaser taps need to be used.
- **Nonstandard firing sequence with pressure switches.** If the wrong polarity is applied to the first (bottom) gun, both the bottom gun and the next one up will fire simultaneously. Pressure switch through wires are not polarity sensitive.
- **Don’t guess.** If unsure whether a gun shot correctly, come out of the hole and check it. Do not move up and try the next gun to see if it will shoot. Depending on the combination of switch types used, once the polarity is switched and power sent again, a gun could be shot at the wrong depth. A little time spent at this point will prove to the shooter and the client that the guns are shooting in proper sequence, or at least avoid further off-depth perforating.

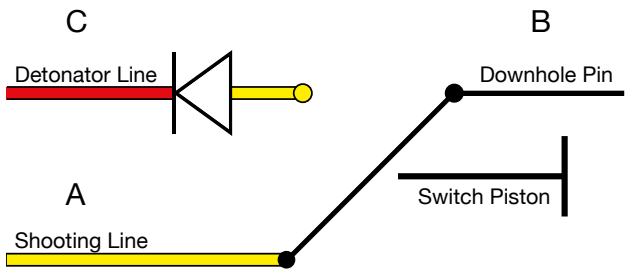
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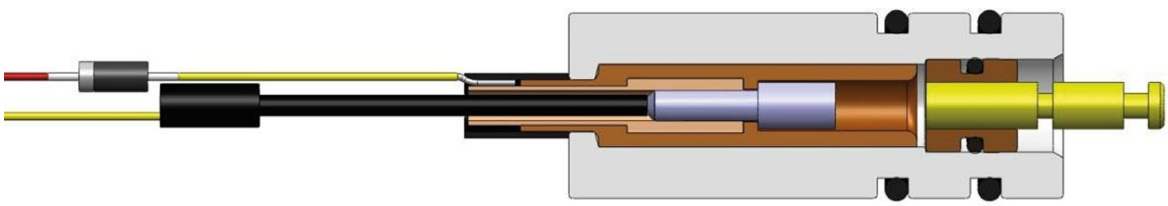
P-100 SWITCH

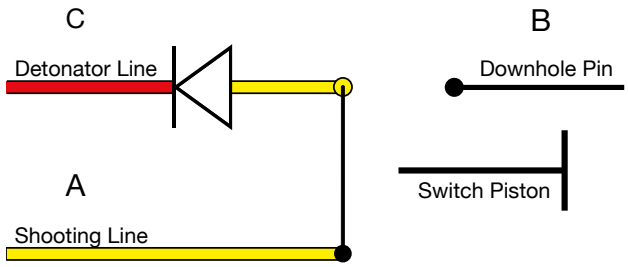
Before switch actuation





After switch actuation





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Below is listed the most common frequently asked questions concerning switch testing and operations.

Q. If the downhole pin of the pressure switch is bent over and touching the housing after firing the gun, will it cause a short circuit?

A. No. Refer to page 22. When the switch has been activated, the through circuit is disconnected from the previous gun. If debris packs in around the pin, or the pin itself gets bent over and touches the housing, it cannot cause a short circuit because it is no longer connected to the dart and upper lead wires of the switch.

Q. I inspect my pressure switches before loading them into the gun subs by pulling on the dart (yellow) wire until the through circuit opens up. When I release the tension on the dart wire, the circuit should reconnect. If it doesn't, I set the switch aside and label it as defective. Is this the correct way to inspect pressure switches?

A. The practice of "popping" pressure switches needs to be discontinued immediately as it can permanently damage the switch. Some of the switches internal parts are designed for a one time operation. This includes compressing the dart spring. Rigorous testing is conducted on 100% of the assemblies during manufacturing ensuring correct mechanical functionality. The only tests that should be done in the field are the mechanical and electrical checks described in each switches summary page of this booklet.

Q. If I run out of EBPS-P assemblies, can I switch wires on the EBPS-N and use them as positive assemblies?

A. No. Referring to the EBPS-N circuit schematic on page 11, reversing the leads (shooting line for detonating line) will not achieve anything. In this configuration, positive power will be blocked by the diode. Sending negative power will detonate one or both guns as the detonators are both connected to the firing line.

Q. How much pressure does it take to activate a pressure switch?

A. It takes a combination of pressure and velocity to properly activate pressure switches. One charge of any size in any length carrier will activate a pressure switch if it is placed 4-6 inches away from it.

Q. Why can't I read the upper detonator lead on a pressure switch?

A. The upper detonator lead is electrically isolated until the switch is activated. See switch function diagram on page 22 and electrical checks on pages 13 and 14.

Q. In what quantities are the pressure switches and dual diodes packaged for sale?

A. All switches and feed throughs are packaged in quatities of 20.

Q. Can we order parts directly from Wichita Falls or do we need to go directly to the warehouse?

A. You may order your parts from either location. However, please be aware that shipping charges will apply if you order from the Wichita Falls location.

Q. What kind of O-Rings are used on the swicthes and feed throughs?

A. Size 113, 70 durometer, O-Rings are used.

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Underbalance Sub 18

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Fill/Stop Fill Valve 20

Annular Pressure Packer Bypass 21

Drop Bar Operated Production Vent 22

Annular Pressure Operated Production Vent 23

Tubing Swivel 24

Digital Shot Detection System TSD-100-100 25

APPLICATIONS

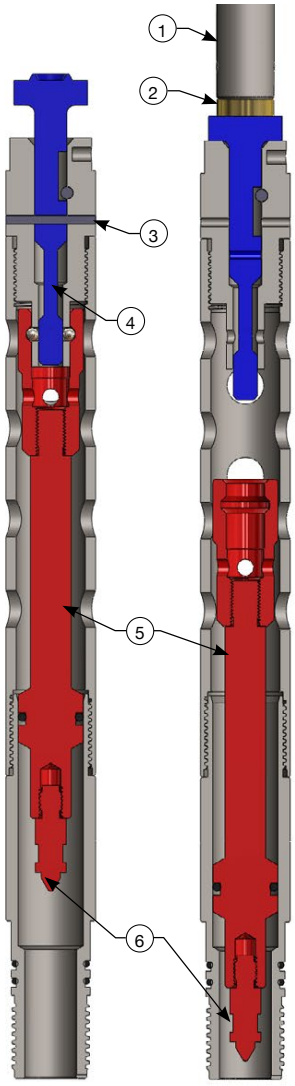
- TCP perforating
- Underbalance and overbalance perforating
- Straight wells with deviation less than 55°

FEATURES

- Designed to API RP-67 (Oilfield Explosive Safety) guidelines
- Impression pad can confirm drop bar impact
- High pressure version available
- Firing head extensions offered upon request
- Roller drop bars available for high deviation wells
- Redress kits
- Simple, reliable and rugged design

BENEFITS

- Enhanced safety as cannot be detonated at surface or by electrical sources
- Can be operated at low hydrostatic pressure conditions, providing a high underbalanced environment when guns are fired
- Compatible with all Titan TCP firing systems
- Extensions can reduce risk of debris settling on firing head
- Cost effective solution for TCP perforating
- Redress kits allow for quick turnarounds



1. Drop Bar
2. Brass Impression Pad
3. Retaining Pin CTSP-0125-1375-MDP
4. Release Rod
5. Firing Piston
6. Firing Pin

The drop bar impacts a release rod and shears the retaining pin holding it in place which causes the rod to move down. This movement of the rod releases the firing piston. Hydrostatic pressure drives the firing piston down towards the percussion initiator. The firing pin located at the end of the firing piston strikes the percussion initiator which in turn detonates the gun assembly. As a safety feature, a minimum hydrostatic pressure is required on the firing piston when the drop bar impacts in order to operate.

The drop bar has a brass impression pad on the base of it which can be used to confirm impact with the release rod by identifying a familiar pattern on the impression. The upper end of the drop bar incorporates a standard slickline fishing neck.

There is also an option to utilize a direct impact firing head which does not require any hydrostatic pressure (no firing piston) to fire the gun assembly.

DROP BAR FIRING HEAD HARDWARE SPECIFICATIONS

Assembly Part Number	FHBD-1375-000** (Low Pressure)	FHBD-1375-100** (High Pressure)	FHBD-1375-500** (Direct Impact)
O.D. (in)[mm]	1-3/8 [35]	1-3/8 [35]	1-3/8 [35]
Makeup Length (ft)[m]	1.08 [0.33]	1.08 [0.33]	0.21 [0.06]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]	400 [204]
Min. Required Hydrostatic (psi)[MPa]	200 [1.4]	2,000 [13.8]	N/A
Max. Operating Pressure (psi)[MPa]‡	8,500 [59]	20,000 [138]	20,000 [138]
Redress Kit Part Number	FHBD-1375-000**-KIT	FHBD-1375-100**-KIT	FHBD-1375-500**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kit FHBD-1375-x00-BUKIT needs to be ordered separately

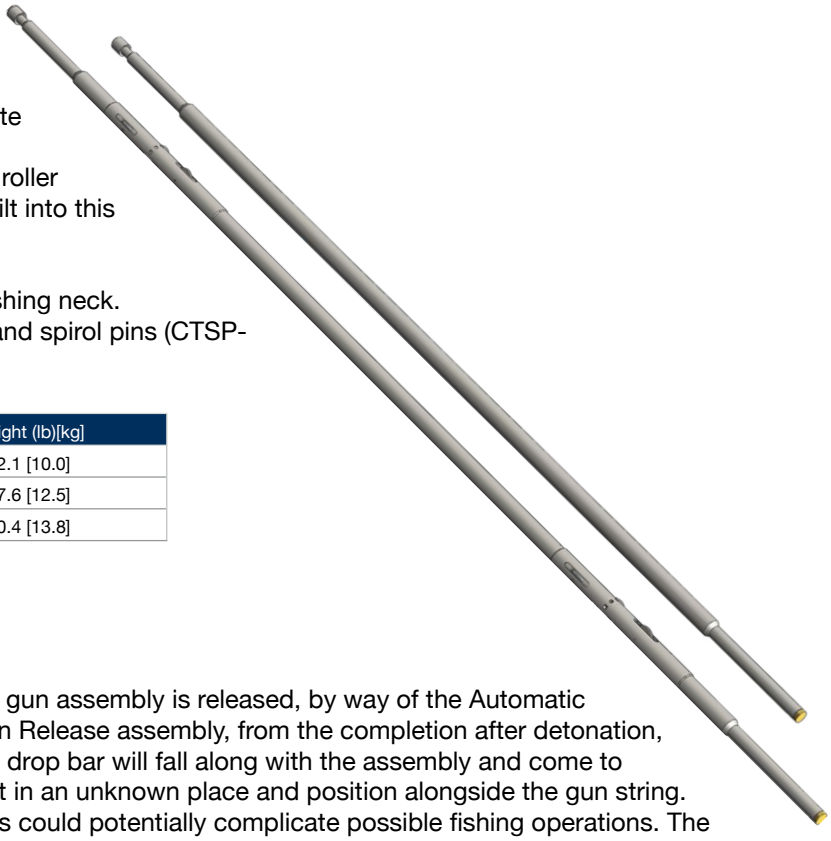
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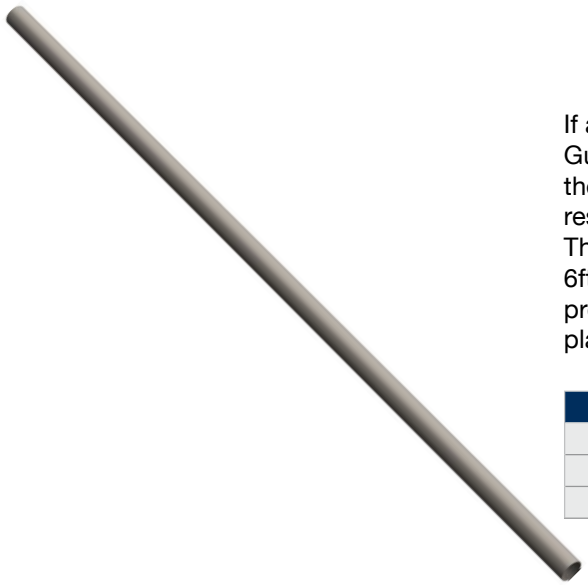
ACCESSORIES

The 1-1/4" (32mm) one piece drop bar is used to initiate the firing head by dropping it through the tubing from surface. For deviations greater than 45°, the drop bar roller assembly can be utilized. 1-3/4" (44mm) rollers are built into this drop bar to assist in reducing friction.

All drop bars include a 1" (25mm) standard slickline fishing neck. Replacement brass impression pads (0487-000-021) and spirol pins (CTSP-0187-0875-HBK) can be ordered separately.



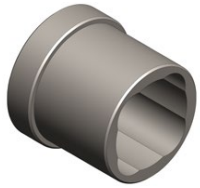
Length (ft)[m]	Assembly Part Number	Weight (lb)[kg]
6 [1.83]	0487-000-122A	22.1 [10.0]
7.13 [2.17] w/ rollers	0487-1375-000	27.6 [12.5]
8 [2.44]	0487-000-130A	30.4 [13.8]



If a gun assembly is released, by way of the Automatic Gun Release assembly, from the completion after detonation, the drop bar will fall along with the assembly and come to rest in an unknown place and position alongside the gun string. This could potentially complicate possible fishing operations. The 6ft (1.83m) bar retention tube is attached to the top of the firing head providing a place where the drop bar can remain in a known position and place allowing simple fishing operations to be executed.

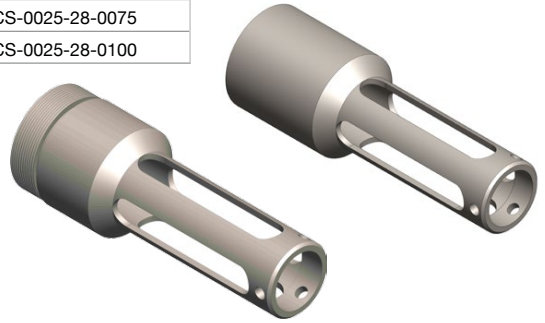
Tubing Size (in)[mm]	Part Number
2-3/8 [60]	AGNR-3063-006
2-7/8 [68]	AGNR-3670-006
3-1/2 [89]	AGNR-4500-006

No-Go sleeves serve two purposes. The first is to ensure that any object greater than a certain diameter will not unintentionally impact the firing head. Secondly, it acts as a guide such that the drop bar smoothly lines up with the firing head upon impact.



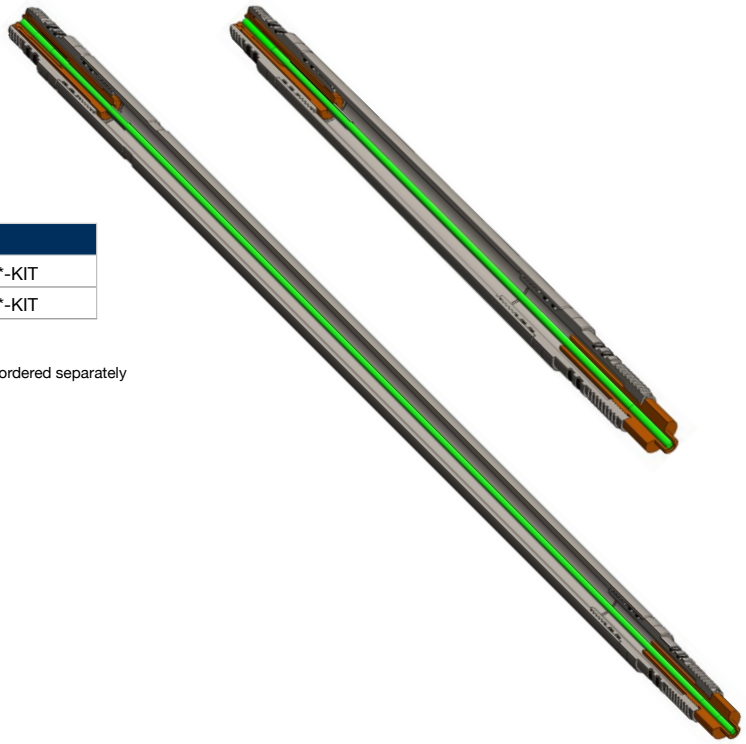
Tubing Size (in)[mm]	Slip Over No-Go Sleeve 1-3/8" (35mm) I.D.	Drop In No-Go Sleeve 1-1/2" (38mm) I.D.	Set Screw for Slip Over No-Go
2-3/8 [60]	FHNG-1375-238*	FHNG-2375-150	BHCS-0025-28-0050
2-7/8 [70]	FHNG-1375-288*	FHNG-2875-150	BHCS-0025-28-0075
3-1/2 [89]	FHNG-1375-350*	FHNG-3500-150	BHCS-0025-28-0100

* Use "T" for sleeve with threads for bar retention tube



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If debris build up in the well is suspected, 1-3/8” (35mm) diameter extensions can be placed on the bottom of the firing head. This will avoid any debris overcoming the release rod ensuring a safe and successful gun detonation. Explosive components (in green) are sold separately.



Length (in)[mm]	Assembly‡	Redress Kit
18 [457]	FHBD-1375-000EX**	FHBD-1375-000EXT**-KIT
32 [813]	FHBD-1375-000EXT**	FHBD-1375-000EXT**-KIT

** Use “HT” for high temperature operations (above 325°F (163°C))

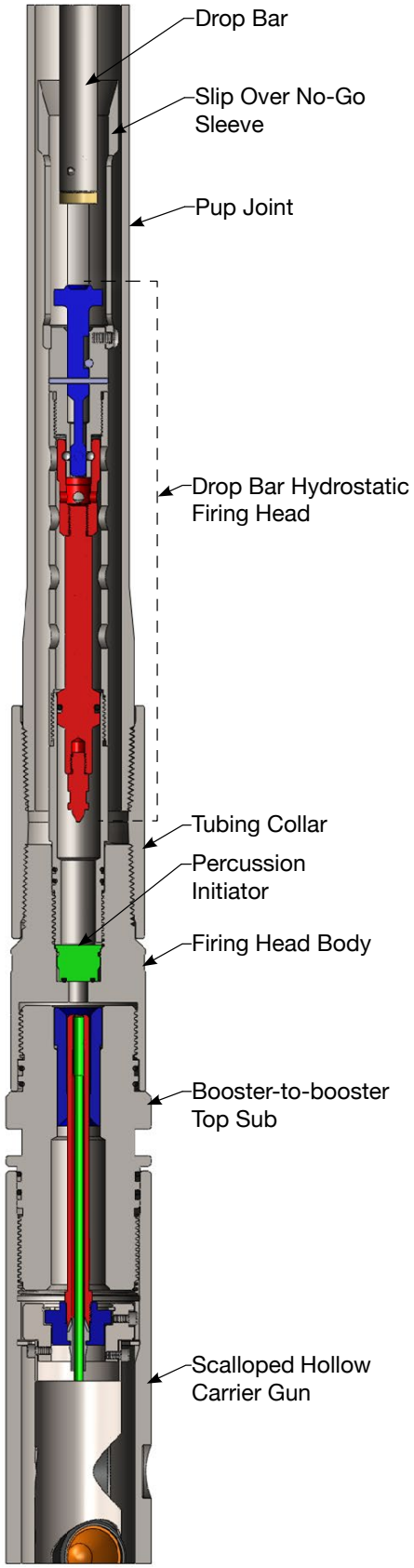
‡ Backup O-rings required above 13,000psi (90MPa). Kit FHBD-1375-xxx-BUKIT needs to be ordered separately

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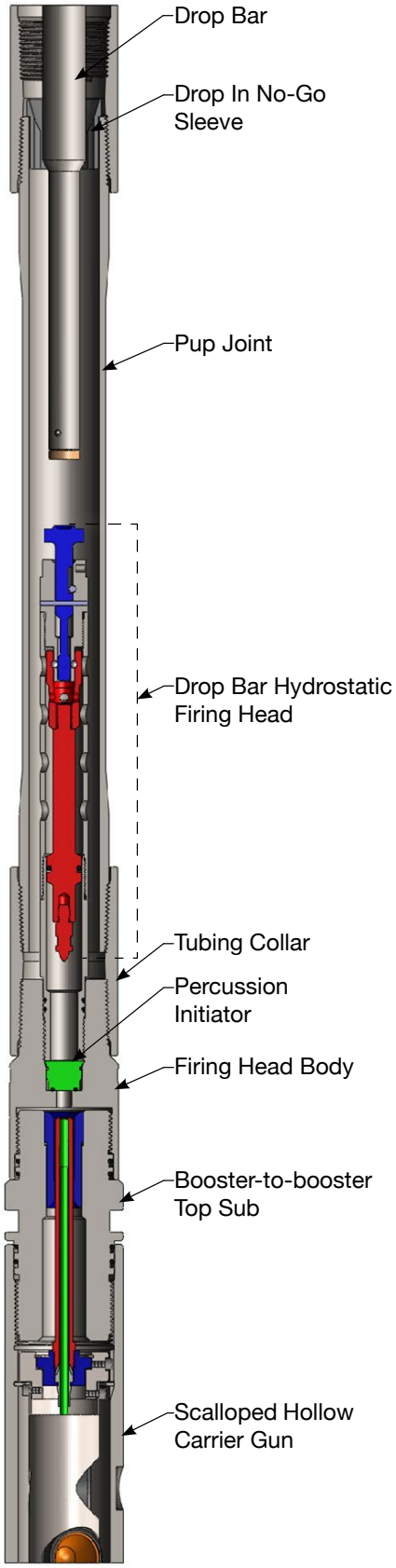
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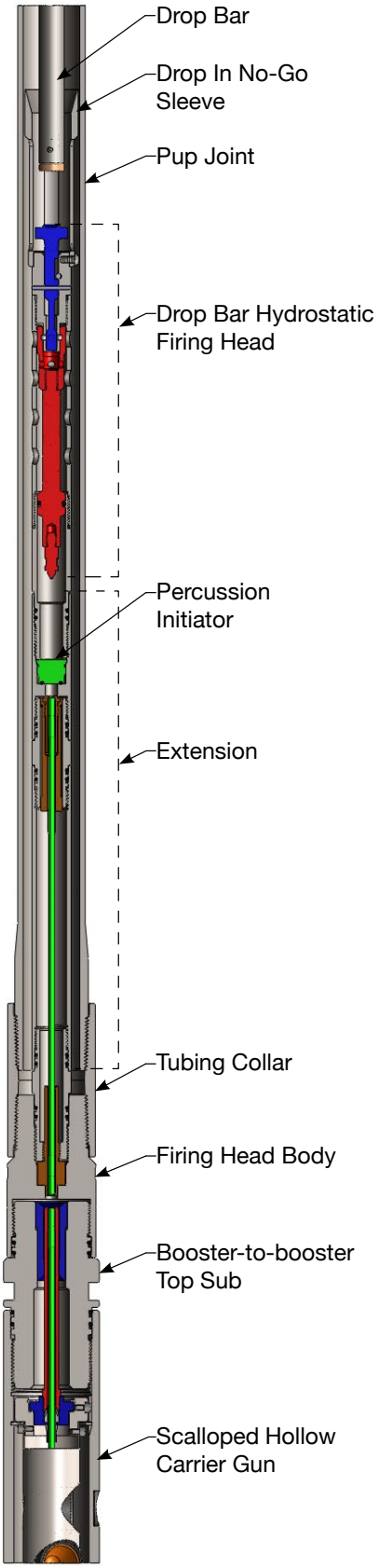
DROP BAR WITH SLIP OVER NO-GO



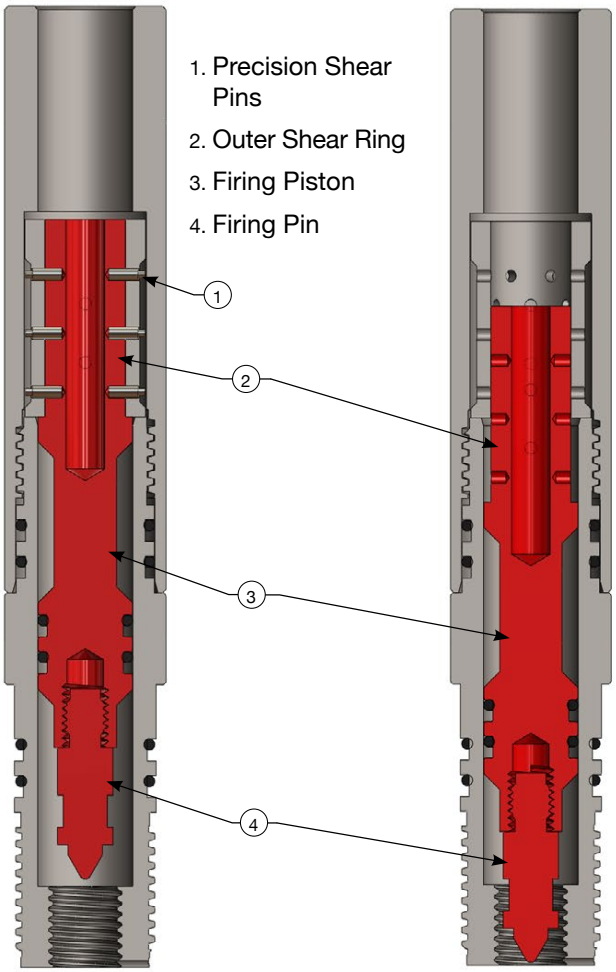
DROP BAR WITH DROP IN NO-GO



DROP BAR WITH EXTENSION



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APPLICATIONS

- TCP and coiled tubing perforating
- Underbalance and overbalance perforating
- Highly deviated and horizontal wells
- Extreme slimhole perforating (1.315” tubing)

FEATURES

- Utilizes industry leading precision shear pins
- Can be run on top or bottom of Hunting Titan guns
- Designed to API RP-67 (Oilfield Explosive Safety) guidelines
- Redress kits
- Simple, reliable and rugged design

BENEFITS

- Precision shear pins guaranteed to actuate within 5% of calculations
- Enhanced safety as difficult to detonate at surface or by electrical sources
- Can be effectively utilized in very high underbalance environments
- Compatible with all Hunting Titan TCP firing systems
- Redress kits allow for quick turnarounds

The Direct Pressure Firing Head is designed for well conditions that are not favorable for dropping a detonating bar or where a backup pressure firing head is desirable.

The firing head is assembled to actuate at a predetermined pressure by using precision shear pins. The firing piston is held within the retainer sleeve by these precision shear pins. The number of pins used is based on well conditions and desired safety factor. Hydrostatic plus applied pressure is used to hydraulically actuate the firing head within ±5% of the calculated values. When the precision shear pins fail at the predetermined pressure, the firing piston drives the firing pin into the percussion initiator which in turn detonates the perforating gun assembly.

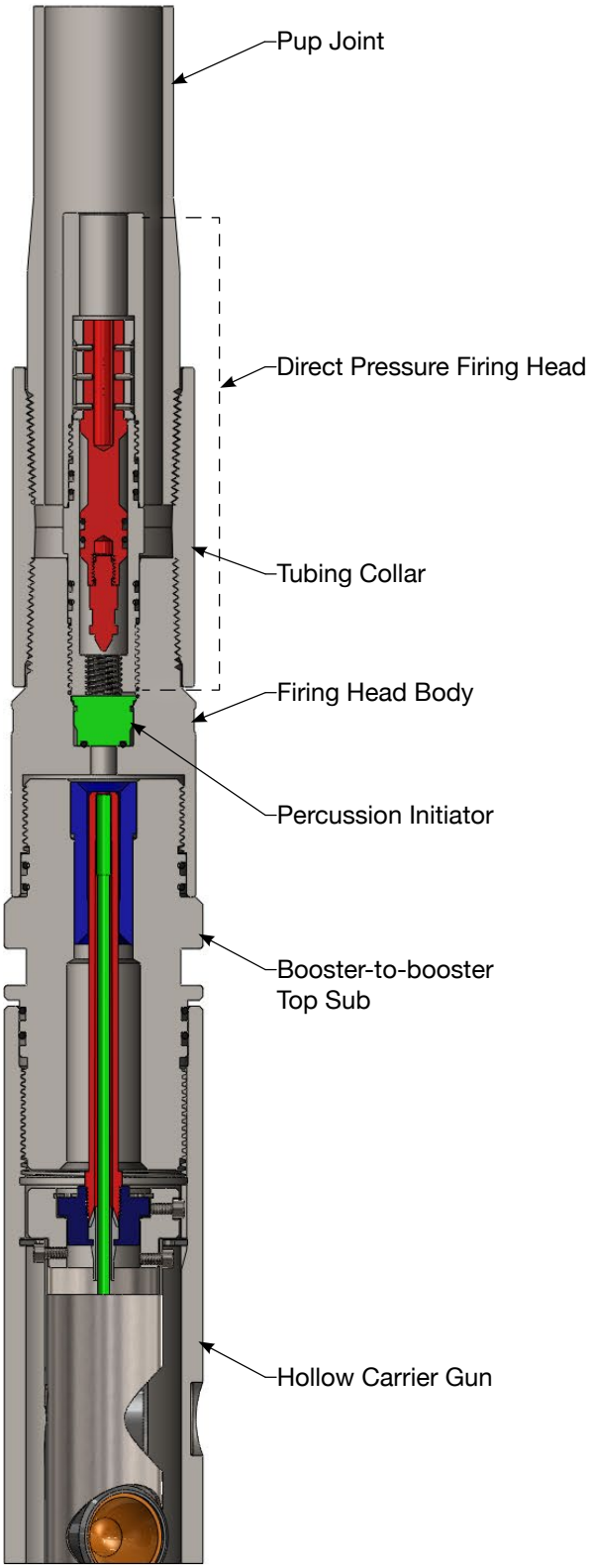
DIRECT PRESSURE FIRING HEAD HARDWARE SPECIFICATIONS

Assembly Part Number	FHPA-1375-000**	FHPA-1375-000T 1.315” NUE Top Connection
O.D. (in)[mm]	1-3/8 [35]	1-3/8 [35]
Makeup Length (ft)[m]	0.49 [0.15]	0.49 [0.15]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]
Min. Required Pinning Pressure (psi)[MPa]	1,800 [12]	1,800 [12]
Max. Operating Pressure (psi)[MPa]‡	20,000 [138]	20,000 [138]
Precision Shear Pin Part Number 500psi/pin [3.4MPa/pin] 900psi/pin [6.2MPa/pin]	 SPIN-0076-250 SPIN-0100-250	 SPIN-0076-250 SPIN-0100-250
Redress Kit Part Number	FHPA-1375-000**-KIT	FHPA-1375-000**-KIT

** Use “HT” for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kit FHPA-1375-000-BUKIT needs to be ordered separately

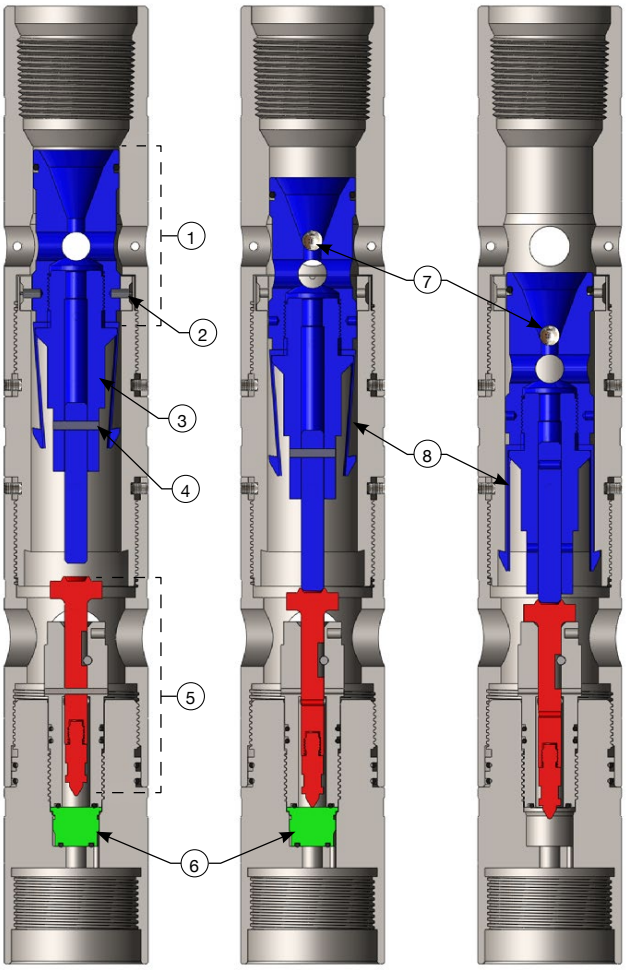
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Ball Drop Hydraulic Actuated Firing Head



1. Piston/shear set (sold separately)
2. Precision shear pins
3. Actuating Piston
4. Retaining Pin
5. Direct Impact Firing Head (sold separately)
6. Percussion Initiator
7. Ball
8. Collet

APPLICATIONS

- Coiled tubing or TCP perforating
- Overbalance and underbalance perforating
- Highly deviated and horizontal wells
- Wells with existing perforations
- Well abandonment

FEATURES

- Can circulate before and after perforating
- Designed to API RP-67 (Oilfield Explosives Safety) guidelines

BENEFITS

- Ideal for single trip operations requiring pre- and post-perforating clean up
- Enhanced safety as firing head can only be activated by properly seated ball

The Ball Drop Hydraulic Actuated Firing Head is ideal for coiled tubing perforating or pipe recovery services. Having the ability to circulate before and after perforating offers a range of extra single run operations, for example, cement squeeze jobs. The well can be circulated clean prior to perforating followed by the cement squeeze post perforating, all in a single run.

A steel ball is dropped or pumped down the tubing and seats into an actuating piston, which is held in place by precision shear pins, the number of pins determined by the well conditions and desired safety factor. A differential pressure is then created across this piston which shears the precision shear pins. The actuating piston is then driven into a Direct Impact Drop Bar Firing Head which in turn detonates the gun assembly. The firing head can also be configured to utilize the Drop Bar Hydrostatic Firing Head system.

After impacting the firing pin, the actuating piston continues to be driven down by differential pressure shearing the retaining pin. A continued downward movement allows the collet to lock into the housing. This prevents the flow ports from sealing should reverse flow occur.

BALL DROP HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	1.66 [42] EUE	2-3/8 [60] EUE
Assembly Part Number	ACTU-2000-500**	ACTU-3125-500**
O.D. (in)[mm]	2.00 [54]	3.13 [79]
Makeup Length (ft)[m]	1.65 [0.50]	1.74 [0.53]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]
Min. Required Pressure – 3 pins (psi)[MPa]	1,950 [13]	1,800 [12]
Max. Differential Pressure – 12 pins (psi)[MPa]‡	7,800 [54]	7,200 [50]
Piston/Shear Set Part Numbers (in^2)[cm^2]§ 3/8" Bore. Flow Area (0.11)[0.71] 7/16" Bore. Flow Area (0.15)[0.97] 1/2" Bore. Flow Area (0.20)[1.29] 1-1/8" Bore. Flow Area (0.99)[6.39]	 ACTU-2000-538A** ACTU-2000-544A** ACTU-2000-550A** -	 ACTU-3125-538A** ACTU-3125-544A** ACTU-3125-550A** ACTU-3125-512A**
Flow Area of Ports After Perforating (in^2)[cm^2]	0.99 [6.39]	2.41 [15.55]
Max. Tension (lbf)[kN]	65,000 [289]	158,000 [703]
Precision Shear Pins Part Number	SPIN-0130-250	SPIN-0187-380
Redress Kit Part Number	ACTU-2000-500**-KIT	ACTU-3125-500**-KIT
Piston/Shear Set Redress Kit Part Number	ACTU-2000-xxxA**-KIT	ACTU-3125-xxxA**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kit ACTU-xxxx-500-BUKIT needs to be ordered separately
§ Flow area of piston before perforating

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Dual Top Firing Head

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APPLICATIONS

- TCP perforating
- Permanent completions

FEATURES

- Designed to API RP-67 (Oilfield Explosive Safety) guidelines
- Uses existing Drop Bar and Direct Pressure Firing Head components
- Independent firing systems ideal for permanent completions jobs

BENEFITS

- Provides a complete backup solution in case of misfire of primary system
- Enhanced safety as cannot be detonated at surface or by electrical sources

The Dual Top Firing Head provides an ideal solution for redundant firing systems generally requested for rigless permanent completion perforating operations. It consists of the Drop Bar Hydrostatic and Direct Pressure Firing Heads which function completely independent of each other inside a single assembly.

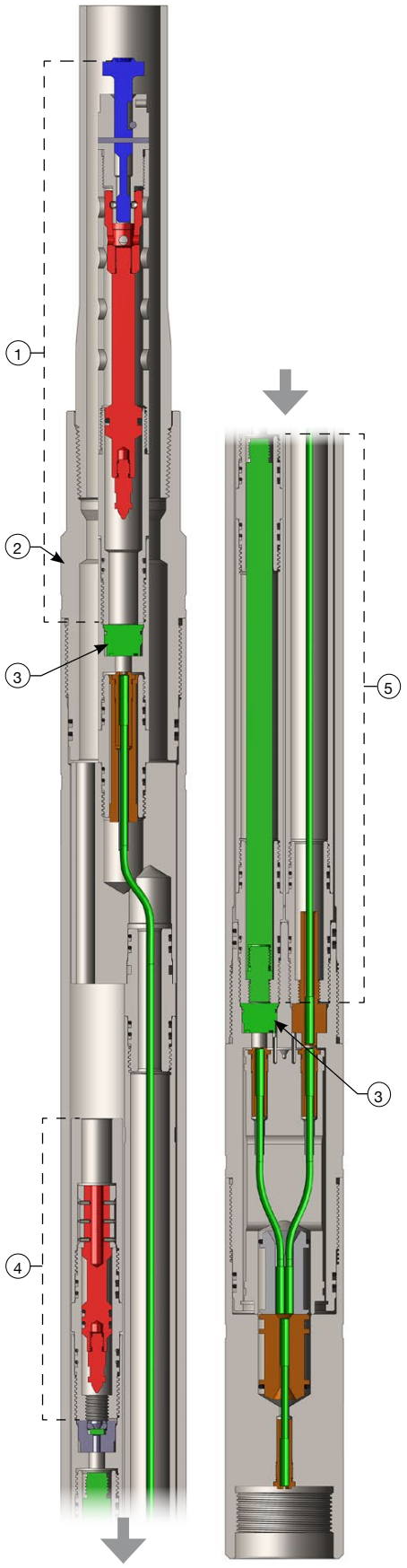
Operating procedures for this system are determined by which firing head is used as the primary system. Generally, the pressure activated firing head is preferred as the primary system. Should no shot be detected using the pressure activated firing head, the mechanically activated firing head can be used as backup. This will ensure no formation damage can occur through pressuring up the wellbore should the primary system have perforated without any indication.

Firing heads and explosives are sold separately. Please refer to their individual data sheets for detailed specifications.

DUAL TOP FIRING HEAD HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE 2-7/8 [68] EUE
Assembly Part Number	FHDT-3375-000**
O.D. (in)[mm]	3.38 [8 6] for 2-3/8" EUE 3.67 [93] for 2-7/8" EUE
Makeup Length (ft)[m]§	5.09 [1.55]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]
Min. Required Hydrostatic (psi)[MPa]	200 [1.4]
Min. Required Pinning Pressure (psi)[MPa]	1,800 [12]
Max. Operating Pressure (psi)[MPa]‡	20,000 [138]
Max. Tension (lbf)[kN]	120,000 [534]
Top Sub Part Number	FHDT-3375-238B (2-3/8" EUE) FHDT-3375-288B (2-7/8" EUE)
9 Minute Pyrotechnic Delay Part Number	FHPA-1375-100**
Redress Kit Part Number	FHDT-3375-000**-KIT FHPA-1375-100**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kit FHDT-3375-000-BUKIT and FHPA-1375-100-BUKIT needs to be ordered separately
§ Including top sub



1. Drop Bar Hydrostatic Firing Head (sold separately)
2. Top Sub
3. Percussion Initiator
4. Direct Pressure Firing Head (sold separately)
5. 9 minute Pyrotechnic Delay

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Dual Top Annulus Differential Pressure Firing Head

APPLICATIONS

- TCP perforating operations
- Drillstem Testing (DST) operations
- Conducting TCP operations in wells with open perforations
- Underbalance perforating

FEATURES

- Packer must be correctly set to achieve initiation
- Designed to API RP-67 (Oilfield Explosive Safety) guidelines
- Uses existing Drop Bar and Direct Pressure Firing Head components

BENEFITS

- Provides a complete backup solution in case of misfire of primary system
- Enhanced safety as cannot be detonated at surface or without proper seal from packer

The Dual Top Annulus Differential Pressure Firing Head uses differential pressure across the packer to actuate the firing head. It also allows the option to include the Drop Bar Hydrostatic Firing Head as a redundancy.

The system is run with the Packer Bypass Assembly and uses control lines to transmit annular pressure above the packer down to the differential pressure activated firing head. The actuating piston for the differential firing head is held within a retainer sleeve by precision shear pins. The number of pins used is based on well conditions and desired safety factor.

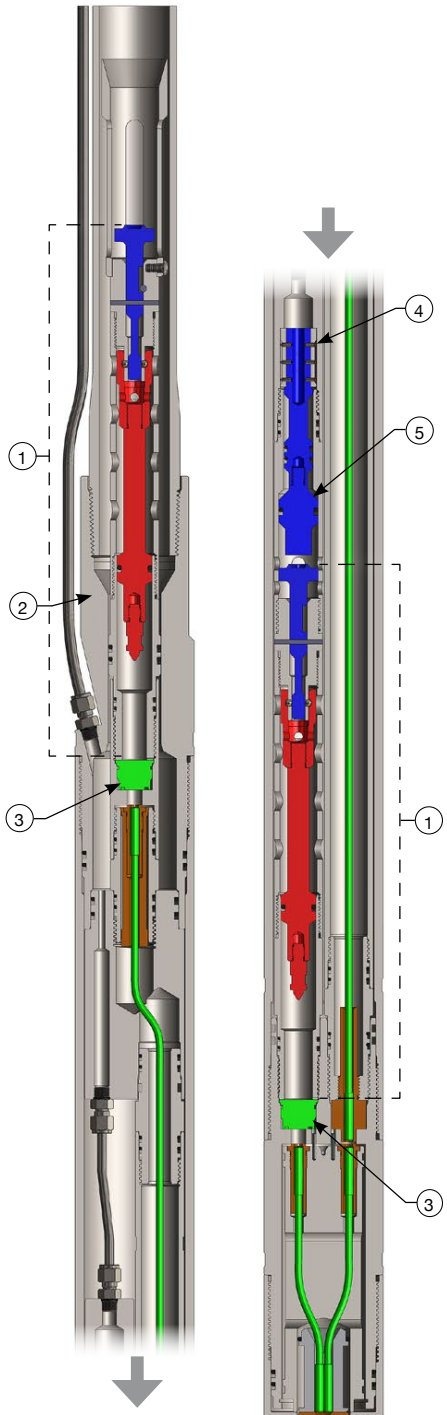
It is ideal for DST operations where underbalanced perforating is desired. Also, wells that have existing perforations in them as no firing head activation pressures can enter the formation causing reservoir damage.

The Drop Bar Hydrostatic Firing Head is sold separately. Please refer to its data sheet for detailed specifications.

ANNULUS DIFFERENTIAL PRESSURE FIRING HEAD HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE 2-7/8 [68] EUE
Assembly Part Number	FHDTAP-3375-000
O.D. (in)[mm]	3.38 [86] for 2-3/8" EUE 3.67 [93] for 2-7/8" EUE
Makeup Length (ft)[m]§	5.29 [1.61]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]
Min. Required Hydrostatic (psi)[MPa]	200 [1.4]
Min. Required Pinning Pressure (psi)[MPa]	950 [7]
Max. Operating Pressure (psi)[MPa]‡	20,000 [138]
Precision Shear Pins - 475psi/pin [3.3MPa/pin]	SPIN-0100-250
Max. Tension (lbf)[kN]	120,000 [534]
Top Sub Part Number	FHDTAP-3375-238B (2-3/8" EUE) FHDTAP-3375-288B (2-7/8" EUE)
Redress Kit Part Number	FHDTAP-3375-000-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325ºF (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kit FHDTAP-3375-000-BUKIT needs to be ordered separately
§ Including top sub



1. Drop Bar Hydrostatic Firing Head (sold separately)
2. Top Sub
3. Percussion Initiator
4. Precision Shear Pins
5. Differential Actuating Piston

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APPLICATIONS

- Coiled tubing, slickline and TCP perforating
- Multistage fracturing operations
- Firing head delays

FEATURES

- Design allows for 6 minute time increments
- Used for detonating multiple gun assemblies in one run
- Redress kits

BENEFITS

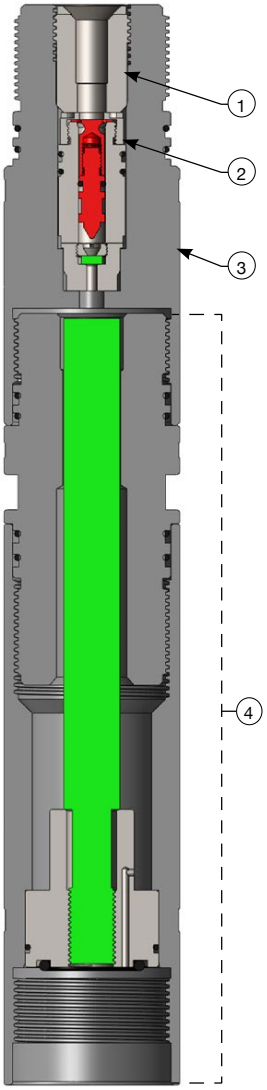
- Only one firing head required
- Redress kits allow for quick turnarounds

Running multiple guns on pipe can become complicated when using conventional pressure activated firing heads. Hunting Titan's Gun to Gun Transfer system can reliably detonate as many guns as required with a 6 minute delay between each initiation. Only one Direct Pressure Firing Head is required either at the top or bottom of the gun assembly.

This system is ideal for multistage fracturing jobs where several intervals require perforating preferably in a single run.

Initiation of the first gun triggers the Gun to Gun Transfer system. This allows a 6 minute time delay where the gunstring can be moved to the next perforating interval. This sequence is repeated until all guns have been fired.

The delay fuse can also be configured to combine with drop bar or pressure firing heads by simply replacing the initiation assembly with a conventional firing body.



GUN TO GUN TRANSFER WITH 6 MINUTE DELAY HARDWARE SPECIFICATIONS

	1	2
	Alignment Insert	Firing Pin Assembly
Part Number	FHPA-3125-607	FPIN-1375-100**
Max. 100 Hour Temperature Rating (°F)[°C]†	N/A	400 [204]
Max. Pressure (psi)[MPa]‡	N/A	20,000 [138]
Redress Kit Part Number	N/A	FPIN-1375-100**-KIT

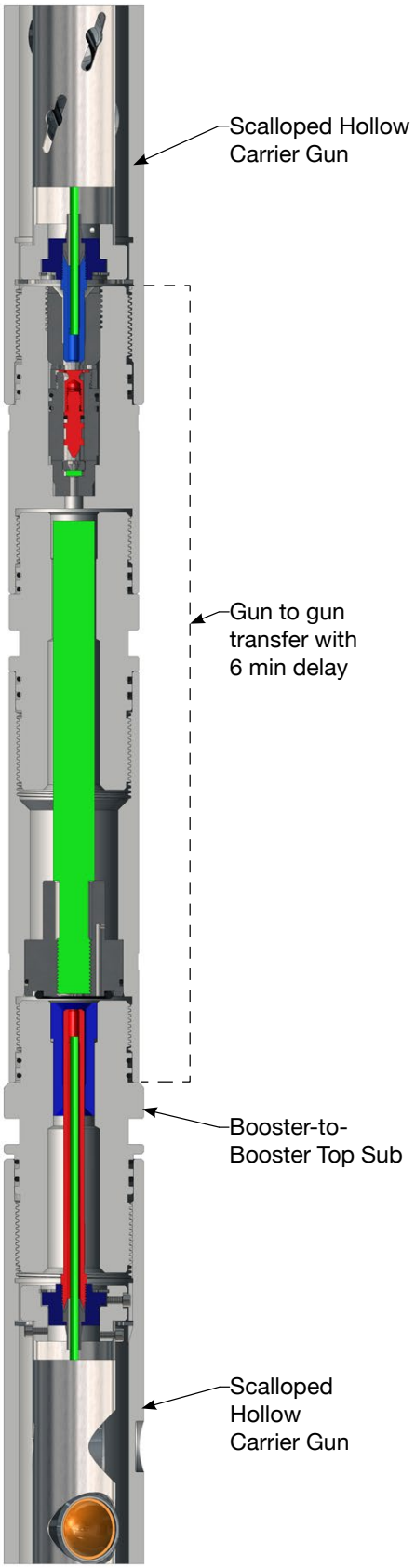
O.D. (in)[mm]	3				
	Firing Head Body	O-Ring†	Max. Temp. (°F)[°C]†	Max. Pressure (psi)[MPa]‡	Max. Tension (lbf)[kN]
2 [51]	FBDY-200P-200B	0111-221-090	400 [204]	20,000 [138]	80,000 [356]
2-1/2 [64]	FBDY-250P-200B	0111-225-090			172,000 [765]
2-3/4 [70]	FBDY-275P-250B	0111-227-090			234,000 [1041]
2-7/8 [73]	FBDY-275P-250B	0111-227-090			234,000 [1041]
3-1/8 [79]	FBDY-313P-313B	0111-230-090			154,000 [685]
3-3/8 [86]	FBDY-338P-313B	0111-231-090			291,000 [1294]

O.D. (in)[mm]	4		
	2 [51]	2-3/4 [70]	3-1/8 [79]
Assembly Part Number	FHPA-2000-200**	FHPA-2750-200**	FHPA-3125-200**
Makeup Length (ft)[m]§	1.45 [0.44]/1.42 [0.43]††	1.34 [0.41]	1.24 [0.38]/1.37 [0.42]‡‡
Max. 100 Hour Temperature Rating (°F)[°C]‡	400 [204]	400 [204]	400 [204]
Max. Pressure (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]
Max. Tension (lbf)[kN]	87,000 [387]	147,000 [654]	174,000 [774]
Redress Kit Part Number	FHPA-2000-200**-KIT	FHPA-2750-200**-KIT	FHPA-3125-200**-KIT

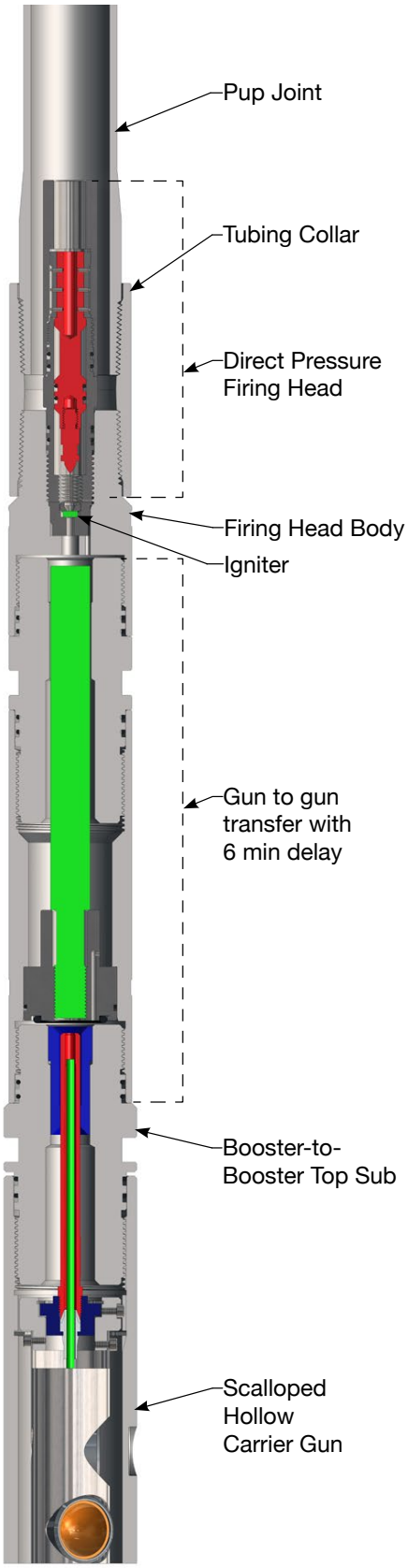
** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. V95 Viton O-rings need to be used above 325°F (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kits FPIN-1375-100-BUKIT and FHPA-xxxx-200-BUKIT need to be ordered separately
§ Includes firing head body
†† 2in gun system / 2-1/2in gun system respectively
‡‡ 3-1/8in guns system / 3-3/8in gun system respectively

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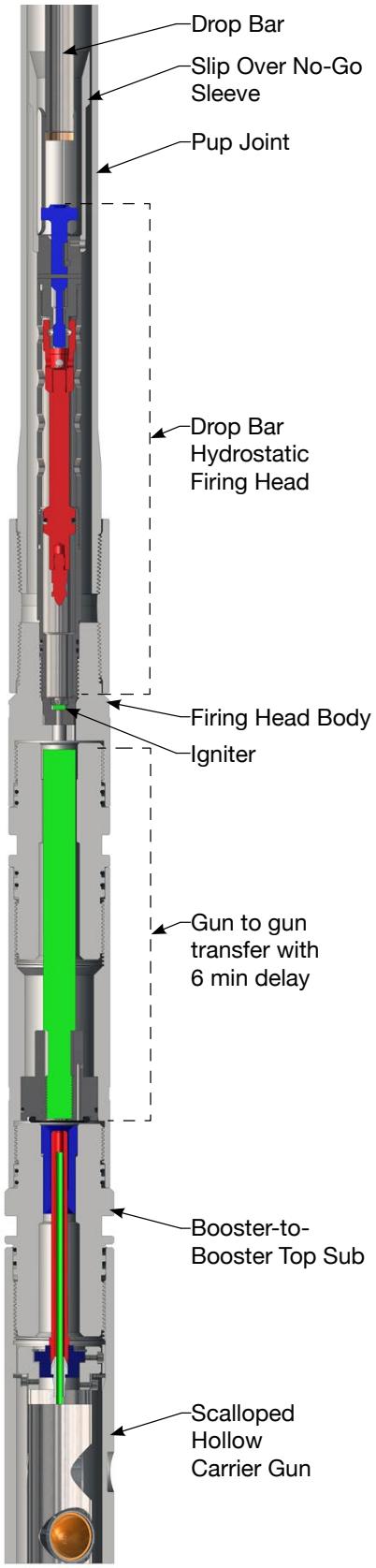
GUN TO GUN TRANSFER



GUN TO GUN TRANSFER WITH DIRECT PRESSURE FIRING HEAD



GUN TO GUN TRANSFER WITH DROP BAR HYDROSTATIC FIRING HEAD



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Hunting Titan's team of highly experienced engineers have developed innovative TCP hardware that are cost effective and incredibly reliable. Hunting Titan has selected the explosive initiation technologies offered by Fike® to optimize its TCP systems to perfectly match and offer superior performance. Fike is a globally recognized supplier of oil and gas products including a variety of energetic devices that are rigorously tested and proven to perform within a wide range of temperatures and pressures. For more information on TCP explosive initiation devices, visit their website at www.fike.com. You can also contact your local Hunting Titan representative to find out about the vast range of TCP hardware, including initiation devices, or visit www.hunting-intl.com.

PERCUSSION INITIATOR



Typically used to initiate the detonation train of perforating guns.

Part Number	Max. Temperature Rating (°F)[°C]		Max. Pressure (psi)[MPa]†	Hazard Class	UN Number
	100	200			
DETO-INIT-072120-1	340 [171]	320 [160]	20,000 [138]	1.4S	UN0323
DETO-INIT-072140-1	-	425 [218]	20,000 [138]	1.4S	UN0323

† Before and after function with non-breaching firing pin

SLIM LINE DETONATOR



Used in place of the standard percussion initiator for slim firing heads.

Part Number	200 Hour Temperature Rating (°F)[°C]	Max. Pressure (psi)[MPa]†	Hazard Class	UN Number
DETO-INIT-074140	400 [204]	10,000 [69]	1.4S	UN0455

† Before function

FUSE IGNITER



Primary function is to initiate time delays.

Part Number	Diameter (in)[mm]	200 Hour Temperature Rating (°F)[°C]	Hazard Class	UN Number
DETO-IGNT-072130-1	0.482 [12.2]	425 [218]	1.4S	UN0454
DETO-IGNT-072130-3	0.375 [9.53]	425 [218]	1.4S	UN0454

TIME DELAY FUSE

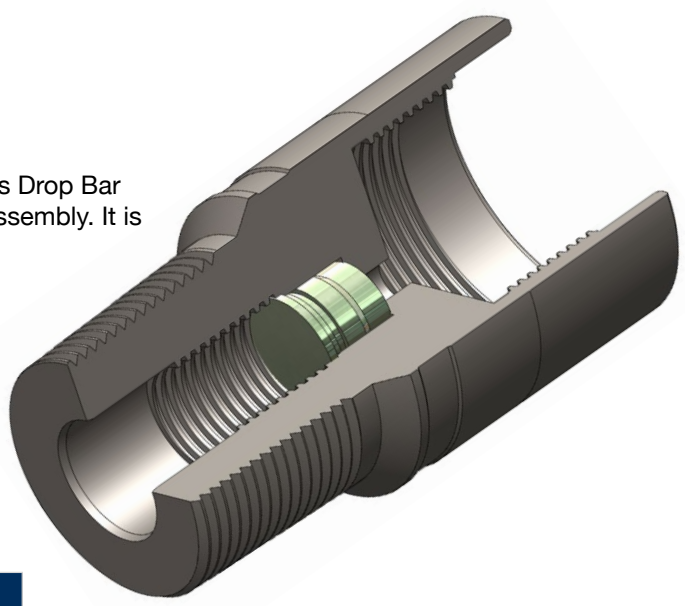


Initiates HMX or HNS Booster after a 6 minute delay.

Part Number	Time Delay (min)	200 Hour Temperature Rating (°F)[°C]	Hazard Class	UN Number
DETO-FUSE-088011-6.0	6	425 [218]	1.4S	UN0500

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The firing body securely contains the percussion initiator and connects Drop Bar Hydrostatic and Direct Pressure Firing Heads to the perforating gun assembly. It is also the main connection to the tubing string.

1-3/8in (35mm) and 1-9/16in (40mm) firing bodies can only be used with Direct Pressure Firing Head FHPA-1375-000T (or modified FHPA-1375-000 with 1.315" NUE top connection).

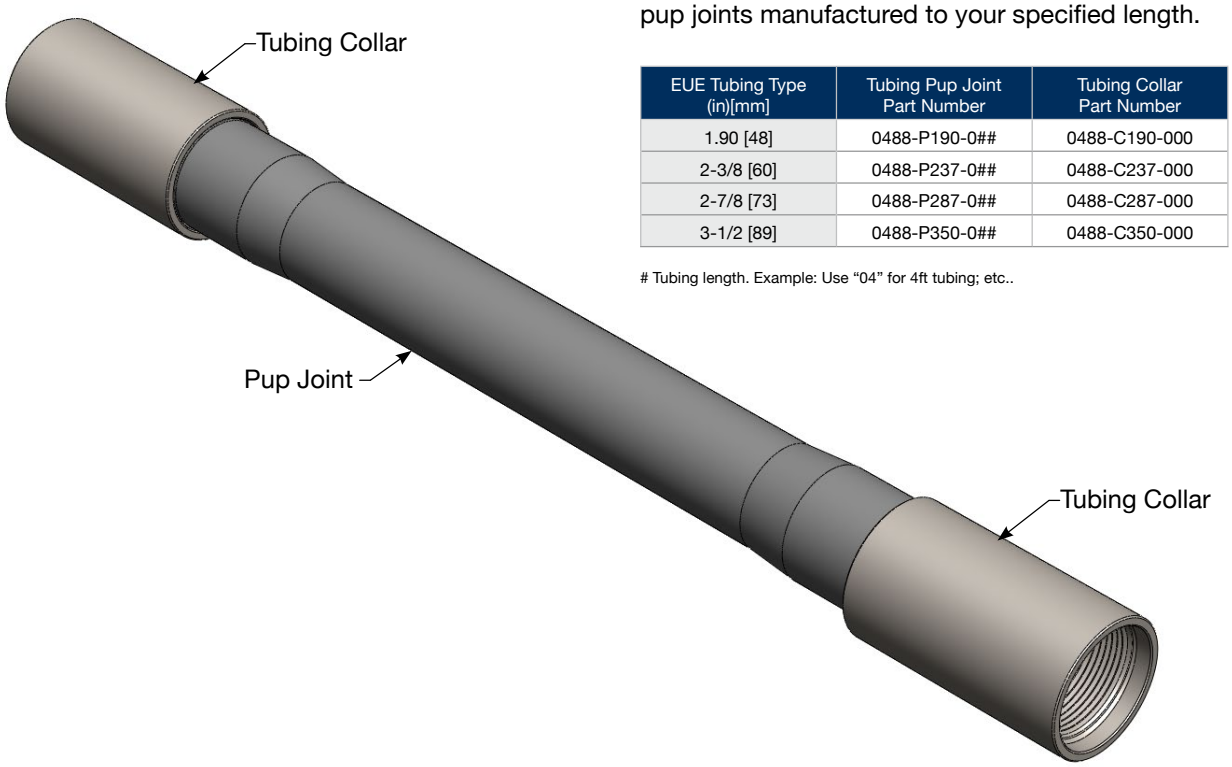
Percussion initiators are sold separately.

O.D. (in)[mm]	Firing Body Part number	Upper Connection	Lower Connection
1-3/8 [35]	FBDY-1375-118B	1-3/16" - 12 Stub Acme Box	1-1/8" – 12 Stub Acme Box
1-9/16 [40]	FBDY-1562-118B	1-3/16" - 12 Stub Acme Box	1-9/32" – 12 Stub Acme Box
2-1/2 [64]	FBDY-2500-190P	1.90" EUE	2-1/8" - 8 Acme Box
3-1/8 [79]	FBDY-3125-238P	2-3/8" EUE	2-3/4" - 6 Acme Box

Tubing pup joints are used to house the Drop Bar Hydrostatic and Direct Pressure Firing Heads. They are standard API N-80 grade pup joints manufactured to your specified length.

EUE Tubing Type (in)[mm]	Tubing Pup Joint Part Number	Tubing Collar Part Number
1.90 [48]	0488-P190-0##	0488-C190-000
2-3/8 [60]	0488-P237-0##	0488-C237-000
2-7/8 [73]	0488-P287-0##	0488-C287-000
3-1/2 [89]	0488-P350-0##	0488-C350-000

Tubing length. Example: Use "04" for 4ft tubing; etc..



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Automatic Gun Release

APPLICATIONS

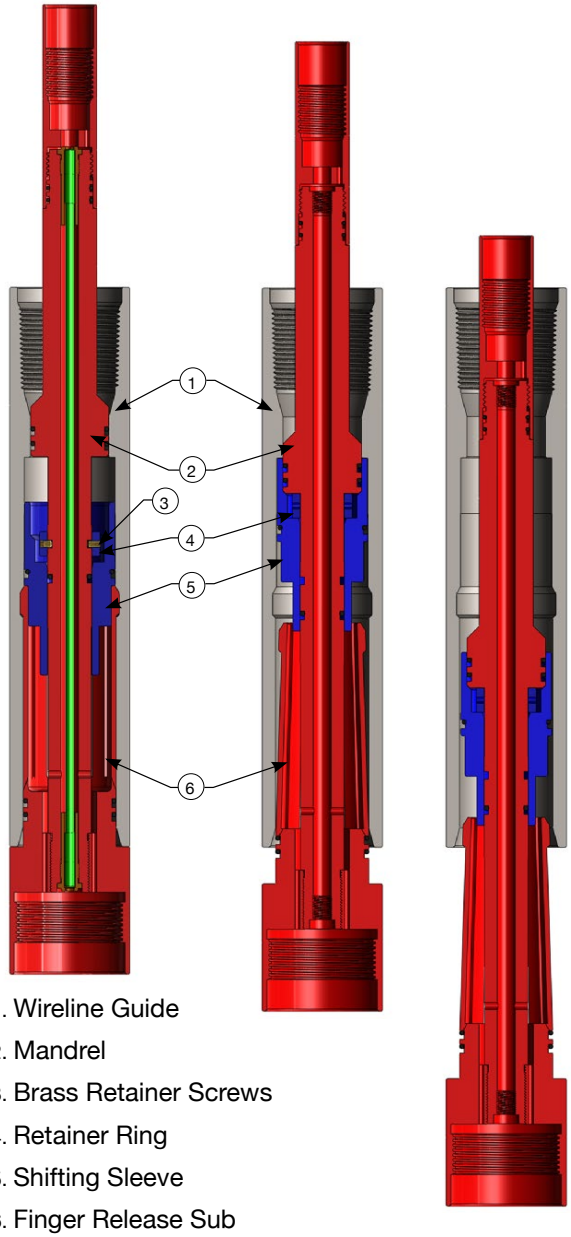
- TCP perforating
- Permanent completions
- Well testing

FEATURES

- Fast activation upon gun detonation
- Allows for fast wellbore cleanup
- Compatible with all Hunting Titan TCP firing systems
- Slick fishing profile

BENEFITS

- No need for wireline or slickline release tools
- Reduces chances of sanding guns
- Gun can be fished in one run



1. Wireline Guide
2. Mandrel
3. Brass Retainer Screws
4. Retainer Ring
5. Shifting Sleeve
6. Finger Release Sub

The Automatic Gun Release is designed to drop a gun string into the rathole immediately after firing.

Dropping the gun string immediately after firing has several advantages over deploying slickline shifting tools or pressure activated release tools. These include: avoiding the gun string sanding in when perforating weak sands, allowing efficient post perforation cleanup in permanent completions and eliminating the complications of dropping guns in highly deviated wells.

The pressure created by a gun after detonation causes the shifting sleeve to move and come in contact with the retainer ring. The brass retainer screws shear and allow the shifting sleeve and retainer ring to continue moving upwards freeing the finger release sub. This allows free movement of the mandrel as well. The chamber of atmospheric pressure between the mandrel and shifting sleeve, causes the mandrel to be sucked into the shifting sleeve which effectively pushes the gun out of the release sub. This dual action allows for minimal gun weight to successfully release the assembly.

The gun string and firing head then drop, exposing the wireline entry guide. The tubing pressure and rathole pressure must be equalized such that the guns string does not become hydraulically locked into the release sub.

The dropped gun string and firing head assembly has a slick fishing profile allowing it to be fished at a later time.

AUTOMATIC GUN RELEASE HARDWARE SPECIFICATIONS

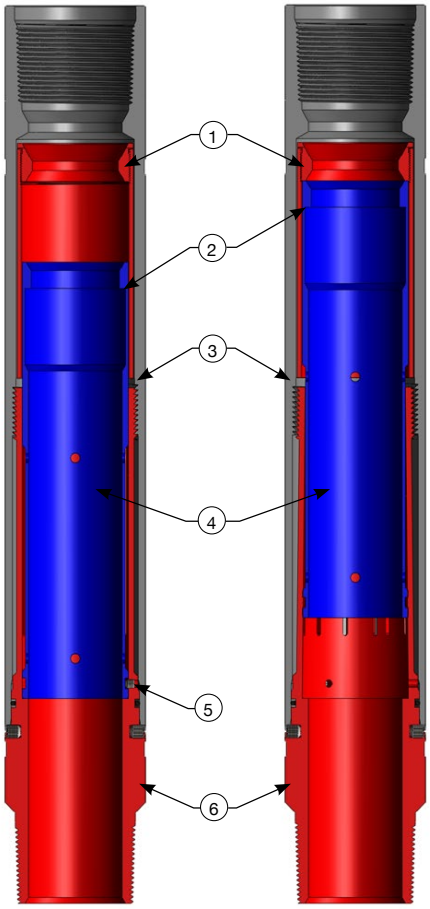
Tubing Size (in)[mm]	1.900 [48] EUE	2-3/8 [60] EUE	2-7/8 [68] EUE	3-1/2 [89] EUE
Assembly Part Number	AGNR-2500-000**	AGNR-3063-000**	AGNR-3670-000**	AGNR-4500-000**
O.D. (in)[mm]	2.50 [64]	3.063 [78]	3.670 [93]	4.50 [114]
Makeup Length (ft)[m]	1.46 [0.44]	1.46 [0.44]	1.46 [0.44]	1.50 [0.46]
Min. I.D. After Release (in)[mm]	1.75 [44]	2.00 [51]	2.50 [93]	3.00 [76]
Entry Guide Length (ft)[m]	1.19 [0.36]	1.19 [0.36]	1.19 [0.36]	1.23 [0.37]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]	400 [204]	400 [204]
Max. Operating Pressure (psi)[MPa]‡	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]
Max. Differential Pressure (psi)[MPa]	13,000 [90]	15,000 [103]	15,000 [103]	9,500 [66]
Min. Gun Weight Required (lbm)[kg]	50 [23]	100 [45]	150 [68]	200 [91]
Max. Tension After Release (lbf)[kN]	125,000 [556	230,000 [1,023]	320,000 [1,423]	300,000 [1,334]
Max. Strength of Fingers (lbf)[kN]	65,000 [289]	85,000 [378]	110,000 [489]	150,000 [667]
Redress Kit Part Number	AGNR-2500-000**-KIT	AGNR-3063-000**-KIT	AGNR-3670-000**-KIT	AGNR-4500-000**-KIT

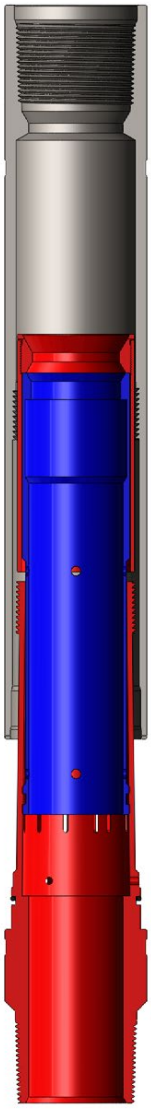
** Use "HT" for high temperature operations (above 325°F (163°C))

† Hardware only. Viton O-rings need to be used above 325°F (163°C)

‡ Backup O-rings required above 13,000psi (90MPa). Kit AGNR-xxxx-000-BUKIT needs to be ordered separately

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1. Release Profile Sleeve
2. Latch
3. Wireline Guide
4. Shifting Sleeve
5. Brass Retainer Screw
6. Finger Release Sub

APPLICATIONS

- TCP perforating operations
- Permanent completions
- Well testing

FEATURES

- Uses standard slickline Type B shifting tools
- Slick fishing profile
- Leaves perforations uncovered

BENEFITS

- Economical method for releasing guns ad optimizing production
- Leaves tubing open for other tools and operations
- Gun can be fished in one run

Hunting Titan's Mechanical Tubing release is designed to provide an option to drop the guns into the rathole after firing. The release is usually run about 30ft above the guns and below the ported debris sub under the packer.

Operation of the release consists of engaging the profile in the latch with a standard slickline Type B shifting tool, jarring upward to shear the latch retainer screws. When the screws shear, the latch moves up allowing the tool to separate, dropping the gun assembly into the rathole and simultaneously releasing the shifting tool.

The tool is fully open to the internal diameter of the tubing after release and the housing, which remains on the end of the tubing, provides a re-entry guide.

MECHANICAL GUN RELEASE HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE	3-1/2 [89] EUE
Assembly Part Number	TRMA-3063-000**	TRMA-3670-000**	TRMA-4500-200**
O.D. (in)[mm]	3.06 [78]	3.67 [93]	4.50 [114]
Makeup Length (ft)[m]	1.78 [0.54]	1.76 [0.54]	2.26 [0.69]
Min. I.D. After Release (in)[mm]	2.00 [51]	2.44 [62]	3.00 [76]
Entry Guide Length (ft)[m]	1.58 [0.48]	1.58 [0.48]	1.75 [0.53]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]	400 [204]
Max. Operating Pressure (psi)[MPa]‡	20,000 [138]	20,000 [138]	20,000 [138]
Max. Differential Pressure (psi)[MPa]	10,000 [69]	8,000 [55]	9,000 [62]
Min. Gun Weight Required (lbm)[kg]	250 [113]	300 [136]	350 [159]
Max. Tension After Release (lbf)[kN]	165,000 [734]	200,000 [890]	300,000 [1,334]
Max. Strength of Fingers (lbf)[kN]	85,000 [378]	125,000 [556]	140,000 [623]
Redress Kit Part Number	TRMA-3063-000**-KIT	TRMA-3670-000**-KIT	TRMA-4500-000**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ Backup O-rings required above 13,000psi (90MPa). Kit TRMA-xxxx-000-BUKIT needs to be ordered separately

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APPLICATIONS

- TCP perforating operations
- Underbalanced perforating

FEATURES

- Heat treated glass used to make strong, durable discs
- Large elongated ports incorporated into the body

BENEFITS

- Debris can be circulated out prior to dropping a ball or bar
- Permits displacement of tubing to lighter fluid or nitrogen
- Ports larger than cross section of tubing allow unrestricted flow
- Allows tubing to be filled while running in hole

The Ported Debris Barrier Sub is an inexpensive device that provides flow ports and a barrier to prevent debris from falling onto mechanical or pressure activated firing heads.

The ports are elongated to allow large debris to pass through unhindered while retaining high mechanical integrity within the sub. It also allows unrestricted fluid flow through the tubing by having a cross sectional area greater than the tubing itself. This provides an ideal setup during well testing.

The heat treated, high strength glass disc is sealed in place to allow clean fluid to remain above the firing head.

DEBRIS BARRIER SUB HARDWARE SPECIFICATIONS

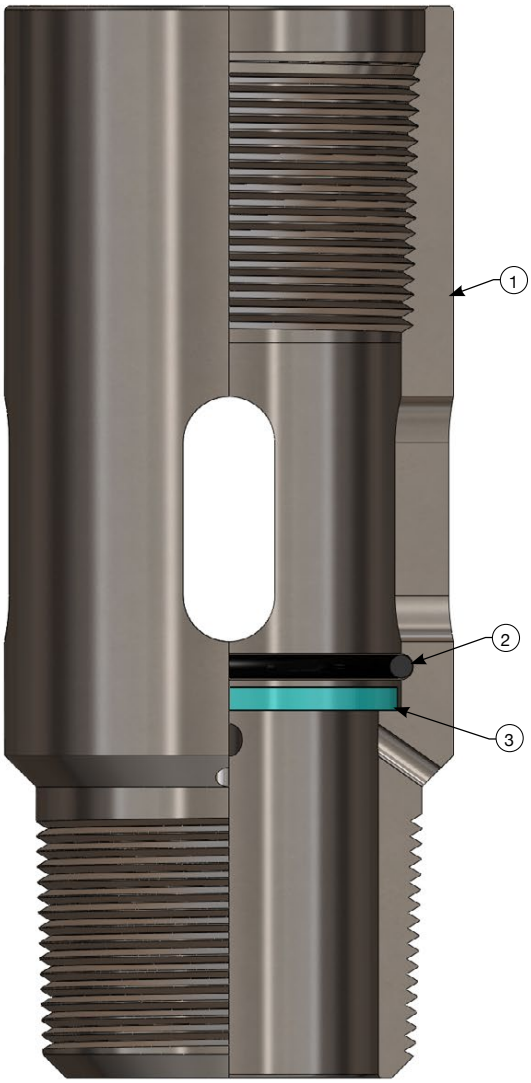
Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE	3-1/2 [89] EUE
O.D. (in)[mm]	3.13 [79]	3.67 [93]	4.44 [113]
I.D. (in)[mm]	1.94 [49]	2.44 [62]	2.99 [76]
Flow Area of Ports (in^2)[cm^2]	5.52 [35.61]	5.52 [35.61]	8.14 [52.52
Makeup Length (ft)[m]	0.51 [0.15]	0.53 [0.16]	0.64 [0.19]
Max. 100 Hour Temperature Rating. (°F)[°C]†	400 [204]	400 [204]	400 [204]
Max. Tension (lbf)[kN]	182,000 [810]	214,000 [952]	475,000 [2113]

† Hardware only. Viton O-rings need to be used above 325°F (163°C)

ASSEMBLY PART NUMBERS

	1	2	3
Tubing Size (in)[mm]	Debris Sub Assembly‡	O-Ring†§	Glass Disc§
2-3/8 [60] EUE	0491-230-000	0111-330-090	0491-000-024
2-7/8 [68] EUE	0491-280-000	0111-334-090	0491-000-014
3-1/2 [89] EUE	0491-350-000	0111-338-090	0491-000-034

† Viton O-rings need to be used above 325°F (163°C)
‡ Includes glass disc and O-ring
§ Expendable items



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Hunting Titan's glass disc Underbalance Sub uses a heat treated frangible disc barrier to isolate the tubing from the annulus allowing for a differential pressure necessary for underbalance perforating or post perforation surging. The glass disc shatters when impacted by a drop bar. The bar continues down the tubing to actuate the firing head and initiate detonation of the gun assembly. As there is no more barrier, fluids are allowed to rush into the essentially dry tubing providing a surge that has the potential to clean out the perforation tunnels improving productivity.

The desired underbalance can be achieved in several ways. The most common method is to top up the tubing whiling running in hole until the required fluid level is reached. Once the Underbalance Sub is connected, the gun assembly is continually run in the hole keeping the tubing dry. This approach can complicate wireline correlation operations as the tools may not be able to go to a sufficient depth.

An alternate method places the Underbalance Sub at least 30ft above the firing head or packer, depending on setup, and the tubing filled with fluid to the desired level. The advantage of this technique is that wireline correlation tools can be used to determine where the fluid level is in the tubing. A ported sub needs to be run below the underbalance sub to allow fluid flow into the tubing string.

APPLICATIONS

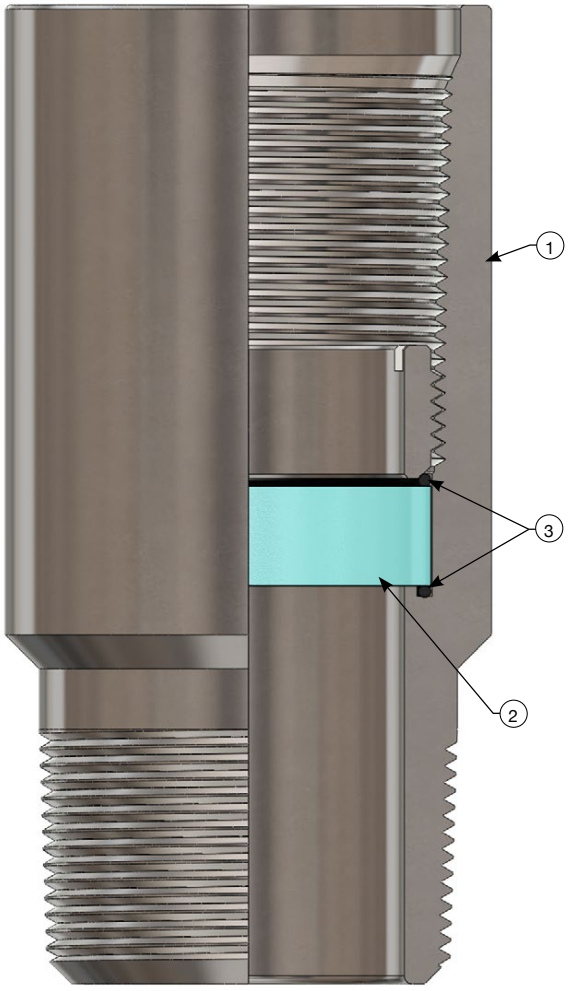
- Underbalanced TCP perforating

FEATURES

- Heat treated glass used to make strong, durable discs
- Can be run above or below a packer

BENEFITS

- Affordable method for achieving underbalance
- Glass discs available in various thicknesses enhancing reliability



UNDERBALANCE SUB HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE	3-1/2 [89] EUE
O.D. (in)[mm]	3.13 [79]	3.67 [93]	4.25 [108]
I.D. (in)[mm]	1.90 [46]	2.35 [60]	2.35 [60]
Makeup Length (ft)[m]	0.42 [0.13]	0.39 [0.12]	0.48 [0.15]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]	400 [204]
Max. Operating Pressure (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]
Max. Differential Pressure (psi)[MPa] 3/8" (10mm) Glass 1/2" (13mm) Glass 3/4" (19mm) Glass	 2,250 [16] 3,500 [24] 7,500 [52]	 - 3,000 [21] 4,500 [31]	 - 3,000 [21] 4,500 [31]
Max. Tension (lbf)[kN]	220,000 [979]	280,000 [1246]	450,000 [2,002]

† Hardware only. Viton O-rings need to be used above 325°F (163°C)

ASSEMBLY PART NUMBERS

Tubing Size (in)[mm]	Glass Thickness (in)[mm]	① Underbalance Sub Assembly†	② Glass Disc‡	③ O-Ring‡§	Redress Kit Part Number
2-3/8 [60] EUE	3/8 [10]	0492-232-000	0492-000-027	0111-137-090	0492-232-002
	1/2 [13]	0492-231-000	0492-000-025	0111-137-090	0492-231-002
	3/4 [19]	0492-230-000	0492-000-024	0111-137-090	0492-230-002
2-7/8 [68] EUE	1/2 [13]	0492-281-000	0492-000-015	0111-145-090	0492-281-002
	3/4 [19]	0492-280-000	0492-000-014	0111-145-090	0492-280-002
3-1/2 [89] EUE	1/2 [13]	0492-361-000	0492-000-015	0111-145-090	0492-281-002
	3/4 [19]	0492-360-000	0492-000-014	0111-145-090	0492-280-002

† Includes glass disc and O-ring
‡ Expendable items
§ Viton O-rings need to be used above 325°F (163°C)

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APPLICATIONS

- TCP depth correlation

FEATURES

- Highly visible to logging tools that detect gamma rays
- Radioactive marker positively contained inside sub with set screws
- Full opening

BENEFITS

- Accurate method for correlating pipe conveyed gun systems
- Containment of radioactive marker guarantees retrieval
- Allows unrestricted flow through tubing

The typical method of correlating a TCP gun string is to use the pipe tally. Even though this process is straight forward, depth errors are produced by pipe stretch that is unaccounted for. Pipe stretch can be hard to predict due to factors such as selected pipe stretch calculation parameters, well tortuosity, buoyancy effects and surface friction. As a well gets deeper, the inaccuracies become larger. Hunting Titan's Radioactive Marker Sub can be used to make very accurate depth correlation of pipe conveyed gun systems.

A small radioactive pip tag is secured inside a cavity on the side of the Radioactive Marker Sub with a set screw. The sub is then placed a known distance above the firing head as part of the work string and run in hole to the proposed perforating depth. A wireline gamma ray logging tool is run through the tubing to perform the correlation log. The resulting log will show a large spike at the depth of the pip tag. When this log is compared to the open hole gamma ray log, adjustments can be made to the work string placing the guns on depth.

As the Radioactive Marker Sub has the same or larger diameter than the surrounding tubing, it will not cause any restriction to fluid flow. This makes it an ideal choice to use the sub in permanent completion perforating systems.

Typical 1-µCi pip tags used are Cobalt-60 (5.2 years half-life) or Zinc-65 (240 days half-life). Hunting Titan does not supply radioactive pip tags.

RADIOACTIVE MARKER SUB HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE	3-1/2 [89] EUE
Assembly Part Number	RAMS-230-000	RAMS-280-000	RAMS-350-000
O.D. (in)[mm]	3.06 [78]	3.67 [93]	4.44
I.D. (in)[mm]	2.00 [51]	2.44 [62]	2.99
Makeup Length (ft)[m]	0.51 [0.16]	0.53 [0.16]	0.65
Max. Operating Pressure (psi)[MPa]	20,000	20,000	20,000
Max. Tension (lbf)[kN]	145,000	195,000	350,000

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APPLICATIONS

- Partial cushion TCP perforating
- Permanent completions
- Drillstem Testing (DST)

FEATURES

- Underbalance can be quantified before deploying gun system
- High precision shear pins guarantee actuation at required pressure

BENEFITS

- Tubing does not need to be filled joint by joint while running in hole
- Required underbalance will ensure proper perforation cleanup potentially improving productivity or injectivity
- No wireline or slickline tools required saving rig time

Fill/Stop Fill Valves are used to establish a predetermined fluid level in the tubing while running in hole or as circulating valves to displace well fluid prior to setting a plug or packer.

Partial cushions are commonly used for underbalance TCP perforating. Surging cleans the perforation tunnels which in turn reduces perforation skin and can potentially improve productivity or injectivity. The amount of fluid that can build up in the tubing (required hydrostatic pressure) is determined by the number of precision shear pins used. This will vary from job to job depending on well conditions.

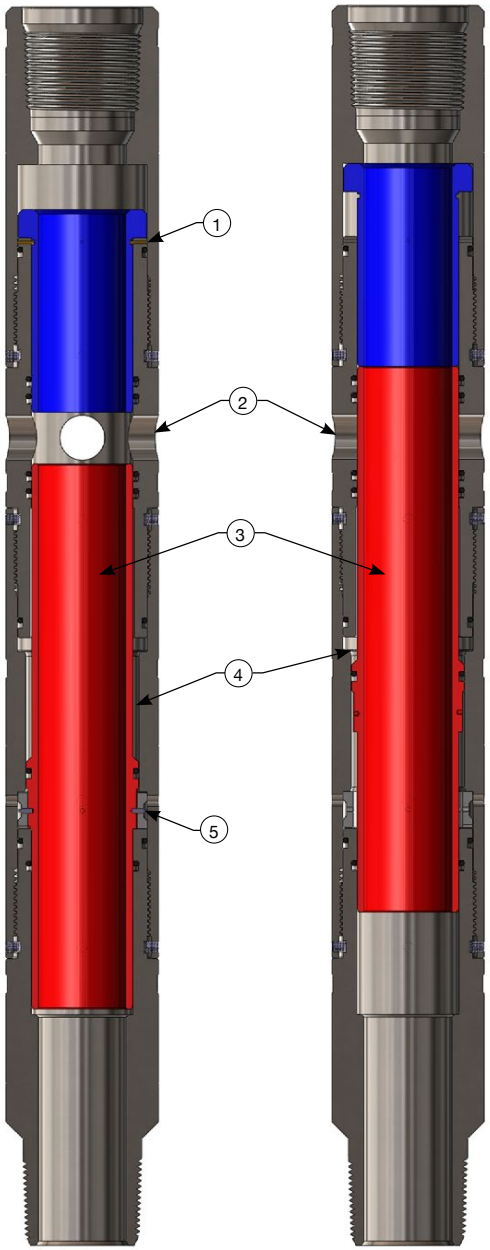
The valve will remain open until the precision shear pins fail within ±5% of the calculated hydrostatic pressure. This causes the piston sleeve to move closing the valve. The valve will remain closed as long as there is hydrostatic pressure acting upon it.

FILL/STOP FILL VALVE HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE
Assembly Part Number	FV-338-238-200**	FV-380-288-200**
O.D. (in)[mm]	3.38 [86]	3.80 [97]
I.D. (in)[mm]	1.94 [49]	2.38 [60]
Flow Area of Ports (in^2)[cm^2]	3.14 [20.26]	4.71 [30.39]
Makeup Length (ft)[m]	2.09 [0.64]	2.03 [0.62]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]
Min. Operating Pressure (psi)[MPa]	500 [3]	500 [3]
Max. Operating Pressure (psi)[MPa]‡	9,000 [62]	10,000 [69]
Max. Differential Pressure (psi)[MPa]	7,500 [52]	6,000 [41]
Precision Shear Pins 500psi/pin [3.4MPa/pin] 900psi/pin [6.2MPa/pin]	 SPIN-0076-250 SPIN-0100-250	 SPIN-0076-250 SPIN-0100-250
Max. Tension (lbf)[kN]	185,000 [823]	185,000 [823]
Redress Kit Part Number	FV-338-238-200**-KIT	FV-380-288-200**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))

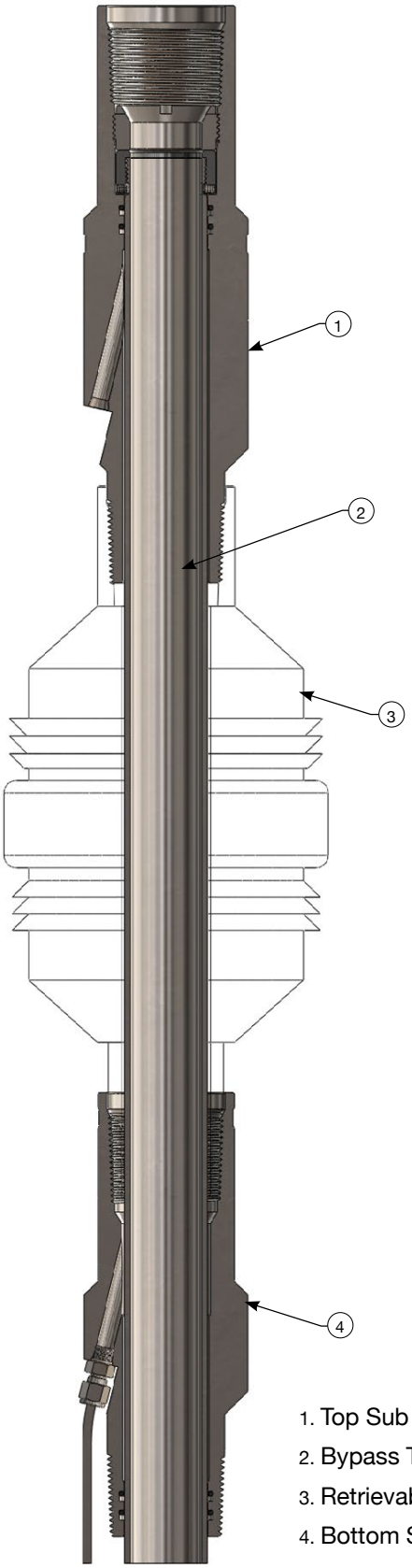
† Hardware only. Viton O-rings need to be used above 325°F (163°C)



1. Brass Shear Pin
2. Flow Ports
3. Piston Sleeve
4. Air Chamber
5. Precision Shear Pins

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1. Top Sub
2. Bypass Tube
3. Retrievable Packer
4. Bottom Sub

APPLICATIONS

- Annulus differential pressure perforating
- Annular pressure operated production vent

FEATURES

- Compatible with most retrievable packers
- Immune to wellbore debris
- Full open ID to allow for drop bars

BENEFITS

- Prevents dirty fluid entering the system
- Enables hydraulic communication with equipment below a packer

The Annular Pressure Bypass assembly is used to transmit annular pressure below a retrievable packer in order to operate differential or direct pressure firing heads and annular pressure operated production vents.

An O-Ring sealed bypass tube isolates the tubing from the annulus when annular pressure is being manipulated. This assembly is ideal for situations where tubing pressure needs to be maintained while operating hydraulically controlled TCP or completion equipment.

Retrievable packers are not supplied by Hunting Titan.

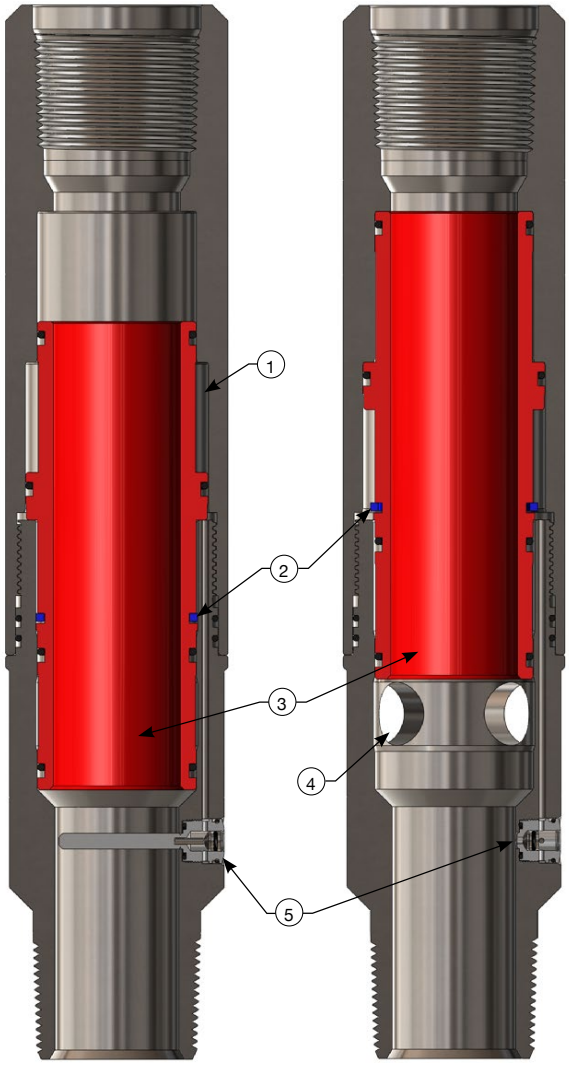
ANNULAR PRESSURE PACKER BYPASS ASSEMBLY HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE
Assembly Part Number	APCA-2375-000**	APC-2875-000**
O.D. (in)[mm]	3.69 [94]	4.10 [104]
I.D. (in)[mm]	1.60 [41]	2.00 [51]
Length Above Packer (ft)[m]	0.92 [0.28]	0.90 [0.27]
Length Below Packer (ft)[m]	0.67 [0.20]	0.73 [0.22]
Mandrel Length (ft)[m]	8.83 [2.69]	10.67 [3.25]
Min. Packer I.D. (in)[mm]	1.88 [48]	2.30 [58]
Max. Packer Length (ft)[m]	7.50 [2.29]	9.33 [2.84]
Max. Pressure (psi)[MPa]‡	20,000 [138]	20,000 [138]
Max. Differential Pressure (psi)[MPa]	10,000 [69]	8,500 [59]
Max. Tension (lbf)[kN]	150,000 [667]	280,000 [1,246]
Redress Kit Part Number	APCA-2375-000**-KIT	APCA-2375-000**-KIT

** Use “HT” for high temperature operations (above 325°F (163°C))

‡ Backup O-rings required above 13,000psi (90MPa). Kit APCA-xxxx-000-BUKIT needs to be ordered separately

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1. Air Chamber
2. Snap Ring
3. Piston Sleeve
4. Flow Ports
5. Break Plug Assembly

APPLICATIONS

- Permanent completions
- Underbalanced perforating
- Drillstem Testing (DST)

FEATURES

- Drop bar operated
- Ideal for perforating underbalanced in wells with existing perforations
- A snap ring ensures that once the valve opens, it cannot close

BENEFITS

- Required underbalance will ensure proper perforation cleanup potentially improving productivity or injectivity
- No wireline or slickline tools required saving rig time

Creating underbalanced perforating scenarios using a permanent completion string in a well that already possess open perforations can be challenging as only tubing pressure can be manipulated to fire the guns and open the well for surging. The Drop Bar Operated Production Vent allows this to be possible.

The Drop Bar Operated Production Vent prevents fluid entry into the tubing while running in hole. The desired underbalance can be achieved by topping up fluid from surface or using the Fill/Stop Fill Valve. This will vary from job to job depending on well conditions. The production vent can also be used to set packers and liner hangers.

The vent remains closed until a drop bar is deployed which shatters a break plug assembly. This allows hydrostatic to move the piston sleeve, opening the flow ports allowing fluid flow into the tubing. A snap ring inside the vent locks the sleeve in place such that it cannot close should hydrostatic pressure be significantly lowered or from friction caused by fluid injection.

A pressure actuated version of the production vent is also available.

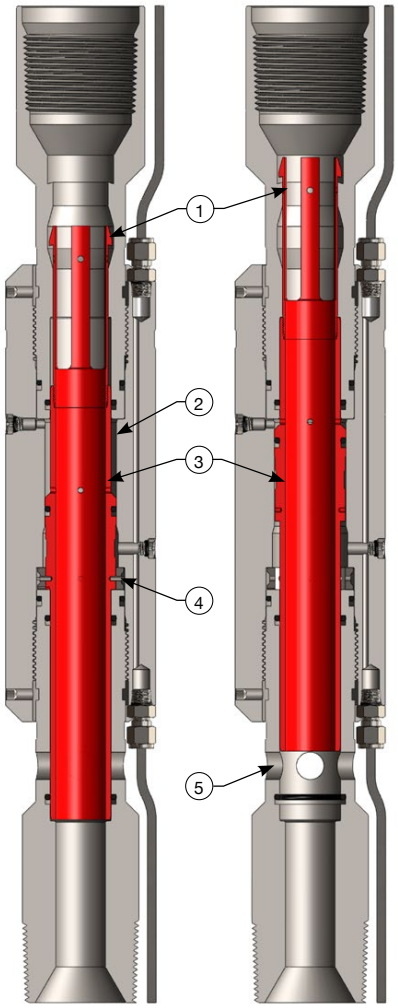
DROP BAR OPERATED PRODUCTION VENT HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE
Assembly Part Number	VENT-3500-000**	VENT-3900-000**
O.D. (in)[mm]	3.50 [89]	3.90 [99]
I.D. (in)[mm]	2.00 [51]	2.40 [61]
Flow Area of Ports (in^2)[cm^2]	3.14 [20.26]	4.71 [30.39]
Makeup Length (ft)[m]	1.19 [0.36]	1.20 [0.36]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]
Min. Operating Pressure (psi)[MPa]	500 [3.4]	500 [3.4]
Max. Operating Pressure (psi)[MPa]	13,000 [90]	13,000 [90]
Max. Differential Pressure (psi)[MPa]	13,000 [90]	13,000 [90]
Max. Tension (lbf)[kN]	175,000 [778]	200,000 [890]
Redress Kit Part Number	VENT-3500-000**-KIT	VENT-3900-000**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)

C_TOP_Catalog 2012 2013.indd_09132013 0436

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1. Collets
2. Air Chamber
3. Piston Sleeve
4. Precision Shear Pins
5. Flow Ports

APPLICATIONS

- Highly deviated or horizontal permanent completions
- Underbalanced perforating
- Drillstem Testing (DST)

FEATURES

- Annular pressure bar operated
- Compatible with Dual Top Annulus Differential Pressure Firing Head
- Ideal for perforating underbalanced in wells with existing perforations
- Collets ensure that once the valve opens, it cannot close

BENEFITS

- Required underbalance will ensure proper perforation cleanup potentially improving productivity or injectivity
- Ideal for completions where wireline or slickline tools cannot be used because of high deviation

Creating underbalanced perforating scenarios using a permanent completion string in a well that already possess open perforations can be challenging as only tubing pressure and annular pressure above the packer can be manipulated to fire the guns and open the well for surging. Annular Pressure Operated Production Vent allows this to be possible.

The Annular Pressure Operated Production Vent prevents fluid entry into the tubing while running in hole. The desired underbalance can be achieved by topping up fluid from surface or using the Fill/Stop Fill Valve. This will vary from job to job depending on well conditions. The production vent can also be configured to set packers and liner hangers.

The production vent is run with the Packer Bypass Assembly and Dual Top Annulus Differential Pressure Firing Head. By manipulating the annular pressure above the packer, the gun system can be initiated followed by opening the flow ports allowing fluid to surge into the tubing. This setup is ideal for highly deviated or horizontal completions where drop bars cannot be deployed and wireline or slickline intervention is not possible.

A drop bar actuated version of the production vent is also available.

ANNULAR PRESSURE OPERATED PRODUCTION VENT HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE		2-7/8 [68] EUE	
Assembly Part Number	VENT-313-238-000CL	VENT-340-238-000CL	VENT-400-288-000CL	VENT-463-288-000CL
O.D. (in)[mm]	3.13 [80]	3.40 [86]	4.00 [102]	4.63 [118]
I.D. (in)[mm]	1.13 [29]	1.13 [29]	1.75 [44]	2.25 [57]
Flow Area of Ports (in^2)[cm^2]	1.23 [7.94]	1.23 [7.94]	2.41 [15.55]	3.98 [25.68]
Makeup Length (ft)[m]	1.72 [0.53]	1.72 [0.53]	1.73 [0.53]	1.73 [0.53]
Max. 100 Hour Temperature Rating (°F)[°C]†	400 [204]	400 [204]	400 [204]	400 [204]
Min. Operating Pressure (psi)[MPa]	1,000 [7]	1,000 [7]	1,000 [7]	1,000 [7]
Max. Operating Pressure (psi)[MPa]‡	18,000 [124]	18,000 [124]	20,000 [138]	20,000 [138]
Max. Differential Pressure (psi)[MPa]	13,000 [90]	13,000 [90]	7,500 [52] across Shear Pins 4,500 [31] across Collet	5,600 [39] across Shear Pins 3,500 [24] across Collet
Precision Shear Pins (psi/pin)[MPa/pin] Part Numbers	(485)[3.3] SPIN-076-250 (835)[5.8] SPIN-100-250	(485)[3.3] SPIN-076-250 (835)[5.8] SPIN-100-250	(615)[4.2] SPIN-100-250	(480)[3.3] SPIN-100-250
Max. Tension (lbf)[kN]	85,000 [378]	97,000 [431]	127,000 [565]	160,000 [712]
Redress Kit Part Number	VENT-313-238-000CL-KIT	VENT-340-238-000CL-KIT	VENT-400-288-000CL-KIT	VENT-463-288-000CL-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))

† Hardware only. Viton O-rings need to be used above 325°F (163°C)

‡ Backup O-rings required above 13,000psi (90MPa). Kit VENT-xxx-xxx-000CL-BUKIT needs to be ordered separately

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APPLICATIONS

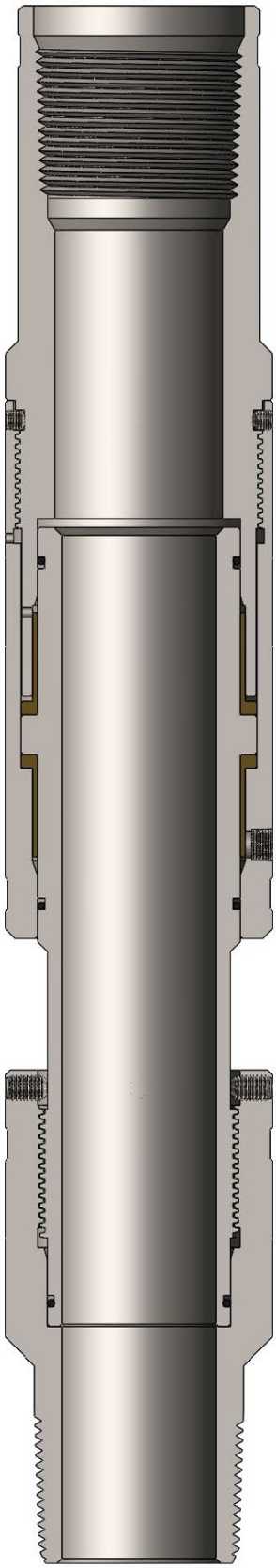
- Oriented perforating
- Tandem dual string completions
- Highly deviated and horizontal wells

FEATURES

- High quality journal bearings
- Compact design results in small OD and large bore

BENEFITS

- Ensures free rotation under tension, compression and side loading
- Design aloows for unrestricted flow inside tubing
- Cost effective and easy maintenance



Hunting Titan's Tubing Swivel is designed to allow the tubing above and below a TCP gun assembly to rotate independently. When run in conjunction with eccentric weight bars or orienting fins, above or between TCP gun systems, the gun assembly can rotate freely to orient for perforating in the desired direction of a deviated or horizontal well.

When designing dual completions, it is critical that the TCP gun assembly in the short string is oriented correctly such that it does not puncture the long string. The Tubing Swivel can be used to facilitate the connection of a short string gun assembly to a dual packer TCP system by allowing the operator to turn and then lock the guns such that they are facing away from the long string.

The swivel contains a low friction seal design that allows it to rotate freely when exposed to equal hydrostatic pressure on the ID and OD of the tool. The high quality bearing surfaces ensure that free rotation is maintained under low to moderate compression, tension or side loadings. By having a slim design, the Tubing Swivel will allow unrestricted fluid flow through the tubing while retaining a small OD.

TUBING SWIVEL HARDWARE SPECIFICATIONS

Tubing Size (in)[mm]	2-3/8 [60] EUE	2-7/8 [68] EUE
Assembly Part Number	SWVL-TBG-238-000**	SWVL-TBG-288-000**
O.D. (in)[mm]	3.38 [86]	3.88 [99]
I.D. (in)[mm]	1.95 [50]	2.44 [62]
Makeup Length (ft)[m]	1.44 [044]	1.52 [0.46]
Max. 100 Hour Temperature rating (°F)[°C]	400 [204]	400 [204]
Collapse Pressure (psi)[MPa]	15,000 [103]	12,500 [86]
Burst Pressure (psi)[MPa]	17,500 [121]	14,500 [100
Max. Tension (lbf)[kN]	115,000 [512]	125,000 [556]
Redress Kit Part Number	SWVL-TBG-238-000**-KIT	SWVL-TBG-288-000**-KIT

** Use "HT" for high temperature operations (above 325°F (163°C))
† Hardware only. Viton O-rings need to be used above 325°F (163°C)

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HUNTING
Hunting Titan



APPLICATIONS

- TCP shot detection

FEATURES

- Excellent acoustic coupling between pipe and transducer
- State of the art recording and processing equipment
- Programmable low-cut filter can block out background noise
- Acoustic signals can be monitored real-time and digitally recorded

BENEFITS

- Crisp and clear audio signals make easy identification of gun detonation
- Rapid and informed decisions can be made real-time



Transducer block assembly

Hunting Titans' Digital Shot Detection System is used to monitor and record downhole acoustics associated with TCP perforating. By monitoring these acoustics signals at surface real-time, the operator can be confident if positive gun detonation occurs.

A sensitive acoustic transducer, packaged inside a customized block, can be attached tightly onto all types of pipe. When the perforating gun initiates, a tremendous amount of acoustic energy is transmitted up the tubing. The transducer block assembly detects these signals and converts them to electrical sound pulses that are digitally recorded by a separate recorder.

A key feature of the transducer block is its excellent acoustic coupling properties. Conventional, metallic microphone packages can cause a lot of ringing making it difficult to identify positive gun detonation.



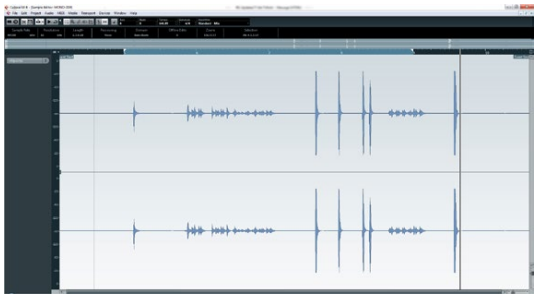
Amplifier/speaker



H4n Handy Recorder

The Zoom® H4n Handy Recorder is a versatile, state of the art digital recorder widely used in the music and film industry. Its ability to potentially cut out background noise makes it ideal for noisy wellsite environments. Data is always recorded on an SD memory card, but the included speaker can be connected to allow listening of the acoustic signals real-time.

Once the perforating job has been successfully completed, the digital audio files can be edited before presenting them to the operator. Steinburg's renowned CUBASE LE6 software can be utilized to crop long files and filter out any excessive background noise.



CUBASE LE6 software

The kit comes complete, ready to use in an easy to carry Pelican™ case and includes:

- Transducer block assembly
- Zoom H4n Handy Recorder
- Portable amplifier/speaker
- CUBASE LE6 software
- 30ft (9.1m) audio cable
- 2GB SD memory card
- 9V and 2x AA alkaline batteries
- Earphones

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4 SPF (13 SPM) GUNFACTS®

Strip Material:	Mild steel
Strip Configuration:	Threaded
Charge Loading Method:	Threaded into formed strip
Mode of Fire:	Simultaneous
Type of Tandem Connection:	Continuous
Initiation Point:	TOP fired only
Recommended Detonating Cord:	80 grains/foot, extra high velocity

Phasing	0°
Strip Part Number	0215-1**-041
Nominal O.D. (in)[mm]	1.72 [44]
Nominal Strip Thickness (in)[mm]	0.11 [3]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 N/A N/A
Min. Recommended Restriction (in)[mm]	1.78 [45]
Drift Gauge I.D. for Gun O.D. (in)[mm]	1.74 [44] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 N/A N/A
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	15,000 [103]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots)	 3.67 [1.12] 6.67 [2.03] 10.67 [3.25]
Gun End to Top Shot Distance (in)[mm]	5.50 [140]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	2.0 [3.0]
Max. Tension (lbf)[kN]	2,400 [11]
Charge Hole Thread Type	5/8" – 24 TPI

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 1-11/16IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**CAP-1708-421T**	**8.0**	**4 [13], 0°**	**0.24 [6]**	**20.41 [51.84]**	**0.05 [0.13]**	**4-1/2 [114]**	**7,170 [49.4]**
-	BH	*CAP-1708-310B*	*8.0*	*6 [20], 0°*	*0.59 [15]*	*5.01 [12.73]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,215 [42.9]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Strip Material:	Mild steel
Strip Configuration:	Threaded
Charge Loading Method:	Threaded into formed strip
Mode of Fire:	Simultaneous
Type of Tandem Connection:	Continuous
Initiation Point:	TOP fired only
Recommended Detonating Cord:	80 grains/foot, extra high velocity

Phasing	0°
Strip Part Number	0215-1**-061
Nominal O.D. (in)[mm]	1.72 [44]
Nominal Strip Thickness (in)[mm]	0.11 [3]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 N/A N/A
Min. Recommended Restriction (in)[mm]	1.78 [45]
Drift Gauge I.D. for Gun O.D. (in)[mm]	1.74 [44] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 N/A N/A
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	15,000 [103]
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots)	 3.67 [1.12] 6.67 [2.03] 10.67 [3.25]
Gun End to Top Shot Distance (in)[mm]	5.00 [127]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	2.0 [3.0]
Max. Tension (lbf)[kN]	2,400 [11]
Charge Hole Thread Type	5/8" – 24 TPI

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 1-11/16IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**CAP-1708-421T**	**8.0**	**4 [13], 0°**	**0.24 [6]**	**20.41 [51.84]**	**0.05 [0.13]**	**4-1/2 [114]**	**7,170 [49.4]**
-	BH	*CAP-1708-310B*	*8.0*	*6 [20], 0°*	*0.59 [15]*	*5.01 [12.73]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,215 [42.9]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Strip Material:	Mild steel
Strip Configuration:	Threaded
Charge Loading Method:	Threaded into formed strip
Mode of Fire:	Simultaneous
Type of Tandem Connection:	Continuous
Initiation Point:	TOP fired only
Recommended Detonating Cord:	80 grains/foot, extra high velocity

Phasing	0°
Strip Part Number	0215-1**-041
Nominal O.D. (in)[mm]	2.19 [56]
Nominal Strip Thickness (in)[mm]	0.11 [3]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 N/A N/A
Min. Recommended Restriction (in)[mm]	2.25 [57]
Drift Gauge I.D. for Gun O.D. (in)[mm]	2.21 [56] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 N/A N/A
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	15,000 [103]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots)	 3.67 [1.12] 6.67 [2.03] 10.67 [3.25]
Gun End to Top Shot Distance (in)[mm]	5.50 [140]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	3.0 [4.5]
Max. Tension (lbf)[kN]	2,400 [11]
Charge Hole Thread Type	5/8" – 24 TPI

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-1/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**CAP-2115-420T**	**15.0**	**4 [13], 0°**	**0.28 [7]**	**34.84 [88.49]**	**0.05 [0.13]**	**5-1/2 [140]**	**7,125 [49.1]**
-	BH	*CAP-2115-310B*	*15.0*	*6 [20], 0°*	*0.63 [16]*	*6.18 [15.70]*	*0.06 [0.15]*	*5-1/2 [140]*	*6,215 [42.9*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Strip Material:	Mild steel
Strip Configuration:	Threaded
Charge Loading Method:	Threaded into formed strip
Mode of Fire:	Simultaneous
Type of Tandem Connection:	Continuous
Initiation Point:	TOP fired only
Recommended Detonating Cord:	80 grains/foot, extra high velocity

Phasing	0°
Strip Part Number	0215-1**-061
Nominal O.D. (in)[mm]	2.19 [56]
Nominal Strip Thickness (in)[mm]	0.11 [3]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 N/A N/A
Min. Recommended Restriction (in)[mm]	2.25 [57]
Drift Gauge I.D. for Gun O.D. (in)[mm]	2.21 [56] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 N/A N/A
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	15,000 [103]
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots)	 3.67 [1.12] 6.67 [2.03] 10.67 [3.25]
Gun End to Top Shot Distance (in)[mm]	5.00 [127]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	3.0 [4.5]
Max. Tension (lbf)[kN]	2,400 [11]
Charge Hole Thread Type	5/8" – 24 TPI

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-1/8IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**CAP-2115-420T**	**15.0**	**4 [13], 0°**	**0.28 [7]**	**34.84 [88.49]**	**0.05 [0.13]**	**5-1/2 [140]**	**7,125 [49.1]**
-	BH	*CAP-2115-310B*	*15.0*	*6 [20], 0°*	*0.63 [16]*	*6.18 [15.70]*	*0.06 [0.15]*	*5-1/2 [140]*	*6,215 [42.9*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Steel Tubing
Gun Body Configuration:	Threaded and unscalloped
Charge Tube Type:	Twisted strip or round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Initiation Point:	Top or bottom fired options available for wireline
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	60°	90°
Assembly Part Number	0631-A**-046† 0631-A4**-046‡	0631-A**-044† 0631-A4**-044‡
Nominal O.D. (in)[mm]	3.13 [79]	
Nominal Thickness (in)[mm]	0.30 [7.6]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g Ambient Gas	 3.48 [88] Not Recommended	 3.48 [88] Not Recommended
Min. Recommended Restriction (in)[mm]	3.58 [91]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	7,500 [52]	
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]	
Typical Length (ft)[m] 4 ft (12 shots)† (13 shots)‡ 7 ft (24 shots)† (25 shots)‡ 11 ft (40 shots)† (41 shots)‡ 21 ft (80 shots)† (81 shots)‡	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of Top Shot Distance (in)[mm]	7.50 [191]† • 6.00 [152]‡	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	13.0 [19.3]	
Max. Tension (lbf)[kN]	82,000 [365]	
Upper/Lower Head Connection	2-3/4" – 6 Modified Acme	

† Charge round steel tube ‡ Charge twisted strip

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**4 [13], 60°**	**0.43 [11]**	**42.13 [107.01]**	**0.05 [0.13]**	**4-1/2 [114]**	**6,320 [43.6]**
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Steel Tubing
Gun Body Configuration:	Threaded and unscalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Initiation Point:	Top or bottom fired options available for wireline
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	60°
Assembly Part Number	0631-B**-066
Nominal O.D. (in)[mm]	3.13 [79]
Nominal Thickness (in)[mm]	0.30 [7.6]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 12.0g Ambient Gas	 3.45 [88] Not Recommended
Min. Recommended Restriction (in)[mm]	3.58 [91]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	7,500 [52]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of Top Shot Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	13.0 [19.3]
Max. Tension (lbf)[kN]	82,000 [365]
Upper/Lower Head Connection	2-3/4" – 6 Modified Acme

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-2512-421T**	**12.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.36 [9]**	**31.90 [81.03]**	**0.05 [0.13]**	**4-1/2 [114]**	**8,050 [55.5]**
PerfECTA	GH	**RTG-2512-431**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.45 [11]**	**20.31 [51.59]**	**0.05 [0.13]**	**3-1/2 [89]**	**6,710 [46.3]**
BountyHunter	BH	*FLO-2511-310B*	*11.0*	*2-1/2 [64]*	*4 [13], 0°*	*0.59 [15]*	*4.85 [12.32]*	*0.05 [0.13]*	*4-1/2 [114]*	*5,340 [36.8]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Steel Tubing
Gun Body Configuration:	Threaded and unscalloped
Charge Tube Type:	Twisted strip or round steel tube
Mode of Fire:	Simultaneous
Initiation Point:	BOTTOM fired only
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-236-090 / 0111-236-V95

Phasing	60°	90°
Assembly Part Number	0640-B**-046† 0640-A4**-046‡	0640-B**-044† 0640-A4**-044‡
Nominal O.D. (in)[mm]	4.00 [102]	
Nominal Thickness (in)[mm]	0.31 [7.9]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 25.0g Ambient Gas. 22.7.0g	 4.50 [114] 4.49 [114]	 4.50 [114] 4.50 [114]
Min. Recommended Restriction (in)[mm]	4.77 [121]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.18 [81] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	7,500 [52]	
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]	
Typical Length (ft)[m] 4 ft (12 shots)† (13 shots)‡ 7 ft (24 shots)† (25 shots)‡ 11 ft (40 shots)† (41 shots)‡ 21 ft (80 shots)† (81 shots)‡	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of Top Shot Distance (in)[mm]	7.50 [191]† • 6.00 [152]‡	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	16.0 [23.8]	
Max. Tension (lbf)[kN]	120,000 [534]	
Upper/Lower Head Connection	3-1/2" – 6 Stub Acme	

† Charge round steel tube ‡ Charge twisted strip

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**4 [13], 60°**	**0.43 [11]**	**42.13 [107.01]**	**0.05 [0.13]**	**4-1/2 [114]**	**6,320 [43.6]**
Prospector	DP	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
Outlaw	GH	*EXP-3325-331*	*25.0*	*4 [102]*	*6 [20], 60°*	*0.56 [14]*	*35.61 [90.45]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,045 [41.7]*
PerfECTA	GH	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Steel Tubing
Gun Body Configuration:	Threaded and unscalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous
Initiation Point:	BOTTOM fired only
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-236-090 / 0111-236-V95

Phasing	60°
Assembly Part Number	0640-B**-066
Nominal O.D. (in)[mm]	4.00 [102]
Nominal Thickness (in)[mm]	0.31 [7.9]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 25.0g Ambient Gas. 22.7g	 4.31 [109] 4.50 [114]
Min. Recommended Restriction (in)[mm]	4.77 [121]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.18 [81] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	7,500 [52]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of Top Shot Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	18.0 [26.7]
Max. Tension (lbf)[kN]	120,000 [534]
Upper/Lower Head Connection	3-1/2" – 6 Stub Acme

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**4 [13], 60°**	**0.43 [11]**	**42.13 [107.01]**	**0.05 [0.13]**	**4-1/2 [114]**	**6,320 [43.6]**
Prospector	DP	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
Outlaw	GH	*EXP-3325-331*	*25.0*	*4 [102]*	*6 [20], 60°*	*0.56 [14]*	*35.61 [90.45]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,045 [41.7]*
PerfECTA	GH	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Flat strip option (for 0° and 180° bolted gun) or round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-211-090 / 0111-211-V95
O-Ring Size for Threaded Gun:	0111-120-090 / 011-120-V95

Phasing	0°	60°	90°	120°	180°
Assembly Part Number	0327-A**-041^† 0227-A**-041‡ 0527-A**-041§	0327-A**-046† 0227-A**-046‡ 0527-A**-046§	0327-A**-044† 0227-A**-044‡ 0527-A**-044§	0327-A**-043† 0227-A**-043‡ 0527-A**-043§	0327-A**-042^† 0227-A**-042‡ 0527-A**-042§
Nominal O.D. (in)[mm]	1.38 [35]				
Nominal Thickness (in)[mm]	0.16 [4.1]				
Typical Gun Swell at Ambient Conditions (in)[mm]					
Ambient Liquid. 1.8g	1.45 [37]	1.45 [37]	1.45 [37]	1.46 [37]	1.46 [37]
Ambient Gas. 1.8g	1.48 [38]	1.47 [37]	1.47 [37]	1.48 [38]	1.47 [37]
Min. Recommended Restriction (in)[mm]	1.59 [40]				
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	1.03 [26] using Gauge Length 12in [305]				
Min. Recommended Washover Pipe Clearance:					
Casing Drift I.D. to Nom. Washover O.D. (in)[mm]	N/A				
Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	N/A				
Max. Hardware Temperature (°F)[°C]	500 [260]				
Max. Pressure (psi)[MPa]	21,000 [145]	22,000 [152]			
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]				
Typical Length (ft)[m]					
4 ft (12 shots)	3.75 [1.14]				
7 ft (24 shots)	6.75 [2.06]				
11 ft (40 shots)	10.75 [3.28]				
21 ft (80 shots)	20.75 [6.32]				
Gun End to Center of First Scallop Distance (in)[mm]	6.00 [152]				
Approximate Weight Fully Loaded (lb/ft)[kg/m]	3.0 [4.5]				
Max. Tension (lbf)[kN]	24,000 [107]† • 59,000 [262]‡§				
Upper/Lower Head Connection	10-32 UNF-2B† • 1-1/8" - 12 Stub Acme‡§				

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit
** Gun length. Example: Use "07" for 7ft gun; etc. ^ Use "T" for charge tube instead of charge strip

CIRCULATING CHARGE PERFORMANCE WITH 1-3/8IN, 4 SPF GUN SYSTEM

Charge Part Number†	Color Code	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	L-80 Tubing/Casing Wall Thickness (in)[mm]	Penetration in Secondary String with 1/4" Water Clearance (in)[mm]
CIR-1302-4T25	Brown with Green Stripe	1.8	4 [13], 0°	0.17 [4]	1/4 [6]	0.03 [0.76]
CIR-1302-4T38	Orange with Green Stripe	1.8	4 [13], 0°	0.19 [5]	3/8 [10]	0.02 [0.51]
CIR-1302-4C50	Red with Green Stripe	1.8	4 [13], 0°	0.19 [5]	1/2 [13]	0.06 [1.5]
CIR-1302-4C63	Blue with Green Stripe	1.8	4 [13], 0°	0.13 [3]	5/8 [16]	0.02 [0.51]

API PERFORMANCE OF CHARGES COMPATIBLE WITH 1-3/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
-	DP	*RTG-1302-400*	*1.8*	*1-3/8 [35]*	*4 [13], 0°*	*0.17 [4]*	*4.70 [11.94]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,440 [44.4]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Flat strip option (for 0° and 180° bolted gun) or round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-214-090 / 0111-214-V95
O-Ring Size for Threaded Gun:	0111-215-090 / 0111-215-V95

Phasing	0°	60°	90°	120°	180°
Assembly Part Number	0320-A**-041^† 0220-A**-041‡ 0520-A**-041§	0320-A**-046† 0220-A**-046‡ 0520-A**-046§	0320-A**-044† 0220-A**-044‡ 0520-A**-044§	0320-A**-043† 0220-A**-043‡ 0520-A**-043§	0320-A**-042^† 0220-A**-042‡ 0520-A**-042§
Nominal O.D. (in)[mm]	1.56 [40]				
Nominal Thickness (in)[mm]	0.17 [4.3]				
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 3.2g Ambient Gas. 3.2g	1.68 [43] @ 3.2g 1.70 [43] @ 3.2g	1.67 [42] @ 3.2g 1.70 [43] @ 3.2g	1.69 [43] @ 3.2g 1.71 [43] @ 3.2g	1.69 [43] @ 3.2g 1.71 [43] @ 3.2g	1.70 [43] @ 3.2g 1.72 [44] @ 3.2g
Min. Recommended Restriction (in)[mm]	1.78 [45]				
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	1.19 [30] using Gauge Length 12in [305]				
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	N/A N/A				
Max. Hardware Temperature (°F)[°C]	500 [260]				
Max. Pressure (psi)[MPa]	19,000 [131]	20,000 [138]			
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]				
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	3.75 [1.14] 6.75 [2.06] 10.75 [3.28] 20.75 [6.32]				
Gun End to Center of First Scallop Distance (in)[mm]	6.00 [152]				
Approximate Weight Fully Loaded (lb/ft)[kg/m]	4.0 [5.9]				
Max. Tension (lbf)[kN]	35,000 [156]† • 80,000 [356]‡§				
Upper/Lower Head Connection	1/4-20 UNC-2B† • 1-9/32" - 12 Stub Acme‡§				

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc. ^ Use "T" for charge tube instead of charge strip

CIRCULATING CHARGE PERFORMANCE WITH 1-9/16IN, 4 SPF GUN SYSTEM

Charge Part Number†	Color Code	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	L-80 Tubing/Casing Wall Thickness (in)[mm]	Penetration in Secondary String with 1/4" Water Clearance (in)[mm]
CIR-1603-4T25	Brown with Green Stripe	3.2	4 [13], 0°	0.20 [5]	1/4 [6]	0.03 [0.76]
CIR-1603-4T38	Orange with Green Stripe	3.2	4 [13], 0°	0.23 [6]	3/8 [10]	0.02 [0.51]
CIR-1603-4C50	Red with Green Stripe	3.2	4 [13], 0°	0.20 [5]	1/2 [13]	0.05 [1.3]
CIR-1603-4C63	Blue with Green Stripe	3.2	4 [13], 0°	0.14 [4]	5/8 [16]	0.03 [0.76]

API PERFORMANCE OF CHARGES COMPATIBLE WITH 1-9/16IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-1604-421T**	**3.5**	**1-9/16 [40]**	**6 [20], 0°**	**0.23 [6]**	**12.14 [30.84]**	**0.04 [0.10]**	**2-3/8 [60]**	**6,980 [48.1]**
PerfECTA	SDP	**RTG-1604-421T**	**3.5**	**1-9/16 [40]**	**6 [20], 60°**	**0.20[5]**	**12.68 [32.21]**	**0.04 [0.10]**	**2-3/8 [60]**	**6,800 [46.9]**
-	DP	*RTG-1603-300*	*3.2*	*1-9/16 [40]*	*4 [13], 180°*	*0.23 [6]*	*6.62 [16.81]*	-	*2-3/8 [60]*	*7,310 [50.4]*
-	DP	*RTG-1603-400*	*3.2*	*1-9/16 [40]*	*6 [20], 60°*	*0.24 [6]*	*6.52 [16.56]*	*0.04 [0.10]*	*2-3/8 [60]*	*6,630 [45.7]*
Prospector	BH	*FLO-1603-410*	*3.2*	*1-9/16 [40]*	*6 [20], 0°*	*0.41 [10]*	*3.23 [82.00]*	*0.04 [0.10]*	*4-1/2 [114]*	*7,825 [54.0]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-214-090 / 0111-214-V95
O-Ring Size for Threaded Gun:	0111-215-090 / 0111-215-V95

Phasing	0°	60°	180°
Assembly Part Number	0320-A**-061† 0220-A**-061‡ 0520-A**-061§	0320-A**-066† 0220-A**-066‡ 0520-A**-066§	0320-A**-062† 0220-A**-062‡ 0520-A**-062§
Nominal O.D. (in)[mm]	1.56 [40]		
Nominal Thickness (in)[mm]	0.17 [4.3]		
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 3.2g Ambient Gas	1.74 [44] @ 3.2g Not Recommended	1.67 [43] @ 3.2g Not Recommended	1.67 [43] @ 3.2g Not Recommended
Min. Recommended Restriction (in)[mm]	1.78 [45]		
Drift Gauge O.D. for Gun I.D. Body (in)[mm]	1.19 [30] using Gauge Length 12in [305]		
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	N/A N/A		
Max. Hardware Temperature (°F)[°C]	500 [260]		
Max. Pressure (psi)[MPa]	15,000 [103]	20,000 [138]	18,000 [124]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]		
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	3.75 [1.14] 6.75 [2.06] 10.75 [3.28] 20.75 [6.32]		
Gun End to Center of First Scallop Distance (in)[mm]	5.50 [140]		
Approximate Weight Fully Loaded (lb/ft)[kg/m]	4.0 [5.9]		
Max. Tension (lbf)[kN]	35,000 [156]† • 80,000 [356]‡§		
Upper/Lower Head Connection	1/4-20 UNC-2B† • 1-9/32" - 12 Stub Acme‡§		

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

CIRCULATING CHARGE PERFORMANCE WITH 1-9/16IN, 6 SPF GUN SYSTEM

Charge Part Number†	Color Code	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	L-80 Tubing/Casing Wall Thickness (in)[mm]	Penetration in Secondary String with 1/4" Water Clearance (in)[mm]
CIR-1603-4T25	Brown with Green Stripe	3.2	6 [20], 0°	0.20 [5]	1/4 [6]	0.03 [0.76]
CIR-1603-4T38	Orange with Green Stripe	3.2	6 [20], 0°	0.23 [6]	3/8 [10]	0.02 [0.51]
CIR-1603-4C50	Red with Green Stripe	3.2	6 [20], 0°	0.20 [5]	1/2 [13]	0.05 [1.3]
CIR-1603-4C63	Blue with Green Stripe	3.2	6 [20], 0°	0.14 [4]	5/8 [16]	0.03 [0.76]

API PERFORMANCE OF CHARGES COMPATIBLE WITH 1-9/16IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-1604-421T**	**3.5**	**1-9/16 [40]**	**6 [20], 0°**	**0.23 [6]**	**12.14 [30.84]**	**0.04 [0.10]**	**2-3/8 [60]**	**6,980 [48.1]**
PerfECTA	SDP	**RTG-1604-421T**	**3.5**	**1-9/16 [40]**	**6 [20], 60°**	**0.20[5]**	**12.68 [32.21]**	**0.04 [0.10]**	**2-3/8 [60]**	**6,800 [46.9]**
-	DP	*RTG-1603-300*	*3.2*	*1-9/16 [40]*	*4 [13], 180°*	*0.23 [6]*	*6.62 [16.81]*	-	*2-3/8 [60]*	*7,310 [50.4]*
-	DP	*RTG-1603-400*	*3.2*	*1-9/16 [40]*	*6 [20], 60°*	*0.24 [6]*	*6.52 [16.56]*	*0.04 [0.10]*	*2-3/8 [60]*	*6,630 [45.7]*
Prospector	BH	*FLO-1603-410*	*3.2*	*1-9/16 [40]*	*6 [20], 0°*	*0.41 [10]*	*3.23 [82.00]*	*0.04 [0.10]*	*4-1/2 [114]*	*7,825 [54.0]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Flat strip option (for 0° and 180° bolted gun) or round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-220-090 / 0111-220-V95
O-Ring Size for Threaded Gun:	0111-221-090 / 0111-221-V95

Phasing	0°	60°	90°	180°
Assembly Part Number	0321-A**-041^† 0222-A**-041‡ 0521-A**-041§	0321-A**-046† 0222-A**-046‡ 0521-A**-046§	0321-A**-044† 0222-A**-044‡ 0521-A**-044§	0321-A**-042^† 0222-A**-042‡ 0521-A**-042§
Nominal O.D. (in)[mm]	2.03 [52]			
Nominal Thickness (in)[mm]	0.21 [5.3]			
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 7.0g for 0°&60°, 6.5g for 90°&180° Ambient Gas. 7.0g	2.16 [55] 2.21 [56]	2.18 [55] 2.20 [56]	2.16 [55] @ 6.5g 2.20 [56]	2.17 [55] @ 6.5g 2.21 [56]
Min. Recommended Restriction (in)[mm]	2.50 [64]			
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	1.58 [40] using Gauge Length 12in [305]			
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	N/A N/A			
Max. Hardware Temperature (°F)[°C]	500 [260]			
Max. Pressure (psi)[MPa]	17,000 [117]	20,000 [138]		
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]			
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	3.75 [1.14] 6.75 [2.06] 10.75 [3.28] 20.75 [6.32]			
Gun End to Center of First Scallop Distance (in)[mm]	6.00 [152]			
Approximate Weight Fully Loaded (lb/ft)[kg/m]	6.0 [8.9]			
Max. Tension (lbf)[kN]	55,000 [245]† • 135,000 [601]‡§			
Upper/Lower Head Connection	5/16–18 UNC-2B† • 1-11/16" - 8 Stub Acme‡§			

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc. ^ Use "T" for charge tube instead of charge strip

CIRCULATING CHARGE PERFORMANCE WITH 2IN, 4 SPF GUN SYSTEM

Charge Part Number†	Color Code	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	L-80 Tubing/Casing Wall Thickness (in)[mm]	Penetration in Secondary String with 1/4" Water Clearance (in)[mm]
CIR-2106-4T25	Brown with Green Stripe	6.5	4 [13], 0°	0.32 [8]	1/4 [6]	0.05 [1.3]
CIR-2106-4T38	Orange with Green Stripe	6.5	4 [13], 0°	0.33 [8]	3/8 [10]	0.07 [1.8]
CIR-2106-4C50	Red with Green Stripe	6.5	4 [13], 0°	0.31 [8]	1/2 [13]	0.08 [2.0]
CIR-2106-4C63	Blue with Green Stripe	6.5	4 [13], 0°	0.30 [8]	5/8 [16]	0.06 [1.5]

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-2107-421T**	**7.0**	**2 [51]**	**6 [20], 60°**	**0.29 [7]**	**26.07 [66.22]**	**0.05 [0.13]**	**2-7/8 [73]**	**7,650 [52.7]**
PerfECTA for low swell	SDP	**RTG-2104-421T**	**4.0**	**2 [51]**	**6 [20], 0°**	**0.21 [5]**	**19.05 [48.39]**	**0.05 [0.13]**	**2-7/8 [73]**	**8,360 [57.6]**
Outlaw	GH	*RTG-2106-331*	*6.5*	*2 [51]*	*4 [13], 60°*	*0.36 [9]*	*11.82 [30.02]*	*0.05 [0.13]*	*2-7/8 [73]*	*5,720 [39.4]*
BountyHunter	BH	*FLO-2106-310*	*6.5*	*2 [51]*	*4 [13], 0°*	*0.51 [13]*	*4.14 [10.52]*	*0.03 [0.08]*	*4-1/2 [114]*	*8,650 [59.6]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-220-090 / 0111-220-V95
O-Ring Size for Threaded Gun:	0111-221-090 / 0111-221-V95

Phasing	0°	60°	180°
Assembly Part Number	0321-A**-061† 0222-A**-061‡ 0522-A**-061§	0321-A**-066† 0222-A**-066‡ 0522-A**-066§	0321-A**-062† 0222-A**-062‡ 0522-A**-062§
Nominal O.D. (in)[mm]	2.03 [52]		
Nominal Thickness (in)[mm]	0.21 [5.3]		
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 7.0g Ambient Gas	 2.19 [56] Not Recommended	 2.18 [55] Not Recommended	 No Test Not Recommended
Min. Recommended Restriction (in)[mm]	2.25 [57]		
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	1.58 [40] using Gauge Length 12in [305]		
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 N/A N/A		
Max. Hardware Temperature (°F)[°C]	500 [260]		
Max. Pressure (psi)[MPa]	13,000 [90]	20,000 [138]	18,000 [124]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]		
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 3.75 [1.14] 6.75 [2.06] 10.75 [3.28] 20.75 [6.32]		
Gun End to Center of First Scallop Distance (in)[mm]	5.50 [140]		
Approximate Weight Fully Loaded (lb/ft)[kg/m]	7.0 [10.4]		
Max. Tension (lbf)[kN]	55,000 [245]† • 135,000 [601]‡§		
Upper/Lower Head Connection	5/16–18 UNC-2B† • 1-11/16" - 8 Stub Acme‡§		

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

CIRCULATING CHARGE PERFORMANCE WITH 2IN, 6 SPF GUN SYSTEM

Charge Part Number†	Color Code	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	L-80 Tubing/Casing Wall Thickness (in)[mm]	Penetration in Secondary String with 1/4" Water Clearance (in)[mm]
CIR-2106-4T25	Brown with Green Stripe	6.5	6 [20], 0°	0.32 [8]	1/4 [6]	0.05 [1.3]
CIR-2106-4T38	Orange with Green Stripe	6.5	6 [20], 0°	0.33 [8]	3/8 [10]	0.07 [1.8]
CIR-2106-4C50	Red with Green Stripe	6.5	6 [20], 0°	0.31 [8]	1/2 [13]	0.08 [2.0]
CIR-2106-4C63	Blue with Green Stripe	6.5	6 [20], 0°	0.30 [8]	5/8 [16]	0.06 [1.5]

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-2107-421T**	**7.0**	**2 [51]**	**6 [20], 60°**	**0.29 [7]**	**26.07 [66.22]**	**0.05 [0.13]**	**2-7/8 [73]**	**7,650 [52.7]**
PerfECTA for low swell	SDP	**RTG-2104-421T**	**4.0**	**2 [51]**	**6 [20], 0°**	**0.21 [5]**	**19.05 [48.39]**	**0.05 [0.13]**	**2-7/8 [73]**	**8,360 [57.6]**
Outlaw	GH	*RTG-2106-331*	*6.5*	*2 [51]*	*4 [13], 60°*	*0.36 [9]*	*11.82 [30.02]*	*0.05 [0.13]*	*2-7/8 [73]*	*5,720 [39.4]*
BountyHunter	BH	*FLO-2106-310*	*6.5*	*2 [51]*	*4 [13], 0°*	*0.51 [13]*	*4.14 [10.52]*	*0.03 [0.08]*	*4-1/2 [114]*	*8,650 [59.6]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Flat strip option (for 0° and 180° bolted gun) or round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-224-090 / 0111-224-V95
O-Ring Size for Threaded Gun:	0111-225-090 / 0111-225-V95

Phasing	0°	60°	90°	180°
Assembly Part Number	0328-A**-041^† 0228-A**-041‡ 0528-A**-041§	0328-A**-046† 0228-A**-046‡ 0528-A**-046§	0328-A**-044† 0228-A**-044‡ 0528-A**-044§	0328-A**-042^† 0228-A**-042‡ 0528-A**-042§
Nominal O.D. (in)[mm]	2.50 [64]			
Nominal Thickness (in)[mm]	0.25 [6.4]			
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 12.0g for 0°-90°, 11.0g for 180° Ambient Gas. 11.0g	2.71 [69] Not Recommended	2.69 [68] No Test	2.69 [68] No Test	2.63 [67] @ 11.0g 2.66 [68] @ 11.0g
Min. Recommended Restriction (in)[mm]	2.71 [69]			
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	1.98 [50] using Gauge Length 12in [305]			
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	N/A N/A			
Max. Hardware Temperature (°F)[°C]	500 [260]			
Max. Pressure (psi)[MPa]	13,000 [90]	20,000 [138]	20,000 [138]	18,000 [124]
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]			
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	3.92 [1.19]† • 4.00 [1.22]‡§ 6.92 [2.11]† • 7.00 [2.13]‡§ 10.92 [3.33]† • 11.00 [3.35]‡§ 20.92 [6.38]† • 21.00 [6.40]‡§			
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]† • 7.50 [191]‡§			
Approximate Weight Fully Loaded (lb/ft)[kg/m]	8.0 [11.9]			
Max. Tension (lbf)[kN]	80,000 [356]† • 80,000 [356]‡§			
Max. Rockwell "C" Hardness	39			
Upper/Lower Head Connection	3/8–24 UNF-2B† • 2-1/8" - 8 Acme‡§			

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit
** Gun length. Example: Use "07" for 7ft gun; etc. ^ Use "T" for charge tube instead of charge strip

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-1/2IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-2512-421T**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.28 [7]**	**29.36 [74.07]**	**0.05 [0.13]**	**3-1/2 [89]**	**7,650 [52.7]**
PerfECTA	GH	**RTG-2512-431**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.45 [11]**	**20.31 [51.99]**	**0.05 [0.13]**	**3-1/2 [89]**	**6,710 [46.3]**
BountyHunter	BH	*FLO-2511-310B*	*11.0*	*2-1/2 [64]*	*4 [13] 0°*	*0.59 [15]*	*4.85 [12.32]*	*0.05 [0.13]*	*4-1/2 [114*	*5,340 [36.8]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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Petitioner GR Energy Services - Ex. 1009, p. 86

6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Bolted and scalloped, or threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	40 grains/foot, FLAT RIBBON
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size for Bolted Gun:	0111-224-090 / 0111-224-V95
O-Ring Size for Threaded Gun:	0111-225-090 / 0111-225-V95

Phasing	0°	60°
Assembly Part Number	0328-A**-061† 0228-A**-061‡ 0528-A**-061§	0328-A**-066† 0228-A**-066‡ 0528-A**-066§
Nominal O.D. (in)[mm]	2.50 [64]	
Nominal Thickness (in)[mm]	0.25 [6.4]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 11.0g Ambient Gas	 2.71 [69] @ 11.0g Not Recommended	 2.69 [68] @ 11.0g Not Recommended
Min. Recommended Restriction (in)[mm]	2.73 [69]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	1.98 [50] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 N/A N/A	
Max. 1 Hour Temp. (°F)[°C]	500 [260]	
Max. Hardware Temperature (°F)[°C]	8,000 [55]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]	
Typical Length (in)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 3.92 [1.19]† • 4.00 [1.22]‡§ 6.92 [2.11]† • 7.00 [2.13]‡§ 10.92 [3.33]† • 11.00 [3.35]‡§ 20.92 [6.38]† • 21.00 [6.40]‡§	
Gun End to Center of First Scallop Distance (in)[mm]	6.50 [165]† • 7.00 [178]‡§	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	9.0 [13.4]	
Max. Tension (lbf)[kN]	80,000 [356]† • 80,000 [356]‡§	
Max. Rockwell “C” Hardness	39	
Upper/Lower Head Connection	3/8–24 UNF-2B† • 2-1/8” - 8 Acme‡§	

† Wireline bolted gun ‡ Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use “07” for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-1/2IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**RTG-2512-421T**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.28 [7]**	**29.36 [74.07]**	**0.05 [0.13]**	**3-1/2 [89]**	**7,650 [52.7]**
PerfECTA	GH	**RTG-2512-431**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.45 [11]**	**20.31 [51.99]**	**0.05 [0.13]**	**3-1/2 [89]**	**6,710 [46.3]**
BountyHunter	BH	*FLO-2511-310B*	*11.0*	*2-1/2 [64]*	*4 [13] 0°*	*0.59 [15]*	*4.85 [12.32]*	*0.05 [0.13]*	*4-1/2 [114*	*5,340 [36.8]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-227-090 / 0111-227-V95

Phasing	60°	90°
Assembly Part Number	0362-B**-046† 0562-B**-046§	0362-B**-044† 0562-B**-044§
Nominal O.D. (in)[mm]	2.75 [70]	
Nominal Thickness (in)[mm]	0.31 [7.9]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 18.0g Ambient Gas. 18.0g	2.97 [75] 2.99 [76]	2.97 [75] 2.99 [76]
Min. Recommended Restriction (in)[mm]	3.00 [76]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.07 [53] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	23,000 [159]	
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]	
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	11.0 [16.3]	
Max. Tension (lbf)[kN]	210,000 [934]	
Upper/Lower Head Connection	2-3/8" - 6 Acme	

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-3/4IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-2818-421T**	**18.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.41 [10]**	**36.22 [92.00]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,920 [54.6]**
PerfECTA	SDP	**EXP-2716-421T**	**16.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.38 [10]**	**35.94 [91.29]**	**0.04 [0.10]**	**4-1/2 [114]**	**7,470 [51.5]**
PerfECTA	SDP	**RTG-2512-421T**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.28 [7]**	**29.36 [74.07]**	**0.05 [0.13]**	**3-1/2 [89]**	**7,650 [52.7]**
BountyHunter	BH	*FLO-2715-310B*	*15.0*	*2-3/4 [70]*	*6 [20], 60°*	*0.72 [18]*	*4.67 [11.86]*	*0.04 [0.10]*	*4-1/2 [114]*	*10,640 [73.4]*
BountyHunter	BH	*FLO-2511-310B*	*11.0*	*2-1/2 [64]*	*4 [13], 0°*	*0.59 [15]*	*4.85 [12.32]*	*0.05 [0.13]*	*4-1/2 [114*	*5,340 [36.8]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-227-090 / 0111-227-V95

Phasing	60°
Assembly Part Number	0362-B**-066† 0562-B**-066§
Nominal O.D. (in)[mm]	2.75 [70]
Nominal Thickness (in)[mm]	0.31 [8.0]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 18.0g Ambient Gas	 2.97 [75] Not Recommended
Min. Recommended Restriction (in)[mm]	3.00 [76]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.07 [53] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	23,000 [159]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	11.0 [16.3]
Max. Tension (lbf)[kN]	210,000 [934]
Upper/Lower Head Connection	2-3/8" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-3/4IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-2818-421T**	**18.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.41 [10]**	**36.22 [92.00]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,920 [54.6]**
PerfECTA	SDP	**EXP-2716-421T**	**16.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.38 [10]**	**35.94 [91.29]**	**0.04 [0.10]**	**4-1/2 [114]**	**7,470 [51.5]**
PerfECTA	SDP	**RTG-2512-421T**	**12.0**	**2-1/2 [64]**	**6 [20], 60°**	**0.28 [7]**	**29.36 [74.07]**	**0.05 [0.13]**	**3-1/2 [89]**	**7,650 [52.7]**
BountyHunter	BH	*FLO-2715-310B*	*15.0*	*2-3/4 [70]*	*6 [20], 60°*	*0.72 [18]*	*4.67 [11.86]*	*0.04 [0.10]*	*4-1/2 [114]*	*10,640 [73.4]*
BountyHunter	BH	*FLO-2511-310B*	*11.0*	*2-1/2 [64]*	*4 [13], 0°*	*0.59 [15]*	*4.85 [12.32]*	*0.05 [0.13]*	*4-1/2 [114*	*5,340 [36.8]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-227-090 / 0111-227-V95

Phasing	60°	90°
Assembly Part Number	0364-B**-046† 0564-B**-046§	0364-B**-044† 0564-B**-044§
Nominal O.D. (in)[mm]	2.88 [73]	
Nominal Thickness (in)[mm]	0.36 [9.1]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 18.0g Ambient Gas	3.08 [78] 3.14 [80]	3.08 [78] 3.14 [80]
Min. Recommended Restriction (in)[mm]	3.25 [83]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.09 [53] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	25,000 [172]	
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]	
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	12.0 [17.8]	
Max. Tension (lbf)[kN]	275,000 [1,223]	
Upper/Lower Head Connection	2-3/8" - 6 Acme	

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-7/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-2818-421T**	**18.0**	**2-7/8 [73]**	**6 [20], 60°**	**0.41 [10]**	**36.22 [92.00]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,920 [54.6]**
PerfECTA	SDP	**EXP-2716-421T**	**16.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.38 [10]**	**35.94 [91.29]**	**0.04 [0.10]**	**4-1/2 [114]**	**7,470 [51.5]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-227-090 / 0111-227-V95

Phasing	60°
Assembly Part Number	0364-B**-066† 0564-B**-066§
Nominal O.D. (in)[mm]	2.88 [73]
Nominal Thickness (in)[mm]	0.36 [9.1]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 18.0g Ambient Gas. 16.0g	 3.08 [78] 3.14 [80] @ 16.0g
Min. Recommended Restriction (in)[mm]	3.25 [83]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.09 [53] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	25,000 [172]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	13.0 [19.3]
Max. Tension (lbf)[kN]	275,000 [1,223]
Upper/Lower Head Connection	2-3/8" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 2-7/8IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	**SDP**	**EXP-2818-421T**	**18.0**	**2-7/8 [73]**	**6 [20], 60°**	**0.41 [10]**	**36.22 [92.00]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,920 [54.6]**
PerfECTA	**SDP**	**EXP-2716-421T**	**16.0**	**2-3/4 [70]**	**6 [20], 60°**	**0.38 [10]**	**35.94 [91.29]**	**0.04 [0.10]**	**4-1/2 [114]**	**7,470 [51.5]**
BountyHunter	*BH*	*FLO-2715-310B*	*15.0*	*2-3/4 [70]*	*6 [20], 60°*	*0.72 [18]*	*4.67 [11.86]*	*0.04 [0.10]*	*4-1/2 [114]*	*10,640 [73.4]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	0°	60°	90°		180°	180°
	1	1	1	2	1	2
Assembly Part Number‡‡	0363-B**-041† 0502-B**-041§	0363-B**-046† 0502-B**-046§	0363-B**-044† 0502-B**-044§	0363-A**-044† 0502-A**-044§	0363-B**-042† 0502-B**-042§	0363-A**-042† 0502-A**-042§
Nominal O.D. (in)[mm]	3.13 [79]					
Nominal Thickness (in)[mm]	0.31 [7.9]					
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g for 0°, 22.7g for 60°-180° Ambient Gas. 19.0g	3.46 [87] @ 21.0g Not Recommended	3.33 [85] 3.40 [86] @ 19.0g	3.37 [86] 3.35 [85] @ 19.0g		3.36 [85] Not Recommended	
Min. Recommended Restriction (in)[mm]	3.58 [91]					
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]					
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]					
Max. Hardware Temperature (°F)[°C]	500 [260]					
Max. Pressure (psi)[MPa]	16,500 [114]	20,000 [138]			19,500 [135]	
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]					
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]					
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]					
Approximate Weight Fully Loaded (lb/ft)[kg/m]	13.0 [19.3]					
Max. Tension (lbf)[kN]	235,000 [1,045]					
Upper/Lower Head Connection	2-3/4" - 6 Acme					

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Compatible With Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.46 [12]**	**41.17 [104.57]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,770 [46.7]**
PerfECTA	SDP	**1**	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
PerfECTA	SDP	**2**	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.37 [9]**	**35.97 [91.36**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	SDP	**1**	**EXP-3319-423T**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.38 [10]**	**45.89 [116.56]**	**0.05 [0.13]**	**4-1/2 [114]**	**6,320 [43.6]**
Prospector	DP	*1*	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*1*	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*1*	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
PerfECTA	GH	**1**	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**1**	**EXP-3321-431**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.56 [14]**	**29.23 [74.24]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
PerfECTA	GH	**2**	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
PerfECTA	GH	**1**	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
BountyHunter	BH	*1*	*FLO-3323-310B*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.70 [18]*	*6.18 [15.70]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,880 [54.3]*
BountyHunter	BH	*2*	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39], 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*
BountyHunter	BH	*2*	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult with your local Hunting Titan representative for more information.*						
PerfECTA	BH	**1**	**FLO-3323-311CF**	**12.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.68 [17]**	**7.10 [18.03]**	**0.07 [0.18]**	**4-1/2 [114]**	**6,710 [46.3]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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Petitioner GR Energy Services - Ex. 1009, p. 92

5 SPF (16 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	0°	180°
Assembly Part Number	0363-B**-051† 0502-B**-051§	0363-B**-052† 0502-B**-052§
Nominal O.D. (in)[mm]	3.13 [79]	
Nominal Thickness (in)[mm]	0.31 [7.9]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g Ambient Gas	3.38 [86] Not Recommended	3.36 [85] Not Recommended
Min. Recommended Restriction (in)[mm]	3.58 [91]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	13,500 [93]	19,000 [131]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]	
Typical Length (ft)[m] 4 ft (15 shots) 7 ft (30 shots) 11 ft (50 shots) 21 ft (100 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.20 [183]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	14.0 [20.8]	
Max. Tension (lbf)[kN]	235,000 [1,045]	
Upper/Lower Head Connection	2-3/4" - 6 Acme	

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 5 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
PerfECTA	SDP	**EXP-3319-423T**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.38 [10]**	**45.89 [116.56]**	**0.05 [0.13]**	**4-1/2 [114]**	**6,320 [43.6]**
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	0°	60°
Assembly Part Number	0363-B**-061† 0502-B**-061§	0363-B**-066† 0502-B**-066§
Nominal O.D. (in)[mm]	3.13 [79]	
Nominal Thickness (in)[mm]	0.31 [7.9]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g for 0°, 22.7g for 60° Ambient Gas. 19.0g	3.38 [86] @ 21.0g Not Recommended	3.36 [85] 3.39 [86] @ 19.0g
Min. Recommended Restriction (in)[mm]	3.58 [91]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	10,900 [75]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]	
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	14.0 [20.8]	
Max. Tension (lbf)[kN]	235,000 [1,045]	
Upper/Lower Head Connection	2-3/4" - 6 Acme	

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3323-423T**	**22.7**	**3-1/8 [79]**	**6 [20], 60°**	**0.46 [12]**	**41.17 [104.57]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,770 [46.7]**
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
PerfECTA	SDP	**EXP-3319-423T**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.38 [10]**	**45.89 [116.56]**	**0.05 [0.13]**	**4-1/2 [114]**	**6,320 [43.6]**
Prospector	DP	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
PerfECTA	GH	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**EXP-3321-431**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.56 [14]**	**29.23 [74.24]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
BountyHunter	BH	*FLO-3323-310B*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.70 [18]*	*6.18 [15.70]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,880 [54.3]*
PerfECTA	BH	**FLO-3323-311CF**	**12.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.68 [17]**	**7.10 [18.03]**	**0.07 [0.18]**	**4-1/2 [114]**	**6,710 [46.3]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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8 SPF (26 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	135/45°
Assembly Part Number	0363-G**-08D† 0502-G**-08D§
Nominal O.D. (in)[mm]	3.13 [79]
Nominal Thickness (in)[mm]	0.31 [7.9]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 11.0g Ambient Gas	 3.33 [85] Not Recommended
Min. Recommended Restriction (in)[mm]	3.58 [91]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (24 shots) 7 ft (48 shots) 11 ft (80 shots) 21 ft (160 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.75 [171]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	13.0 [19.3]
Max. Tension (lbf)[kN]	235,000 [1,045]
Upper/Lower Head Connection	2-3/4" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 8 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
Gunslinger	DP	*EXP-3112-421T*	*12.0*	*3-1/8 [79]*	*12 [39], 135/45°*	*0.31 [8]*	*19.82 [50.34]*	*0.06 [0.15]*	*5 [127]*	*9,960 [68.7]*
PerfECTA	BH	**FLO-3112-411CFZ**	**12.0**	**3-3/8 [86]**	**12 [39], 140/20°**	**0.55 [14]**	**4.68 [11.89]**	**0.06 [0.15]**	**5 [127]**	**5,860 [40.4]**
BountyHunter	BH	*FLO-3112-410B*	*12.0*	*3-1/8 [79]*	*12 [39], 140/20°*	*0.60 [15]*	*5.73 [14.55]*	*0.07 [0.18]*	*5 [127]*	*6,850 [47.2]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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12 SPF (39 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-230-090 / 0111-230-V95

Phasing	140/20°
Assembly Part Number	0363-G**-12E† 0502-G**-12E§
Nominal O.D. (in)[mm]	3.13 [79]
Nominal Thickness (in)[mm]	0.31 [7.9]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 11.0g Ambient Gas	 3.33 [85] Not Recommended
Min. Recommended Restriction (in)[mm]	3.58 [91]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.44 [62] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]
Typical Length (ft)[m] 4 ft (36 shots) 7 ft (72 shots) 11 ft (120 shots) 21 ft (240 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.50 [165]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	13.0 [19.3]
Max. Tension (lbf)[kN]	235,000 [1,045]
Upper/Lower Head Connection	2-3/4" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-1/8IN, 12 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
Gunslinger	DP	*EXP-3112-421T*	*12.0*	*3-1/8 [79]*	*12 [39], 135/45°*	*0.31 [8]*	*19.82 [50.34]*	*0.06 [0.15]*	*5 [127]*	*9,960 [68.7]*
PerfECTA	BH	**FLO-3112-411CFZ**	**12.0**	**3-3/8 [86]**	**12 [39], 140/20°**	**0.55 [14]**	**4.68 [11.89]**	**0.06 [0.15]**	**5 [127]**	**5,860 [40.4]**
BountyHunter	BH	*FLO-3112-410B*	*12.0*	*3-1/8 [79]*	*12 [39], 40/20°*	*0.60 [15]*	*5.73 [14.55]*	*0.07 [0.18]*	*5 [127]*	*6,850 [47.2]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-231-090 / 0111-231-V95

Phasing	0°	60°		90°		180°
	①	①	②	①	②	①
Assembly Part Number‡‡	0365-B**-041† 0503-B**-041§	0365-B**-046† 0503-B**-046§	0365-1A**-046† 0503-1A**-046§	0365-B**-044† 0503-B**-044§	0365-1A**-044† 0503-1A**-044§	0365-B**-042† 0503-B**-042§
Nominal O.D. (in)[mm]	3.38 [86]					
Nominal Thickness (in)[mm]	0.37 [9.4]					
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 22.7g for 0°&180°, 26.0g for 60°&90° Ambient Gas. 26.0g	3.61 [92] @ 22.7g Not Recommended	3.58 [91] 3.68 [93]		3.61 [92] 3.63 [92]		3.56 [90] @ 22.7g Not Recommended
Min. Recommended Restriction (in)[mm]	3.80 [97]					
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.56 [65] using Gauge Length 12in [305]					
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]					
Max. Hardware Temperature (°F)[°C]	500 [260]					
Max. Pressure (psi)[MPa]	18,000 [124]	20,000 [138]				18,000 [124]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,600 [7,200]					
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]					
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]					
Approximate Weight Fully Loaded (lb/ft)[kg/m]	16.0 [23.8]					
Max. Tension (lbf)[kN]	270,000 [1,200]					
Upper/Lower Head Connection	2-13/16" - 6 Acme					

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-3/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-3326-421T**	**26.0**	**3-3/8 [86]**	**6 [20], 60°**	**0.41 [10]**	**50.05 [127.13]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,835 [54.0]**
PerfECTA	SDP	**1**	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**1**	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
PerfECTA	SDP	**1**	**EXP-3319-423T**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.38 [10]**	**45.89 116.56]**	**0.05 [0.13]**	**4-1/2 114]**	**6,320 [43.6]**
Prospector	DP	*1*	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*1*	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*1*	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
Outlaw	GH	*2*	*EXP-3325-331*	*25.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.57 [14]*	*29.81 [75.72]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,890 [40.6]*
PerfECTA	GH	**1**	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**1**	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
BountyHunter	BH	*1*	*FLO-3323-310B*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.70 [18]*	*6.18 [15.70]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,880 [54.3]*
PerfECTA	BH	**1**	**FLO-3323-311CF**	**12.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.68 [17]**	**7.10 [18.03]**	**0.07 [0.18]**	**4-1/2 [114]**	**6,710 [46.3]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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5 SPF (16 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-231-090 / 0111-231-V95

Phasing	0°	180°
Assembly Part Number	0365-B**-051† 0503-B**-051§	0365-B**-052† 0503-B**-052§
Nominal O.D. (in)[mm]	3.38 [86]	
Nominal Thickness (in)[mm]	0.37 [9.4]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 22.7g Ambient Gas	3.60 [91] Not Recommended	3.56 [90] Not Recommended
Min. Recommended Restriction (in)[mm]	3.80 [97]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.56 [65] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	15,800 [109]	19,500 [135]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]	
Typical Length (in)[m] 4 ft (15 shots) 7 ft (30 shots) 11 ft (50 shots) 21 ft (100 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.20 [183]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	16.0 [23.8]	
Max. Tension (lbf)[kN]	270,000 [1,200]	
Upper/Lower Head Connection	2-13/16" - 6 Acme	

† Threaded gun § Threaded gun compatible with boost-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-3/8IN, 5 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
PerfECTA	SDP	**EXP-3319-423T**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.38 [10]**	**45.89 116.56]**	**0.05 [0.13]**	**4-1/2 114]**	**6,320 [43.6]**
Prospector	DP	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
PerfECTA	GH	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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Petitioner GR Energy Services - Ex. 1009, p. 98

6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-231-090 / 0111-231-V95

Phasing	0°	60°		
	②	①	②	③
Assembly Part Number‡‡	0365-B**-061† 0503-B**-061§	0365-1A**-066† 0503-1A**-066§	0365-B**-066† 0503-B**-066§	0365-C**-066† 0503-C**-066§
Nominal O.D. (in)[mm]	3.38 [86]			
Nominal Thickness (in)[mm]	0.37 [9.4]			
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 22.7g for 0°, 26.0g for 60° Ambient Gas. 21.0g	3.60 [91] @ 22.7g Not Recommended	3.58 [91] 3.62 [92] @ 21.0g		
Min. Recommended Restriction (in)[mm]	3.80 [97]			
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.56 [65] using Gauge Length 12in [305]			
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]			
Max. Hardware Temperature (°F)[°C]	500 [260]			
Max. Pressure (psi)[MPa]	13,700 [94]	20,000 [138]		
Min. Detonating Cord Velocity (ft/s)[m/s]	23,600 [7,200]			
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]			
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]			
Approximate Weight Fully Loaded (lb/ft)[kg/m]	16.0 [23.8]			
Max. Tension (lbf)[kN]	270,000 [1,200]			
Upper/Lower Head Connection	2-13/16" - 6 Acme			

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-3/8IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-3326-421T**	**26.0**	**3-3/8 [86]**	**6 [20], 60°**	**0.41 [10]**	**50.05 [127.13]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,835 [54.0]**
PerfECTA	SDP	**2**	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**2**	**EXP-3321-421T**	**21.0**	**3-1/8 [76]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
PerfECTA	SDP	**3**	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39]k 135/45°**	**0.37 [9]**	**35.97 [91.36]**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	SDP	**1**	**EXP-3319-423T**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.38 [10]**	**45.89 116.56]**	**0.05 [0.13]**	**4-1/2 114]**	**6,320 [43.6]**
Prospector	DP	*2*	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*2*	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*2*	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
Outlaw	GH	*1*	*EXP-3325-331*	*25.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.57 [14]*	*29.81 [75.72]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,890 [40.6]*
PerfECTA	GH	**2**	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**3**	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
PerfECTA	GH	**2**	**EXP-3319-431**	**19.0**	**3-1/8 [76]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
BountyHunter	BH	*2*	*FLO-3323-310B*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.70 [18]*	*6.18 [15.70]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,880 [54.3]*
BountyHunter	BH	*3*	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39], 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*
BountyHunter	BH	*2*	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult your local Hunting Titan representative for more information*						
PerfECTA	BH	**2**	**FLO-3323-311CF**	**12.0**	**3-1/8 [76]**	**6 [20], 60°**	**0.68 [17]**	**7.10 [18.03]**	**0.07 [0.18]**	**4-1/2 [114]**	**6,710 [46.3]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

Gun Systems and Accessories Catalog 2012-2013.indd_09132013094339

8 SPF (26 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCPRecommended Detonating Cord:80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-231-090 / 0111-231-V95

Phasing	135/45°
Assembly Part Number	0365-G**-08D† 0503-G**-08D§
Nominal O.D. (in)[mm]	3.38 [86]
Nominal Thickness (in)[mm]	0.37 [9.4]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 No Test Not Recommended
Min. Recommended Restriction (in)[mm]	3.80 [97]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.56 [65] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (24 shots) 7 ft (48 shots) 11 ft (80 shots) 21 ft (160 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.75 [171]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	15.0 [22.3]
Max. Tension (lbf)[kN]	270,000 [1,200]
Upper/Lower Head Connection	2-13/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-3/8IN, 8 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
Gunslinger	DP	*EXP-3112-421T*	*12.0*	*3-1/8 [79]*	*12 [39], 135/45°*	*0.31 [8]*	*19.82 [50.34]*	*0.06 [0.15]*	*5 [127]*	*9,960 [68.7]*
PERFECTA	BH	**FLO-3112-411CFZ**	**12.0**	**3-3/8 [86]**	**12 [39], 140/20°**	**0.55 [14]**	**4.68 [11.89]**	**0.06 [0.15]**	**5 [127]**	**5,860 [40.4]**
BountyHunter	BH	*FLO-3112-410B*	*12.0*	*3-3/8 [86]*	*12 [39], 135/45°*	*0.61 [15]*	*5.89 [14.96]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,510 [44.9]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

Gun Systems and Accessories Catalog 2012-2013.indd_09132013043

12 SPF (39 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-231-090 / 0111-231-V95

Phasing	140/20°
Assembly Part Number	0365-G**-12E† 0503-G**-12E§
Nominal O.D. (in)[mm]	3.38 [86]
Nominal Thickness (in)[mm]	0.37 [9.4]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 No Test Not Recommended
Min. Recommended Restriction (in)[mm]	3.80 [97]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	2.56 [65] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]
Typical Length (ft)[m] 4 ft (36 shots) 7 ft (72 shots) 11 ft (120 shots) 21 ft (240 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.50 [165]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	16.0 [23.8]
Max. Tension (lbf)[kN]	270,000 [1,200]
Upper/Lower Head Connection	2-13/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 3-3/8IN, 12 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
Gunslinger	DP	*EXP-3112-421T*	*12.0*	*3-1/8 [79]*	*12 [39], 135/45°*	*0.31 [8]*	*19.82 [50.34]*	*0.06 [0.15]*	*5 [127]*	*9,960 [68.7]*
PerfECTA	BH	**FLO-3112-411CFZ**	**12.0**	**3-3/8 [86]**	**12 [39], 140/20°**	**0.55 [14]**	**4.68 [11.89]**	**0.06 [0.15]**	**5 [127]**	**5,860 [40.4]**
BountyHunter	BH	*FLO-3112-410B*	*12.0*	*3-3/8 [86]*	*12 [39], 135/45°*	*0.61 [15]*	*5.89 [14.96]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,510 [44.9]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-236-090 / 0111-236-V95

Phasing	90°		
	①	②	③
Assembly Part Number‡‡	0400-1A**-044† 0504-1A**-044§	0400-A**-044† 0504-A**-044§	0400-C**-044† 0504-C**-044§
Nominal O.D. (in)[mm]	4.00 [102]		
Nominal Thickness (in)[mm]	0.38 [9.7]		
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 38.5g Ambient Gas. 38.5g	 4.28 [109] 4.41 [112]		
Min. Recommended Restriction (in)[mm]	4.60 [117]		
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.18 [81] using Gauge Length 12in [305]		
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]		
Max. Hardware Temperature (°F)[°C]	500 [260]		
Max. Pressure (psi)[MPa]	19,500 [134]		
Min. Detonating Cord Velocity (ft/s)[m/s]	21,000 [6,400]		
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]		
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]		
Approximate Weight Fully Loaded (lb/ft)[kg/m]	21.0 [31.2]		
Max. Tension (lbf)[kN]	410,000 [1,824]		
Upper/Lower Head Connection	3-7/16" - 6 Acme		

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**2**	**EXP-4039-423T**	**38.5**	**4 [102]**	**4 [13], 90°**	**0.44 [11]**	**62.81 [159.54]**	**0.07 [0.18]**	**5-1/2 [140]**	**6,460 [44.5]**
PerfECTA	SDP	**1**	**EXP-4539-425T**	**38.5**	**4-1/2 [114]**	**5 [16], 60°**	**0.46 [12]**	**55.70 [141.48]**	**0.08 [0.20]**	**7 [178]**	**6,320 [43.6]**
PerfECTA	SDP	**3**	**EXP-3326-421T**	**26.0**	**3-3/8 [86]**	**6 [20], 60°**	**0.41 [10]**	**50.05 [127.13]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,835 [54.0]**
PerfECTA	SDP	**3**	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**3**	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
Prospector	DP	*3*	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*3*	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*3*	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
Outlaw	GH	*3*	*EXP-3325-331*	*25.0*	*4 [102]*	*6 [20], 60°*	*0.56 [14]*	*35.61 [90.45]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,045 [41.7]*
PerfECTA	GH	**3**	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**3**	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**
BountyHunter	BH	*2*	*FLO-4039-311CF*	*38.5*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

Gun Systems and Accessories Catalog 2012-2013.indd_09132013043

6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-236-090 / 0111-236-V95

Phasing	60°
Assembly Part Number	0400-C**-066† 0504-C**-066§
Nominal O.D. (in)[mm]	4.00 [102]
Nominal Thickness (in)[mm]	0.38 [9.7]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 25.0g Ambient Gas. 25.0g	 4.27 [108] 4.41 [112]
Min. Recommended Restriction (in)[mm]	4.60 [117]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.18 [81] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	19,500 [134]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (in)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	19.0 [28.2]
Max. Tension (lbf)[kN]	410,000 [1,824]
Upper/Lower Head Connection	3-7/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3326-421T**	**26.0**	**3-3/8 [86]**	**6 [20], 60°**	**0.41 [10]**	**50.05 [127.13]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,835 [54.0]**
PerfECTA	SDP	**EXP-3323-423T**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.45 [11]**	**42.21 [107.21]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,270 [50.1]**
PerfECTA	SDP	**EXP-3321-421T**	**21.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.42 [11]**	**44.19 [112.24]**	**0.05 [0.13]**	**4-1/2 [114]**	**5,900 [40.7]**
Prospector	DP	*EXP-3323-461T*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.36 [9]*	*35.63 [90.50]*	*0.06 [0.15]*	*4-1/2 [114]*	*7,670 [52.9]*
-	DP	*EXP-3323-302*	*22.7*	*3-3/8 [86]*	*6 [20], 60°*	*0.44 [11]*	*21.25 [53.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*6,490 [44.7]*
-	DP	*EXP-3319-302*	*19.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.41 [10]*	*22.04 [55.98]*	*0.06 [0.15]*	*4-1/2 [114]*	*5,410 [37.3]*
Outlaw	GH	*EXP-3325-331*	*25.0*	*3-3/8 [86]*	*6 [20], 60°*	*0.56 [14]*	*35.61 [90.45]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,045 [41.7]*
PerfECTA	GH	**EXP-3323-431**	**22.7**	**3-3/8 [86]**	**6 [20], 60°**	**0.59 [15]**	**29.42 [74.73]**	**0.06 [0.15]**	**4-1/2 [114]**	**5,350 [36.9]**
PerfECTA	GH	**EXP-3319-431**	**19.0**	**3-1/8 [79]**	**6 [20], 60°**	**0.55 [14]**	**29.18 [74.12]**	**0.06 [0.15]**	**4-1/2 [114]**	**6,375 [44.0]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

Gun Systems and Accessories Catalog 2012-2013.indd_09132013043

8 SPF (26 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-236-090 / 0111-236-V95

Phasing	135/45°
Assembly Part Number	0400-1D**-08D† 0504-1D**-08D§
Nominal O.D. (in)[mm]	4.00 [102]
Nominal Thickness (in)[mm]	0.38 [9.7]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g Ambient Gas. 21.0g	 4.13 [105] 4.25 [108]
Min. Recommended Restriction (in)[mm]	4.60 [117]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.18 [81] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	19,500 [134]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (24 shots) 7 ft (48 shots) 11 ft (80 shots) 21 ft (160 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.75 [171]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	19.0 [28.2]
Max. Tension (lbf)[kN]	410,000 [1,824]
Upper/Lower Head Connection	3-7/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4IN, 8 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39] 135/45°**	**0.37 [9]**	**35.97 [91.36]**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	GH	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39] 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
BountyHunter	BH	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39] 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*
BountyHunter	BH	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

Gun Systems and Accessories Catalog 2012-2013.indd_091320130439

4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	90°	
	❶	❷
Assembly Part Number‡‡	0445-1A**-044† 0514-1A**-044§	0445-A**-044† 0514-A**-044§
Nominal O.D. (in)[mm]	4.50 [114]	
Nominal Thickness (in)[mm]	0.38 [9.7]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 38.5g Ambient Gas. 38.5g	 4.71 [120] 4.73 [120]	
Min. Recommended Restriction (in)[mm]	4.92 [125]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.68 [93] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	17,500 [121]	
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]	
Typical Length (ft)[m] 4 ft (12 shots) 7 ft (24 shots) 11 ft (40 shots) 21 ft (80 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	22.0 [32.7]	
Max. Tension (lbf)[kN]	453,000 [2,015]	
Upper/Lower Head Connection	3-15/16" - 6 Acme	

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-1/2IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4539-425T**	**38.5**	**4-1/2 [114]**	**5 [16], 60°**	**0.46 [12]**	**55.70 [141.48]**	**0.08 [0.20]**	**7 [178]**	**6,320 [43.6]**
BountyHunter	BH	*2*	*FLO-4039-311CF*	*38.5*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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5 SPF (16 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	60°	
	①	②
Assembly Part Number‡‡	0445-1A**-056† 0514-1A**-056§	0445-A**-056† 0514-A**-056§
Nominal O.D. (in)[mm]	4.50 [114]	
Nominal Thickness (in)[mm]	0.38 [9.7]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 38.5g Ambient Gas.	 4.73 [120] Not Recommended	
Min. Recommended Restriction (in)[mm]	4.92 [125]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.68 [93] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	17,500 [121]	
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]	
Typical Length (ft)[m] 4 ft (15 shots) 7 ft (30 shots) 11 ft (50 shots) 21 ft (100 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.20 [183]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	23.0 [34.2]	
Max. Tension (lbf)[kN]	453,000 [2,015]	
Upper/Lower Head Connection	3-15/16" - 6 Acme	

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-1/2IN, 5 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4539-425T**	**38.5**	**4-1/2 [114]**	**5 [16], 60°**	**0.46 [12]**	**55.70 [141.48]**	**0.08 [0.20]**	**7 [178]**	**6,320 [43.6]**
BountyHunter	BH	*2*	*FLO-4039-311CF*	*38.5*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	60°
Assembly Part Number	0445-B**-066† 0514-B**-066§
Nominal O.D. (in)[mm]	4.50 [114]
Nominal Thickness (in)[mm]	0.38 [9.7]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 26.0g Ambient Gas. 26.0g	 4.70 [119] 4.73 [120]
Min. Recommended Restriction (in)[mm]	4.92 [125]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.68 [93] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	19,500 [134]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	21.0 [31.2]
Max. Tension (lbf)[kN]	453,000 [2,015]
Upper/Lower Head Connection	3-15/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-1/2IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-3326-421T**	**26.0**	**3-3/8 [86]**	**6 [20], 60°**	**0.41 [10]**	**50.05 [127.13]**	**0.06 [0.15]**	**4-1/2 [114]**	**7,835 [54.0]**
Outlaw	GH	*EXP-3325-331*	*25.0*	*4 [102]*	*6 [20], 60°*	*0.56 [14]*	*35.61 [90.45]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,045 [41.7]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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8 SPF (26 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	135/45°
Assembly Part Number	0445-1D**-08D† 0514-1D**-08D§
Nominal O.D. (in)[mm]	4.50 [114]
Nominal Thickness (in)[mm]	0.38 [9.7]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g Ambient Gas	 4.61 [117] Not Recommended
Min. Recommended Restriction (in)[mm]	4.92 [125]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.68 [93] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	19,500 [134]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (24 shots) 7 ft (48 shots) 11 ft (80 shots) 21 ft (160 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.75 [171]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	21.0 [31.2]
Max. Tension (lbf)[kN]	453,000 [2,015]
Upper/Lower Head Connection	3-15/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-1/2IN, 8 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39] 135/45°**	**0.37 [9]**	**35.97 [91.36]**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	GH	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39] 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
BountyHunter	BH	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39] 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*
BountyHunter	BH	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4-1/2 in (114mm) Scalloped Hollow Carrier Gun

12 SPF (39 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	135/45°	
	❶	❷
Assembly Part Number‡‡	0445-1K**-12D† 0514-1K**-12D§	0445-C**-12D† 0514-C**-12D§
Nominal O.D. (in)[mm]	4.50 [114]	
Nominal Thickness (in)[mm]	0.38 [9.7]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 22.7g Ambient Gas	 4.62 [117] Not Recommended	
Min. Recommended Restriction (in)[mm]	4.92 [125]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.68 [93] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	19,500 [134]	
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]	
Typical Length (ft)[m] 4 ft (36 shots) 7 ft (72 shots) 11 ft (120 shots) 21 ft (240 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	6.50 [165]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	24.0 [35.7]	
Max. Tension (lbf)[kN]	453,000 [2,015]	
Upper/Lower Head Connection	3-15/16" - 6 Acme	

† Threaded gun
§ Threaded gun with booster-to-booster tandem transfer kit
‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number
** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-1/2IN, 12 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39] 135/45°**	**0.37 [9]**	**35.97 [91.36]**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	GH	**1**	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39] 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
PerfECTA	BH CFLD	**2**	**FLO-4623-411CFZ**	**22.7**	**4/5/8 [117]**	**16 [52] 140/20°**	**0.79 [20]**	**7.06 [17.93]**	**0.05 [0.13]**	**7 [178]**	**6,125 [42.2]**
BountyHunter	BH	*1*	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39] 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*
BountyHunter	BH	*1*	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified
Bold indicates API-19B certification. *Italics indicate API RP-43 certification*
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4-1/2 in (114mm) Scalloped Hollow Carrier Gun

16 SPF (52 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	140/20°
Assembly Part Number	0445-C**-16G† 0514-C**-16G§
Nominal O.D. (in)[mm]	4.50 [114]
Nominal Thickness (in)[mm]	0.38 [9.7]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 22.7g Ambient Gas	 4.67 [119] Not Recommended
Min. Recommended Restriction (in)[mm]	4.92 [125]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.68 [93] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	18,500 [128]
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]
Typical Length (ft)[m] 4 ft (48 shots) 7 ft (96 shots) 11 ft (160 shots) 21 ft (320 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.38 [162]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	21.0 [31.2]
Max. Tension (lbf)[kN]	453,000 [2,015]
Upper/Lower Head Connection	3-15/16" - 6 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-1/2IN, 16 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	BH CFLD	**FLO-4623-411CFZ**	**22.7**	**4/5/8 [117]**	**16 [52] 140/20°**	**0.79 [20]**	**7.06 [17.93]**	**0.05 [0.13]**	**7 [178]**	**6,125 [42.2]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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Petitioner GR Energy Services - Ex. 1009, p. 110

4-5/8 in (117mm) Scalloped Hollow Carrier Gun

4 SPF (13 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C]
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	90°	
	①	②
Assembly Part Number‡‡	0446-1A**-044† 0516-1A**-044§	0446-A**-044† 0516-A**-044§
Nominal O.D. (in)[mm]	4.63 [117]	
Nominal Thickness (in)[mm]	0.44 [11.2]	
Typical Gun Swell at Ambient Conditions (in)[mm]		
Ambient Liquid. 38.5g	4.84 [123]	
Ambient Gas. 38.5g	4.87 [124]	
Min. Recommended Restriction (in)[mm]	5.00 [127]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.67 [93] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance:		
Casing Drift I.D. to Nom. Washover O.D. (in)[mm]	0.38 [10]	
Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	20,000 [138]	
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]	
Typical Length (ft)[m]		
4 ft (12 shots)	4.00 [1.22]	
7 ft (24 shots)	7.00 [2.13]	
11 ft (40 shots)	11.00 [3.35]	
21 ft (80 shots)	21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.50 [191]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	25.0 [37.2]	
Max. Tension (lbf)[kN]	570,000 [2,536]	
Upper/Lower Head Connection	3-15/16" - 6 Acme	

† Threaded gun § Threaded gun compatible with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-5/8IN, 4 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4539-425T**	**38.5**	**4-1/2 [114]**	**5 [16], 60°**	**0.46 [12]**	**55.70 [141.48]**	**0.08 [0.20]**	**7 [178]**	**6,320 [43.6]**
BountyHunter	BH	*2*	*FLO-4039-311CF*	*38.5*	*No API tests. Please consult your local Hunting Titan representative for more information.*						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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Petitioner GR Energy Services - Ex. 1009, p. 111

4-5/8 in (117mm) Scalloped Hollow Carrier Gun

5 SPF (16 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	60°	
	①	②
Assembly Part Number‡‡	0446-1A**-056† 0516-1A**-056§	0446-A**-056† 0516-A**-056§
Nominal O.D. (in)[mm]	4.63 [117]	
Nominal Thickness (in)[mm]	0.44 [11.2]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 38.5g Ambient Gas. 38.5g	4.84 [123] 4.87 [124]	
Min. Recommended Restriction (in)[mm]	5.00 [127]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.67 [93] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	20,000 [138]	
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]	
Typical Length (ft)[m] 4 ft (15 shots) 7 ft (30 shots) 11 ft (50 shots) 21 ft (100 shots)	4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	7.20 [183]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	25.0 [37.2]	
Max. Tension (lbf)[kN]	570,000 [2,536]	
Upper/Lower Head Connection	3-15/16" - 6 Acme	

† Threaded gun § Threaded gun compatible with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-5/8IN, 5 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4539-425T**	**38.5**	**4-1/2 [114]**	**5 [16], 60°**	**0.46 [12]**	**55.70 [141.48]**	**0.08 [0.20]**	**7 [178]**	**6,320 [43.6]**
BountyHunter	BH	2	FLO-4039-311CF	38.5	No API tests. Please consult your local Hunting Titan representative for more information.						

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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6 SPF (20 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	60°
Assembly Part Number	0446-B**-066† 0516-B**-066§
Nominal O.D. (in)[mm]	4.63 [117]
Nominal Thickness (in)[mm]	0.44 [11.2]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 No Test No Test
Min. Recommended Restriction (in)[mm]	5.00 [127]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.67 [93] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	22,000 [6,700]
Typical Length (ft)[m] 4 ft (18 shots) 7 ft (36 shots) 11 ft (60 shots) 21 ft (120 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	24.0 [35.7]
Max. Tension (lbf)[kN]	570,000 [2,536]
Upper/Lower Head Connection	3-15/16" - 6 Acme

† Threaded gun § Threaded gun compatible with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-5/8IN, 6 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
Outlaw	GH	*EXP-3325-331*	*25.0*	*4 [102]*	*6 [20], 60°*	*0.56 [14]*	*35.61 [90.45]*	*0.07 [0.18]*	*5-1/2 [140]*	*6,045 [41.7]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4-5/8 in (117mm) Scalloped Hollow Carrier Gun

8 SPF (26 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	135/45°	
	❶	❷
Assembly Part Number‡‡	0446-1D**-08D† 0516-1D**-08D§	0446-2D**-08D† 0516-2D**-08D§
Nominal O.D. (in)[mm]	4.63 [117]	
Nominal Thickness (in)[mm]	0.44 [11.2]	
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 No Test Not Recommended	
Min. Recommended Restriction (in)[mm]	5.00 [127]	
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.67 [93] using Gauge Length 12in [305]	
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]	
Max. Hardware Temperature (°F)[°C]	500 [260]	
Max. Pressure (psi)[MPa]	20,000 [138]	
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]	
Typical Length (ft)[m] 4 ft (24 shots) 7 ft (48 shots) 11 ft (80 shots) 21 ft (160 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]	
Gun End to Center of First Scallop Distance (in)[mm]	6.75 [171]	
Approximate Weight Fully Loaded (lb/ft)[kg/m]	24.0 [35.7]	
Max. Tension (lbf)[kN]	570,000 [2,536]	
Upper/Lower Head Connection	3-15/16" - 6 Acme	

† Threaded gun § Threaded gun compatible with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-5/8IN, 8 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.37 [9]**	**35.97 [91.36]**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	GH	**1**	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
BountyHunter	BH	*2*	*FLO-5028-310B*	*28.0*	*5 [127]*	*12 [39], 150/30°*	*0.80 [20]*	*8.22 [20.88]*	*0.06 [0.15*	*7 [178]*	*5,340 [36.8]*
BountyHunter	BH	*1*	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult your local Hunting Titan representative for more information.*						
BountyHunter	BH	*1*	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39], 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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12 SPF (39 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	135/45°		
	❶	❷	❸
Assembly Part Number‡‡	0446-1K**-12D† 0516-1K**-12D§	0446-2K**-12D† 0516-2K**-12D§	0446-C**-12D† 0516-C**-12D§
Nominal O.D. (in)[mm]	4.63 [117]		
Nominal Thickness (in)[mm]	0.44 [11.2]		
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid. 21.0g Ambient Gas	 4.70 [119] @ 21.0g Not Recommended		
Min. Recommended Restriction (in)[mm]	5.00 [127]		
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.67 [93] using Gauge Length 12in [305]		
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]		
Max. Hardware Temperature (°F)[°C]	500 [260]		
Max. Pressure (psi)[MPa]	20,000 [138]		
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]		
Typical Length (ft)[m] 4 ft (36 shots) 7 ft (72 shots) 11 ft (120 shots) 21 ft (240 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]		
Gun End to Center of First Scallop Distance (in)[mm]	6.50 [165]		
Approximate Weight Fully Loaded (lb/ft)[kg/m]	27.0 [40.1]		
Max. Tension (lbf)[kN]	570,000 [2,536]		
Upper/Lower Head Connection	3-15/16" - 6 Acme		

† Threaded gun § Threaded gun compatible with booster-to-booster tandem transfer kit

‡‡ Refer to API performance table to determine which charges are compatible with the respective assembly part number

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-5/8IN, 12 SPF GUN SYSTEM

Charge Name	Charge Type	Gun Assembly No.	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**1**	**EXP-4521-423T**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.37 [9]**	**35.97 [91.36]**	**0.05 [0.13]**	**7 [178]**	**8,470 [58.4]**
PerfECTA	GH	**1**	**EXP-4521-431**	**21.0**	**4-1/2 [114]**	**12 [39], 135/45°**	**0.46 [12]**	**22.02 [55.93]**	**0.07 [0.18]**	**7 [178]**	**5,350 [36.9]**
BountyHunter	BH	*2*	*FLO-5028-310B*	*28.0*	*5 [127]*	*12 [39], 150/30°*	*0.80 [20]*	*8.22 [20.88]*	*0.06 [0.15*	*7 [178]*	*5,340 [36.8]*
BountyHunter	BH	*1*	*FLO-4521-310CF*	*21.0*	*No API tests. Please consult your local Hunting Titan representative for more information.*						
BountyHunter	BH	*1*	*FLO-4521-310B*	*21.0*	*4-1/2 [114]*	*12 [39], 135/45°*	*0.67 [17]*	*5.49 [13.94]*	*0.05 [0.13]*	*7 [178]*	*6,025 [41.5]*
PerfECTA	BH CFLD	**3**	**FLO-4623-411CFZ**	**22.7**	**4-5/8 [117]**	**16 [52], 140/20°**	**0.75 [19]**	**6.11 [15.52]**	**0.05 [0.13]**	**7 [178]**	**6,070 [41.9]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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4-5/8 in (117mm) Scalloped Hollow Carrier Gun

HUNTING
Hunting Titan

16 SPF (52 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems such as EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-342-090 / 0111-342-V95

Phasing	140/20°
Assembly Part Number	0446-C**-16G† 0516-C**-16G§
Nominal O.D. (in)[mm]	4.63 [117]
Nominal Thickness (in)[mm]	0.44 [11.2]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 No Test Not Recommended
Min. Recommended Restriction (in)[mm]	5.00 [127]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	3.67 [93] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	20,000 [138]
Min. Detonating Cord Velocity (ft/s)[m/s]	24,750 [7,500]
Typical Length (ft)[m] 4 ft (48 shots) 7 ft (96 shots) 11 ft (160 shots) 21 ft (320 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	6.38 [162]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	24.0 [35.7]
Max. Tension (lbf)[kN]	570,000 [2,536]
Upper/Lower Head Connection	3-15/16" - 6 Acme

† Threaded gun § Threaded gun compatible with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 4-5/8IN, 16 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	BH CFLD	**FLO-4623-411CFZ**	**22.7**	**4-5/8 [117]**	**16 [52], 140/20°**	**0.75 [19]**	**6.11 [15.52]**	**0.05 [0.13]**	**7 [178]**	**6,070 [41.9]**

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

Gun Systems and Accessories Catalog 2012-2013.indd_09132013043

Petitioner GR Energy Services - Ex. 1009, p. 116

12 SPF (39 SPM) GUNFACTS®

Gun Body Material:	Heat treated, seamless steel tubing
Gun Body Configuration:	Threaded and scalloped
Charge Tube Type:	Round steel tube
Mode of Fire:	Simultaneous or selective firing systems like EBFire® and ControlFire®
Type of Tandem Connection:	Booster-to-booster (no splice)
Initiation Point:	Top or bottom fired options available for wireline and TCP
Recommended Detonating Cord:	80 grains/foot
O-Ring Material:	Nitrile – 90 Durometer (Viton – 95 Durometer for temperatures >325°F [163°C])
O-Ring Size:	0111-360-090 / 0111-360-V95

Phasing	135/45°
Assembly Part Number	0338-1D**-12D† 0507-1D**-12D§
Nominal O.D. (in)[mm]	7.00 [178]
Nominal Thickness (in)[mm]	0.50 [12.7]
Typical Gun Swell at Ambient Conditions (in)[mm] Ambient Liquid Ambient Gas	 No Test Not Recommended
Min. Recommended Restriction (in)[mm]	7.50 [191]
Drift Gauge O.D. for Gun Body I.D. (in)[mm]	5.88 [149] using Gauge Length 12in [305]
Min. Recommended Washover Pipe Clearance: Casing Drift I.D. to Nom. Washover O.D. (in)[mm] Washover Drift I.D. to Nom. Gun O.D. (in)[mm]	 0.38 [10] 0.31 [8]
Max. Hardware Temperature (°F)[°C]	500 [260]
Max. Pressure (psi)[MPa]	13,000 [90]
Min. Detonating Cord Velocity (ft/s)[m/s]	23,000 [7,000]
Typical Length (ft)[m] 4 ft (35 shots) 7 ft (71 shots) 11 ft (119 shots) 21 ft (239 shots)	 4.00 [1.22] 7.00 [2.13] 11.00 [3.35] 21.00 [6.40]
Gun End to Center of First Scallop Distance (in)[mm]	7.00 [178]
Approximate Weight Fully Loaded (lb/ft)[kg/m]	49.0 [22.2]
Max. Tension (lbf)[kN]	952,000 [4,233]
Upper/Lower Head Connection	6-1/4" - 5 Acme

† Threaded gun § Threaded gun with booster-to-booster tandem transfer kit

** Gun length. Example: Use "07" for 7ft gun; etc.

API PERFORMANCE OF CHARGES COMPATIBLE WITH 7IN, 12 SPF GUN SYSTEM

Charge Name	Charge Type	Charge Part Number†	Explosive Weight (g)	Gun O.D. (in)[mm]	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Target Strength (psi)[MPa]
PerfECTA	SDP	**EXP-4039-423T**	**38.5**	**7 [178]**	**12 [39], 135/45°**	**0.40 [10]**	**49.60 [125.98]**	**0.09 [0.23]**	**9-5/8 [245]**	**6,175 [42.6]**
Outlaw	GH	*EXP-7039-331*	*38.5*	*7 [178]*	*12 [39], 135/45°*	*0.75 [19]*	*28.54 [72.49]*	*0.08 [0.20]*	*9-5/8 [245]*	*5,345 [36.9]*

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API-19B or API RP-43 certified

Bold indicates API-19B certification. *Italics indicate API RP-43 certification*

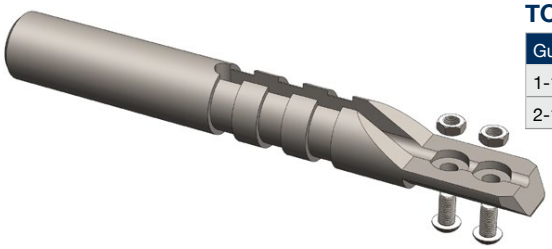
† xxx-xxxx-3xxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

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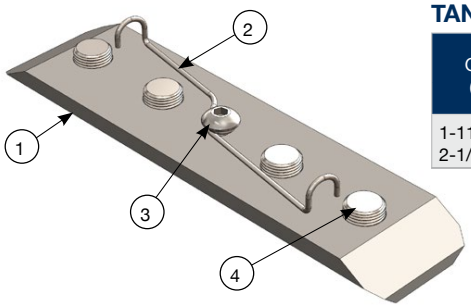
Wireline Capsule Gun Accessories





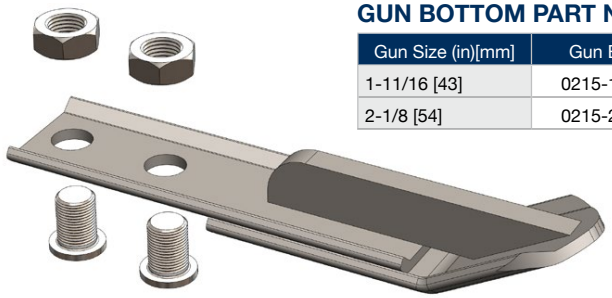
TOP SUB PART NUMBERS

Gun Size (in)[mm]	Top Sub	Cap Screw	Nut
1-11/16 [43]	0215-168-001	BHCS-0037-24-0075	0215-000-004
2-1/8 [54]	0215-212-001	BHCS-0037-24-0075	0215-000-004



TANDEM ADAPTER PART NUMBERS

Gun Size (in)[mm]	1	2	3	4
	Tandem Adapter	Det Cord Clip	Screw	Cap Screw
1-11/16 [43] 2-1/8 [54]	0215-000-002	0215-000-005	SCR-BHS-ST-10-32-0.25	0215-000-003



GUN BOTTOM PART NUMBERS

Gun Size (in)[mm]	Gun Bottom	Cap Screw	Nut
1-11/16 [43]	0215-168-003	0215-000-003	0215-000-004
2-1/8 [54]	0215-212-003	0215-000-003	0215-000-004

MISCELLANEOUS ACCESSORIES

Due to the geometry and weight distribution of long capsule gun strings, the charge strips tend to flex and twist as it is run in hole. This can affect the performance of the shaped charges and hinder the retrieval of the gun string. Rollover sleeves help stabilize and line up the charge strip correctly to optimize gun performance and hardware survivability.



Gun Size (in)[mm]	Part Number
1-11/16 [43]	0215-168-006
2-1/8 [54]	0215-212-006

The loading socket assembly allows the capsule gun shaped charges to be lined up correctly such that detonating cord can be easily fed through. It also reduces the possibility of damaging the detonating cord as it contracts when exposed to downhole conditions.



Gun Size (in)[mm]	Part Number
1-11/16 [43]	0215-168-010
2-1/8 [54]	0215-212-010

Detonating cord retainers are used to secure detonating cord onto the charge strip in areas where there are no shaped charges. This ensures no detonating cord is floating allowing it to be prone to damage.



Part Number: 0215-000-008

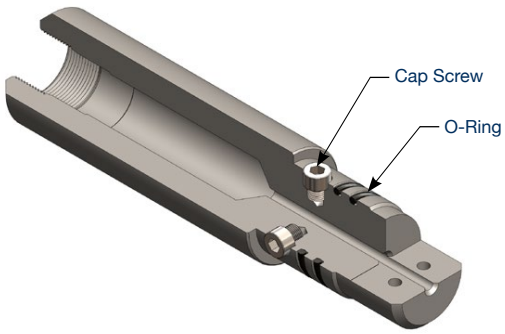
Detonating cord clips secure the detonating cord onto the shaped charges and detonating cord retainers. They come included with the shaped charges but can be ordered separately.



Part Number: 24-1688-001

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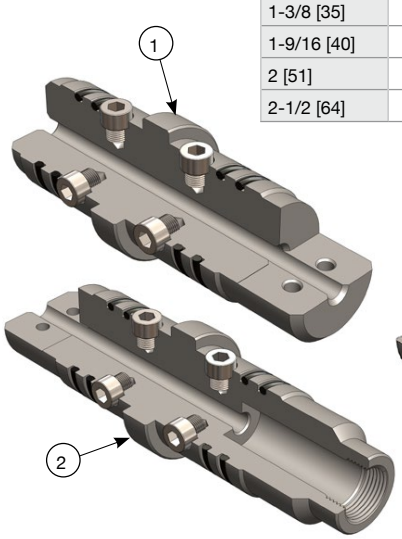


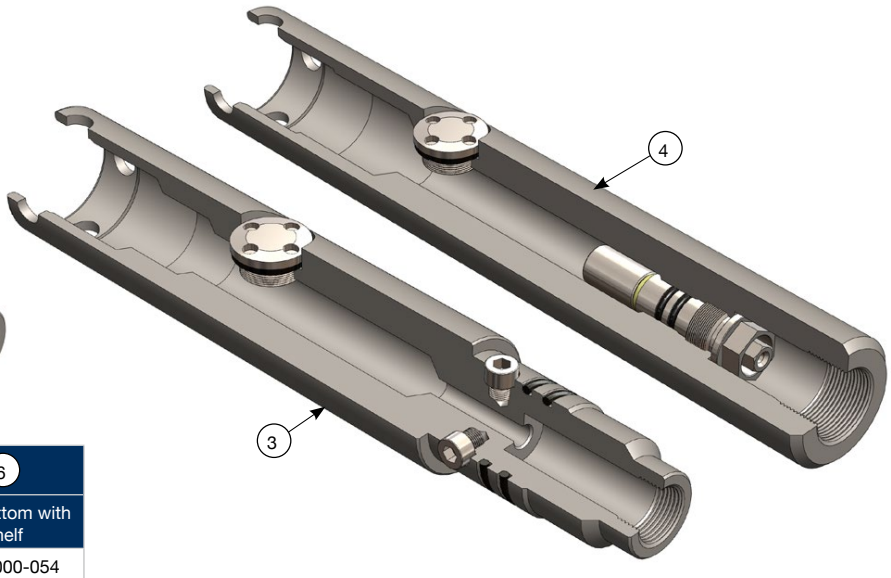
TOP SUB PART NUMBERS

Gun Size (in)[mm]	Top Sub	Upper Head Connection
1-3/8 [35]	0327-000-001	1-3/16"-12 GO Box
1-9/16 [40]	0320-000-001	1-3/16"-12 GO Box
2 [51]	0321-000-001	1-3/16"-12 GO Box
2-1/2 [64]	0328-000-001	1-3/16"-12 GO Box

TANDEM ADAPTER PART NUMBERS

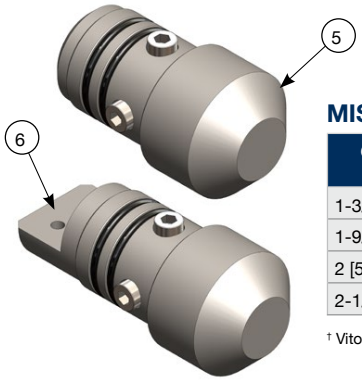
Gun Size (in)[mm]	1	2	3	4	
	Tandem Adapter	EB Switch Tandem No Port	EB Switch Tandem with Port	Plug-Shoot Assembly	Plug Shoot Lower Head Connection
1-3/8 [35]	0327-000-002	-	-	-	-
1-9/16 [40]	0320-000-002	0323-000-063	0323-000-065	0320-000-235A	1-3/16" – 12 GO Box
2 [51]	0321-000-002	0324-000-063	0324-000-169	0321-000-235A	1-3/16" – 12 GO Box
2-1/2 [64]	0328-000-002	0325-000-063	0325-000-168	0328-000-235A	1-3/16" – 12 GO Box





GUN BOTTOM PART NUMBERS

Gun Size (in)[mm]	5	6
	Gun Bottom	Gun Bottom with Shelf
1-3/8 [35]	0327-000-004	0327-000-054
1-9/16 [40]	0320-000-004	0320-000-054
2 [51]	0321-000-004	0321-000-054
2-1/2 [64]	0328-000-004	0321-000-054



MISCELLANEOUS ACCESSORIES

Gun Size (in)[mm]	Cap Screw	O-Ring†	Port Plug	Port Plug Gasket	Plug Shoot Contact Kit
1-3/8 [35]	0327-000-019	0111-211-090	-	-	-
1-9/16 [40]	0320-000-019	0111-214-090	0323-000-066	0111-114-090†	0320-000-238
2 [51]	0321-000-019	0111-220-090	0331-90S-081	0330-900-073	0320-000-238
2-1/2 [64]	0328-000-019	0111-224-090	0331-90S-081	0330-900-073	0320-000-238

† Viton O-rings need to be used above 325°F (163°C)

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APPLICATIONS

- Single gun wireline perforating operations

FEATURES

- No electrical wiring
- No detonator to detonating cord crimping required
- Simple to use detonator
- Detonator is always shunted until properly armed
- Ideal for long gun strings with TCP transfer systems
- Arming procedures comply with API RP-67 electrical before ballistic arming (EBBA) recommendations

Hunting Titan has developed a simple to use Top Fire Detonator System that consists of a Quick Change Assembly† and a specialized, easy to use, detonator. This eliminates the use of any electrical wiring associated with bottom-fire gun systems or ported firing head adapters, which will improve the efficiency of single gun perforating operations.

Safe arming procedures comply with API RP-67 EBBA recommendations and are incorporated into the design of the Top Fire Detonator System:

- Attach the stem protector (shunt)
- Insert the specialized detonator
- Screw in the safety blast shield
- Remove the shunt and connect to the logging head (electrical arming)
- Remove the safety blast shield and connect to the perforating gun (ballistic arming)

BENEFITS

- Eliminates electrical wiring and detonator crimping problems
- More efficient perforating gun arming without compromising safety

Rigorous testing has been performed on this system to ensure that mechanical integrity is maintained due to the unlikely event of an unintentional surface detonation during the arming procedure. Contact your local Hunting Titan representative for more information.

HARDWARE SPECIFICATIONS

Part Number	TFA-156-000	TFA-275-000	TFA-312-000
Gun Size	1-9/16 – 2-1/2 in (40 – 64 mm)	2-3/4 in (70 mm)†	3-1/8 – 7 in (79 – 178 mm)†
O.D. (in)[mm]	1.56 [40]	2.75 [70]	3.13 [79]
Max. Temperature (°F)[°C]	475 [246]	475 [246]	475 [246]
Max. Pressure (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]
Max. Voltage (VDC)	600	600	600
Max. Current (mA)	2,000	2,000	2,000
Max. Tension (lbf)[kN]	72,000 [320]	126,000 [560]	126,000 [560]

† Quick Change Assembly style

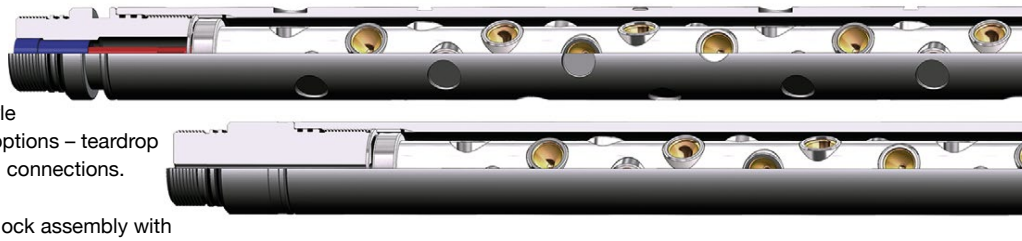
DETONATOR SPECIFICATIONS

Part Number	DETO-3050-008
1 hr Temp Rating (°F)[°C]	475 [246]
No Fire Current (mA)	200
All Fire Current (mA)	800
Resistance (Ω)	51
Static Sensitivity	MIL-SPEC-322B
UN Number	UN0456
Hazard Class	1.4S
US DOT	EX-2011021343



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TOP SUB PART NUMBERS



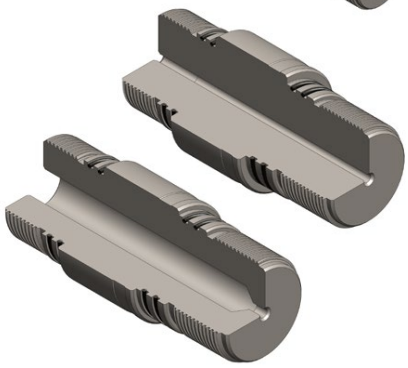
2-3/4" (70mm) top subs and larger have upper head connections that are compatible with GO and SIE style Quick Change Assemblies. Each style provides two options – teardrop connections, being the preferred method, and pig tail connections.

For GO Quick Change Assemblies, firing head seal block assembly with teardrop connection 0271-000-020 (2-3/4") or 0256-000-020 (3-1/8") is connected directly into the quick change. If using pigtail assembly 0256-000-010, then detonator block 0271-000-013 (2-3/4") and 0256-000-013 (3-1/8") is connected into the quick change.

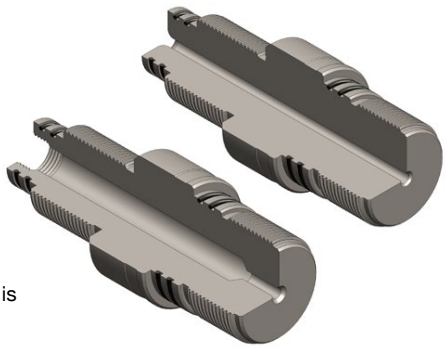
For SIE Quick Change Assemblies, contact block assembly 0260-000-040 is coupled with blast plug (teardrop connector style 0330-000-190. Third party rubber blast plugs can be used when opting to use a pig tail assembly.



GO Box top sub



GO Quick Change top subs



SIE Quick Change top subs

Gun Size (in)[mm]	Top Sub	Upper O-Ring†	Lower O-Ring†	Upper Head Connection‡
1-3/8 [35]	0227-000-001	-	0111-120-090	1-3/16" - 12 GO Box
1-9/16 [40]	0220-000-001	-	0111-215-090	1-3/16" - 12 GO Box
2 [51]	0222-000-001	-	0111-221-090	1-3/16" - 12 GO Box
2-1/2 [64]	0228-000-001	-	0111-225-090	1-3/16" - 12 GO Box
2-3/4 [70] 2-7/8 [73]	0362-000-001	-	0111-227-090	1-3/16" - 12 GO Box
	0362-000-###	0111-227-090	0111-227-090	2-3/4" O.D. GO Quick-Change Assembly
	0362-000-^^^	0111-222-090	0111-227-090	2-3/4" O.D. SIE Quick-Change Assembly
3-1/8 [79]	0363-000-0**	0111-230-090 GO style 0111-222-090 SIE style	0111-230-090	3-1/8" O.D. GO Quick-Change and 3-1/8" O.D. SIE Quick-Change
3-3/8 [86]	0365-000-0**		0111-231-090	
4 [102] Scalloped 4 [102] Economical	0400-000-0** 0640-000-0**		0111-236-090	
4-1/2 [114] 4-5/8 [117]	0445-000-0**		0111-342-090	
7 [178]	0338-000-0**		0111-360-090	

† Viton O-rings need to be used above 325°F (163°C) ‡ Refer to GunFacts for lower head connection thread

Use "101" for GO style pig tail connection; "107" for GO style teardrop connection

^^^ Use "104" for SIE style pig tail connection; "184" for SIE style blast plug connection

** Use "01" for GO style pig tail connection; "07" for GO style teardrop connection
"04" for SIE style pig tail connection; "84" for SIE blast plug connection

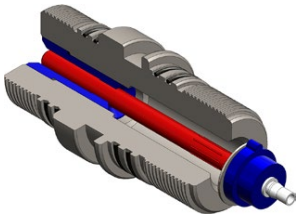
BOOSTER-TO-BOOSTER TOP SUB PART NUMBERS

Booster-to-booster connections are typically associated with TCP operations. However, they can also be utilized for wireline perforating when using Hunting Titan's Wireline Top Fire Detonator Systems. This system is not compatible with 4in (114mm) Economical Casing Guns.

Gun Size (in)[mm]	Top Sub	Booster Transfer Kit	Upper O-Ring†	Lower O-Ring†	Upper Head Connection‡
1-3/8 [35]	0527-000-001	0520-500-150 (Blue)	0111-120-090	0111-120-090	1-1/8" - 12 Stub Acme Pin
1-9/16 [40]	0520-000-021	0520-500-150 (Blue)	0111-215-090	0111-215-090	1-9/32" - 12 Stub Acme Pin
2 [51]	0522-000-021	0520-500-150 (Blue)	0111-215-090	0111-221-090	1-9/32" - 12 Stub Acme Pin
2-1/2 [64]	0528-000-021	0520-500-150 (Blue)	0111-215-090	0111-225-090	1-9/32" - 12 Stub Acme Pin
2-3/4 [70] 2-7/8 [73]	0562-000-*01	0504-500-150 (White)	0111-225-090 (TCP) 0111-227-090 (WL)	0111-227-090	2-1/8" - 8 Acme Pin (TCP) 2-3/4" O.D. GO Quick-Change (WL)
3-1/8 [79]	0502-000-001	0503-500-150 (Red)	0111-230-090	0111-230-090	3-1/8" O.D. GO Quick-Change
3-3/8 [86]	0503-000-001	0503-500-150 (Red)	0111-230-090	0111-231-090	3-1/8" O.D. GO Quick-Change
4 [102] Scalloped	0504-000-001	0504-500-150 (White)	0111-230-090	0111-236-090	3-1/8" O.D. GO Quick-Change
4-1/2 [114] 4-5/8 [117]	0514-000-001	0514-500-150 (Black)	0111-230-090	0111-342-090	3-1/8" O.D. GO Quick-Change
7 [178]	0507-000-001	0506-500-150 (Tan)	0111-230-090	0111-360-090	3-1/8" O.D. GO Quick-Change

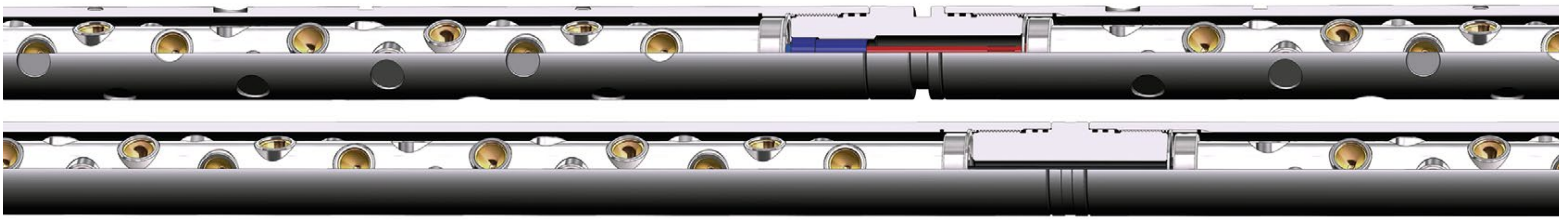
† Viton O-rings need to be used above 325°F (163°C) ‡ Refer to GunFacts for lower head connection thread

* Use "0" for TCP firing system; "1" for wireline top fire system



Booster-to-booster top sub

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TANDEM, ARMING AND PLUG SHOOT ADAPTER PART NUMBERS

Gun Size (in)[mm]	① Tandem Adapter	② EB Switch Tandem Adapter Assembly w/ Port	③ Arming Sub Adapter Assembly w/ Port	④ Plug Shoot Adapter Assembly	O-Ring†	Port Plug	Port Plug O-Ring†	Plug Shoot Contact Kit
1-3/8 [35]	0227-000-002‡	-	-	-	0111-120-090	-	-	-
1-9/16 [40]	0220-000-002‡	0220-000-269A	0220-012-001A	0220-000-245A	0111-215-090	0323-000-066	0111-114-090	0320-000-238
2 [51]	0222-000-002‡	0222-000-268A	0222-012-001A	0222-000-245A	0111-221-090	0331-90S-181	0330-900-073	0320-000-238
2-1/2 [64]	0228-000-002‡	0228-000-268A	0228-012-001A	0228-000-245A	0111-225-090	0331-90S-181	0330-900-073	0320-000-238
2-3/4 [70] 2-7/8 [73]	0362-000-002	0362-000-489A§	0362-000-366A	0362-000-245A	0111-227-090	0363-000-361	0111-217-090	0330-000-238
3-1/8 [79]	0363-000-002	0363-000-489A§	0363-000-366A	0363-000-245A	0111-230-090	0363-000-361	0111-217-090	0330-000-238
3-3/8 [86]	0365-000-002	0365-000-489A§	0365-000-366A	0365-000-245A	0111-231-090	0363-000-361	0111-217-090	0330-000-238
4 [102] Scalloped 4 [102] Economical	0400-000-002 0640-000-002	0400-000-389A§ -	0400-000-366A -	0400-000-245A -	0111-236-090	0363-000-361 -	0111-217-090 -	0330-000-238 -
4-1/2 [114] 4-5/8 [117]	0445-000-002	0445-000-389A§	0445-000-366A	0445-000-245A	0111-342-090	0363-000-361	0111-217-090	0330-000-238
7 [178]	0338-000-002	-	-	-	0111-360-090	-	-	-

† Viton O-rings need to be used above 325°F (163°C)
‡ Grounding screw 0327-000-003 (10-32x3/8) required
§ Grounding screw SCR-SHC-8-32-0.38 (8-32x3/8) required

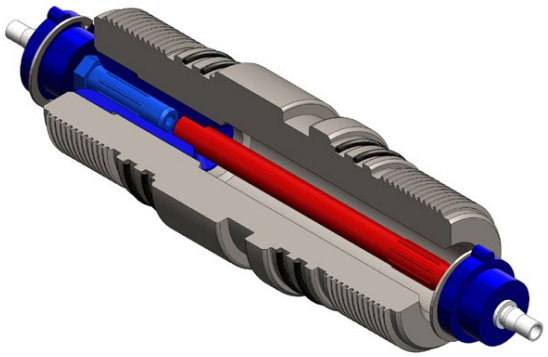


BOOSTER-TO-BOOSTER TANDEM SUB PART NUMBERS

Booster-to-booster connections are typically associated with TCP operations. However, they can also be utilized for wireline perforating when using Hunting Titan's Wireline Top Fire Detonator Systems. This system is not compatible with 4in (114mm) Economical Casing Guns.

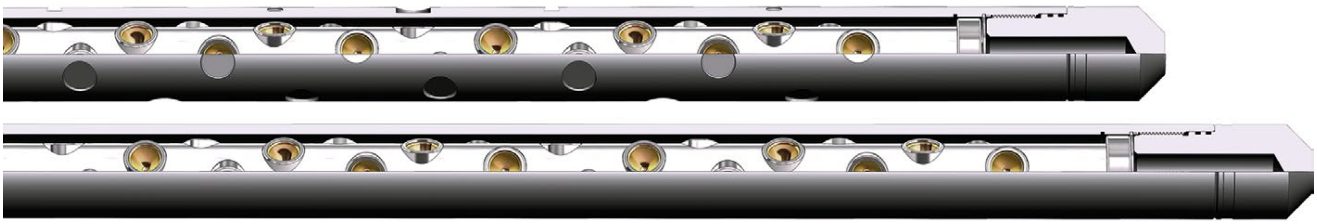
Gun Size (in)[mm]	Tandem Sub	Booster Transfer Kit	O-Ring†
1-3/8 [35]	0527-000-032	0520-500-160 (Blue)	0111-120-090
1-9/16 [40]	0520-000-032	0520-500-160 (Blue)	0111-215-090
2 [51]	0522-000-032	0520-500-160 (Blue)	0111-221-090
2-1/2 [64]	0528-000-032	0520-500-160 (Blue)	0111-225-090
2-3/4 [70] 2-7/8 [73]	0562-000-032	0504-500-160 (White)	0111-227-090
3-1/8 [79]	0502-000-032	0503-500-160 (Red)	0111-230-090
3-3/8 [86]	0503-000-032	0503-500-160 (Red)	0111-231-090
4 [102] Scalloped	0504-000-032	0504-500-160 (White)	0111-236-090
4-1/2 [114] 4-5/8 [117]	0514-000-032	0514-500-160 (Black)	0111-342-090
7 [178]	0507-000-032	0506-500-160 (Tan)	0111-360-090

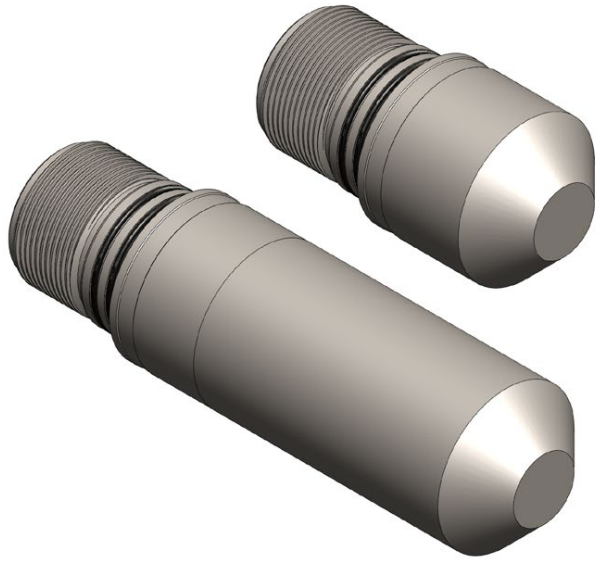
† Viton O-rings need to be used above 325°F (163°C)



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GUN BOTTOM PART NUMBERS

Gun Size (in)[mm]	Gun Bottom	Gun Bottom Extra Long	O-Ring†
1-3/8 [35]	0227-000-003	0227-000-013	0111-120-090
1-9/16 [40]	0220-000-003	0220-000-013	0111-215-090
2 [51]	0222-000-003	0222-000-013	0111-221-090
2-1/2 [64]	0228-000-003	0228-000-013	0111-225-090
2-3/4 [70] 2-7/8 [73]	0362-000-003	0362-000-013	0111-227-090
3-1/8 [79]	0363-000-003	0363-000-013	0111-230-090
3-3/8 [86]	0365-000-003	0365-000-013	0111-231-090
4 [102] Scalloped 4 [102] Economical	0400-000-003 0640-000-003	0400-000-013 -	0111-236-090
4-1/2 [114] 4-5/8 [117]	0445-000-003	0445-000-013	0111-342-090
7 [178]	0338-000-003	0338-000-013	0111-360-090

† Viton O-rings need to be used above 325°F (163°C)

MISCELLANEOUS ACCESSORIES

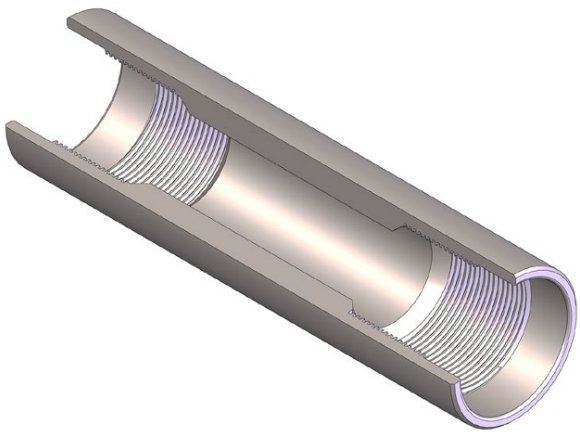
Hunting Titan offers a gun loading tool to help prevent the accidental dislodging of charge retainer clips while inserting a loaded charge tube into the carrier.

Gun Size (in)[mm]	"Clip Saver" Part Number
2-3/4 [70] 2-7/8 [73]	0362-100-195
3-1/8 [79]	0363-100-195
3-3/8 [86]	0365-100-195
4 [102] Scalloped	0400-100-195
4-1/2 [114] 4-5/8 [117]	0445-100-195



Blast sleeves can be utilized in situations where extra space is required for detonators or gun switch systems.

Gun Size (in)[mm]	Blast Sleeve Part Number
1-3/8 [35]	0227-012-000
1-9/16 [40]	0220-012-000
2 [51]	0222-012-000
2-1/2 [64]	0228-012-000
2-3/4 [70] 2-7/8 [73]	0362-012-000
3-1/8 [79]	0363-012-000
3-3/8 [86]	0365-012-000
4 [102] Scalloped 4 [102] Economical	0400-012-000 0640-012-000
4-1/2 [114] 4-5/8 [117]	0445-012-000
7 [178]	0338-012-000



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TCP Gun Lift Subs are used when perforating guns need to be connected together vertically on the drill floor. It consists of a standard 2ft (0.61m) N-80 pup joint. An elevator disc is screwed into the top of the pup joint and welded for security. This is where the rig elevators latch on and supports the entire gun weight. The lift sub connector at the bottom is removable allowing multifunctional use with different gun sizes.

ASSEMBLY PART NUMBERS

The part numbers in the following table include the respective lift sub connector.

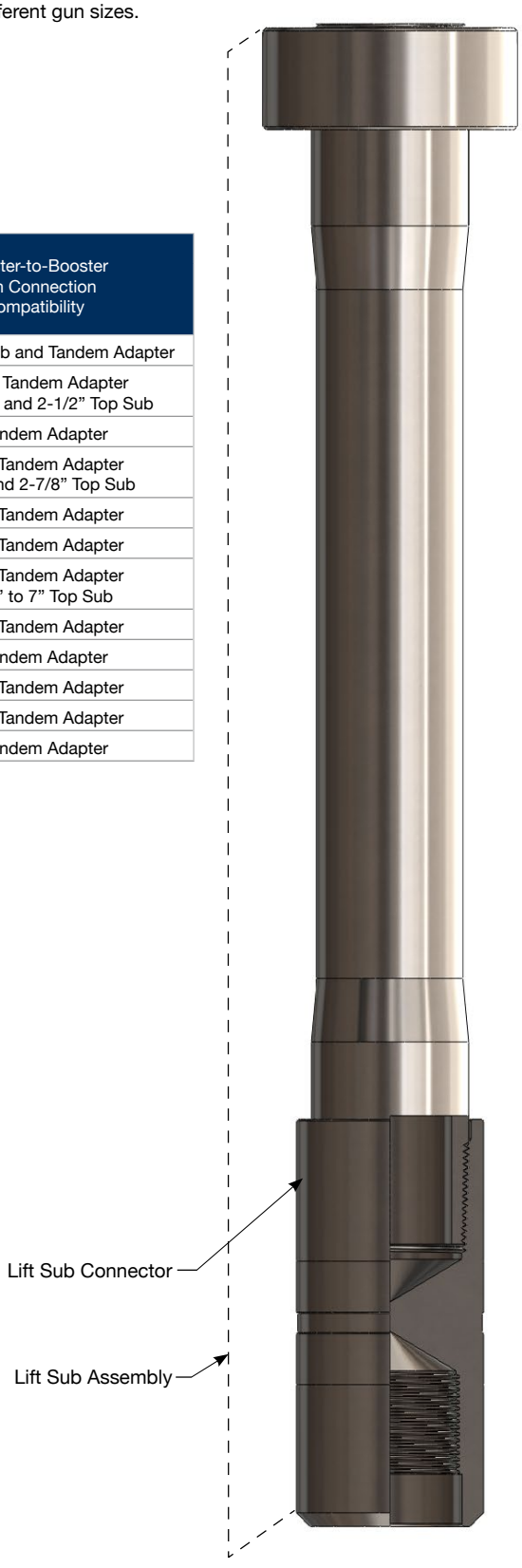
Gun Size (in)[mm]	2-3/8" (60mm) EUE		2-7/8" (73mm) EUE		Booster-to-Booster Gun Connection Compatibility
	Assembly Part Number	Max. Gun Weight (lb)[kg]	Assembly Part Number	Max. Gun Weight (lb)[kg]	
1-3/8 [35]	0227-010-23B	59,000 [26,800]†	-	-	1-3/8" Top Sub and Tandem Adapter
1-9/16 [40]	0220-010-23B	80,000 [36,300]†	-	-	1-9/16" Tandem Adapter 1-9/16", 2" and 2-1/2" Top Sub
2 [51]	0222-010-23B	104,000 [47,200]	-	-	2" Tandem Adapter
2-1/2 [64]	0228-010-23B	80,000 [36,300]†	-	-	2-1/2" Tandem Adapter 2-3/4" and 2-7/8" Top Sub
2-3/4 [70]	0462-010-23B	104,000 [47,200]	-	-	2-3/4" Tandem Adapter
2-7/8 [73]	0464-010-23B	104,000 [47,200]	-	-	2-7/8" Tandem Adapter
3-1/8 [79]	0402-010-23B	104,000 [47,200]	0402-010-28B	145,000 [65,800]	3-1/8" Tandem Adapter 3-1/8" to 7" Top Sub
3-3/8 [86]	0403-010-23B	104,000 [47,200]	0403-010-28B	145,000 [65,800]	3-3/8" Tandem Adapter
4 [102]	0404-010-23B	104,000 [47,200]	0404-010-28B	145,000 [65,800]	4" Tandem Adapter
4-1/2 [114]	0414-010-23B	104,000 [47,200]	0414-010-23B	145,000 [65,800]	4-1/2" Tandem Adapter
4-5/8 [117]	0416-010-23B	104,000 [47,200]	0416-010-28B	145,000 [65,800]	4-5/8" Tandem Adapter
7 [178]	0407-010-23B	104,000 [47,200]	0407-010-28B	145,000 [65,800]	7" Tandem Adapter

† Gun carrier is the limiting factor

LIFT SUB CONNECTOR PART NUMBERS

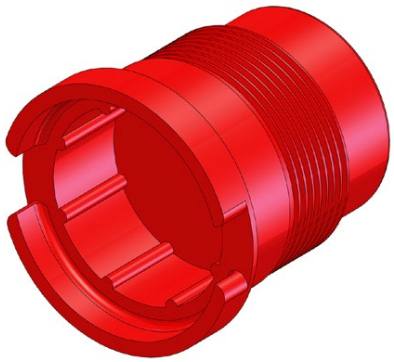
Lift sub connectors can be purchased separately such that easy changes can be made at the wellsite when rigging up tandem and top guns with differing thread profiles.

Gun Size (in)[mm]	2-3/8" (60mm) Lift Sub Connector	2-7/8" (73mm) Lift Sub Connector
1-3/8 [35]	0227-001-23B	-
1-9/16 [40]	0220-001-23B	-
2 [51]	0222-001-23B	-
2-1/2 [64]	0228-001-23B	-
2-3/4 [70]	0462-001-23B	-
2-7/8 [73]	0464-001-23B	-
3-1/8 [79]	0402-001-23B	0402-001-28B
3-3/8 [86]	0403-001-23B	0403-001-28B
4 [102]	0404-001-23B	0404-001-28B
4-1/2 [114]	0414-001-23B	0414-001-28B
4-5/8 [117]	0416-001-23B	0416-001-28B
7 [178]	0407-001-23B	0407-001-28B



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These plastic box thread protectors are suitable for storing and transporting loaded or unloaded gun carriers. They provide an O-Ring seal keeping moisture out and protect the gun carrier threads from becoming damaged during normal every day handling.



Gun Size (in)[mm]	Gun Box Protector	O-Ring†
1-3/8 [35]	0227-000-220P	0111-120-090
1-9/16 [40]	0220-000-220P	0111-215-090
2 [51]	0222-000-220P	0111-221-090
2-1/2 [64]	0228-000-220P	0111-225-090
2-3/4 [70] 2-7/8 [73]	0362-000-320	0111-227-090
3-1/8 [79]	0363-000-320	0111-230-090
3-3/8 [86]	0365-000-320	0111-231-090
4 [102]	0400-000-320	0111-236-090
4-1/2 [114] 4-5/8 [117]	0414-000-320	0111-342-090
7 [178]	0338-000-320	0111-360-090

† Lower grade O-Rings can be used

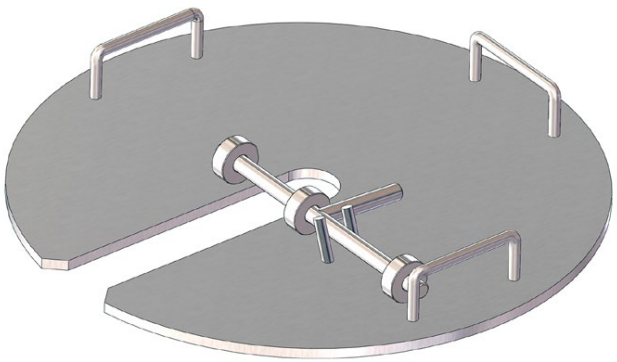
Steel protectors with handles provide an easier way of handling loaded guns especially when booster-to-booster transfers and tandems are already installed on each end of the carrier. O-Rings provide a moisture seal while a melt plug provides pressure relief should a loaded gun be involved in a blaze. They are not rated for rigging up/down operations. TCP Lift Subs need to be utilized for this purpose.

Gun Size (in)[mm]	Gun Box Protector	Gun Pin Protector	Melt Plug	O-Ring†	Booster-to-Booster Gun Connection Compatibility
1-3/8 [35]	0227-000-220	0227-000-230	8801-00P-28	0111-120-090	1-3/8” Top Sub and Tandem Adapter
1-9/16 [40]	0220-000-220	0220-000-230	8801-00P-28	0111-215-090	1-9/16” Tandem Adapter 1-9/16”, 2” and 2-1/2” Top Sub
2 [51]	0222-000-220	0222-000-230	8801-00P-28	0111-221-090	2” Tandem Adapter
2-1/2 [64]	0228-000-220	0228-000-230	8801-00P-28	0111-225-090	2-1/2” Tandem Adapter 2-3/4” and 2-7/8” Top Sub
2-3/4 [70] 2-7/8 [73]	0462-000-220	0462-000-230	8801-00P-68V	0111-227-090	2-3/4” and 2-7/8” Tandem Adapter
3-1/8 [79]	0402-000-220	0402-000-230	8801-00P-68V	0111-230-090	3-1/8” Tandem Adapter 3-1/8” to 7” Top Sub
3-3/8 [86]	0403-000-220	0403-000-230	8801-00P-68V	0111-231-090	3-3/8” Tandem Adapter
4 [102]	0404-000-220	0404-000-230	8801-00P-68V	0111-236-090	4” Tandem Adapter
4-1/2 [114] 4-5/8 [117]	0414-000-220	0414-000-230	8801-00P-68V	0111-342-090	4-1/2” Tandem Adapter 4-5/8” Tandem Adapter
7 [178]	0407-000-220	0407-000-230	8801-00P-68V	0111-360-090	7” Tandem Adapter

† Lower grade O-Rings can be used



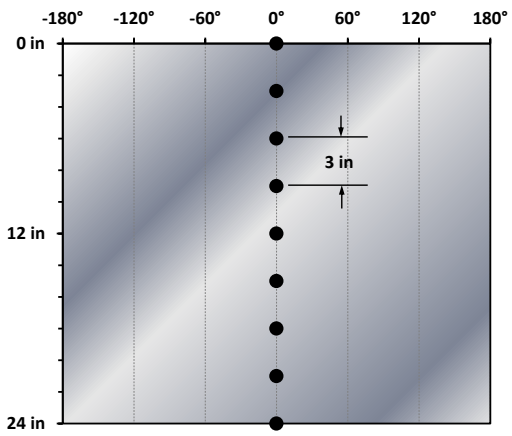
Support plates are used when perforating guns need to be connected vertically on the drill floor. They are rated to hold a specified gun weight as listed in the following table.



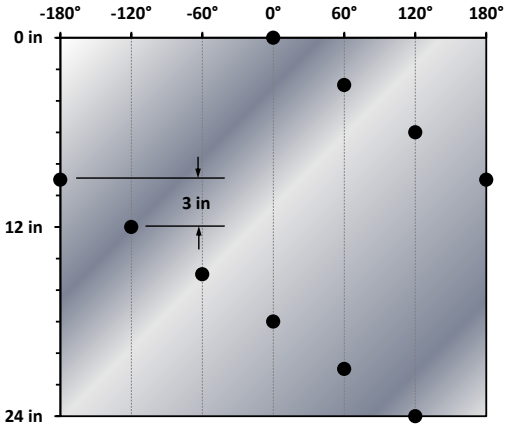
Gun Size (in)[mm]	Support Plate Part Number	Max. Gun Weight (lb)[kg]
1-3/8 [35]	0227-000-090	1,000 [454]
1-9/16 [40]	0220-000-090	1,100 [499]
2 [51]	0222-000-090	1,200 [544]
2-1/2 [64]	0228-000-090	1,800 [816]
2-3/4 [70] 2-7/8 [73]	0462-000-090	1,900 [862]
3-1/8 [79] 3-3/8 [86]	0403-000-090	2,100 [953]
4 [102]	0404-000-090	2,250 [1,021]
4-1/2 [114] 4-5/8 [117]	0414-000-090	2,400 [1,089]
7 [178]	0407-000-090	3,100 [1,406]

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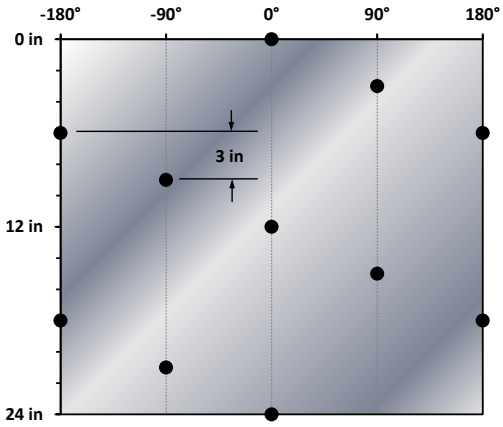
4 SPF (13 SPM)



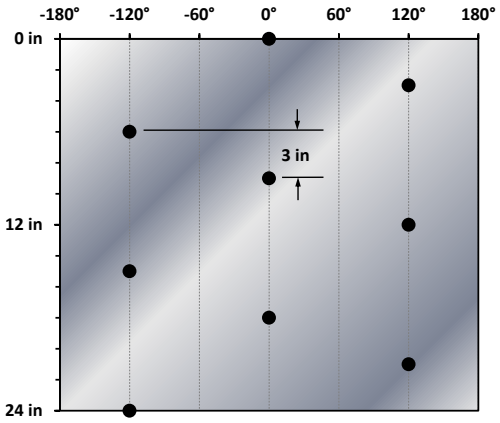
4 spf, 0° phasing



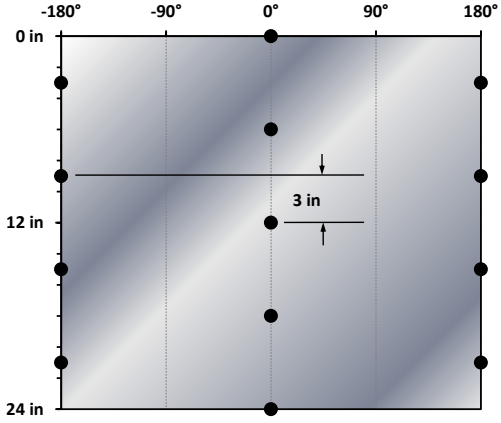
4 spf, 60° phasing



4 spf, 90° phasing



4 spf, 120° phasing

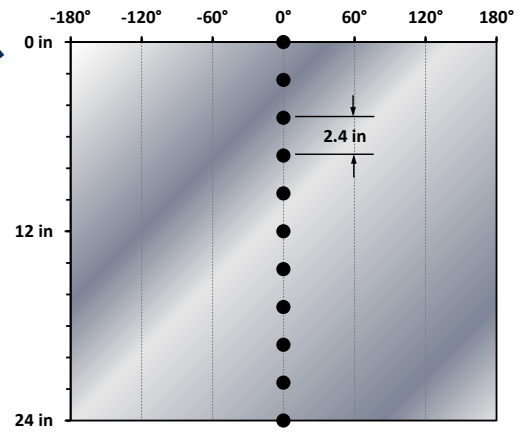


4 spf, 180° phasing

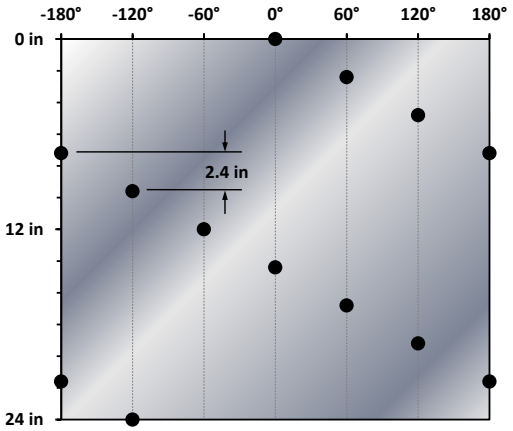
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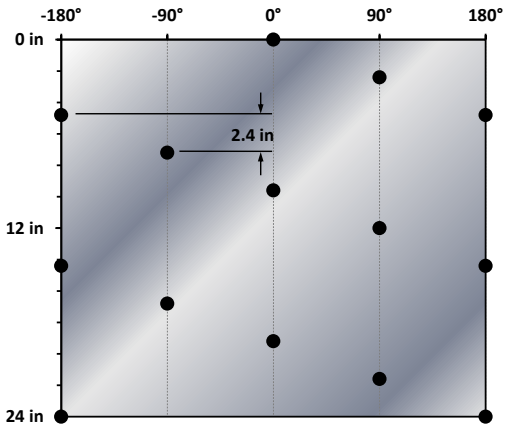
5 SPF (16 SPM)



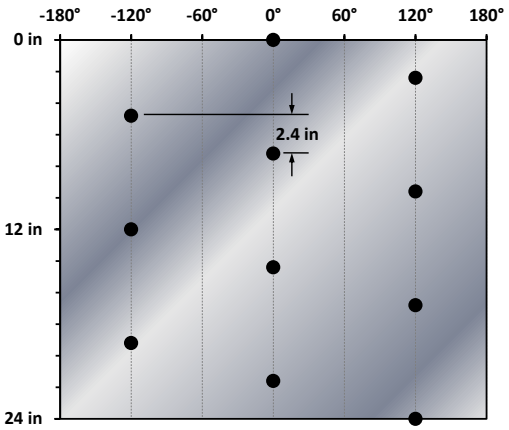
5 spf, 0° phasing



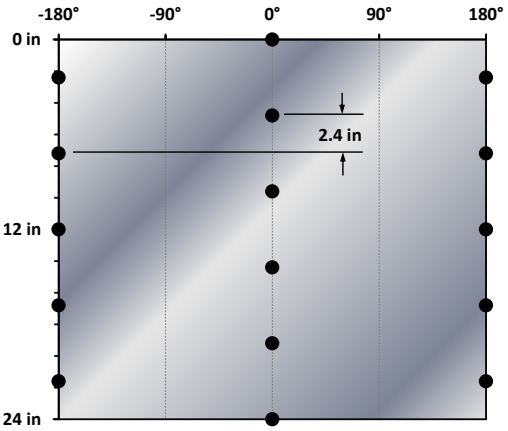
5 spf (16 spm) 60° phasing



5 spf (16 spm) 90° phasing



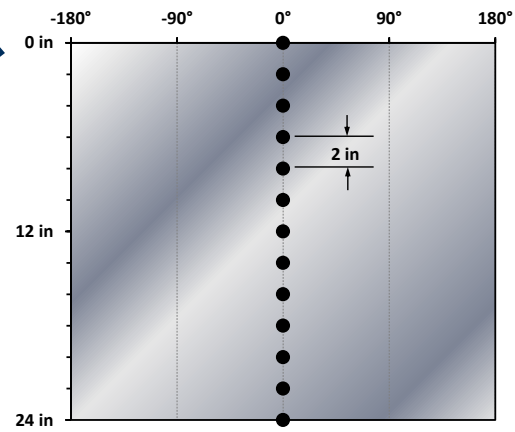
5 spf (16 spm) 120° phasing



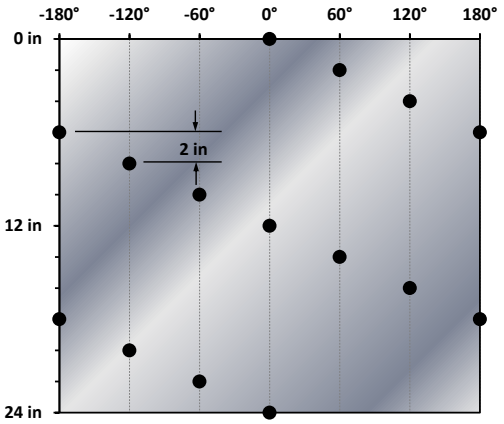
5 spf, 180° phasing

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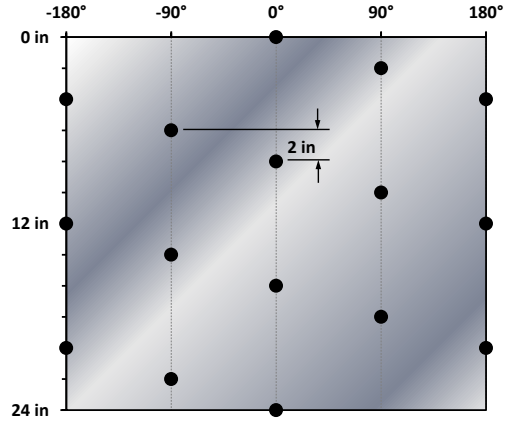
6 SPF (20 SPM)



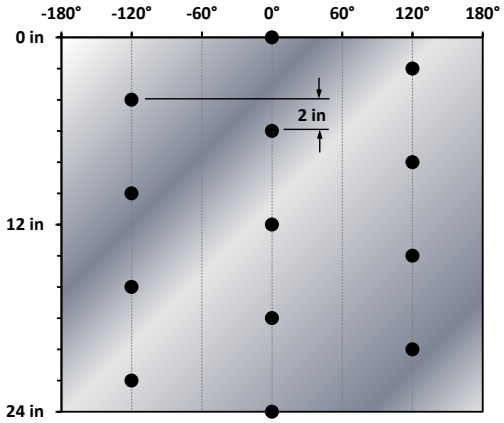
6 spf, 0° phasing



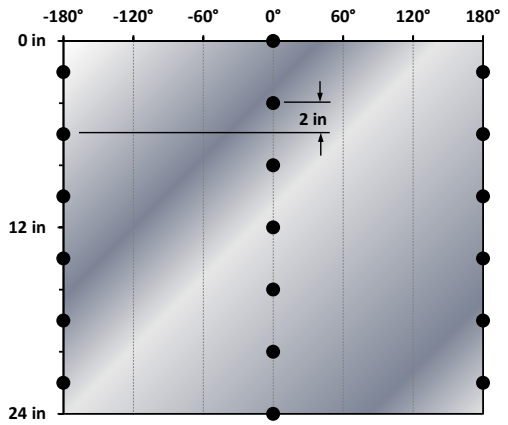
6 spf, 60° phasing



6 spf, 90° phasing



6 spf, 120° phasing

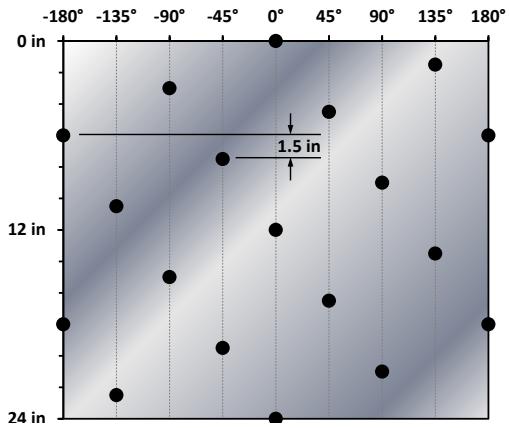


6 spf, 180° phasing

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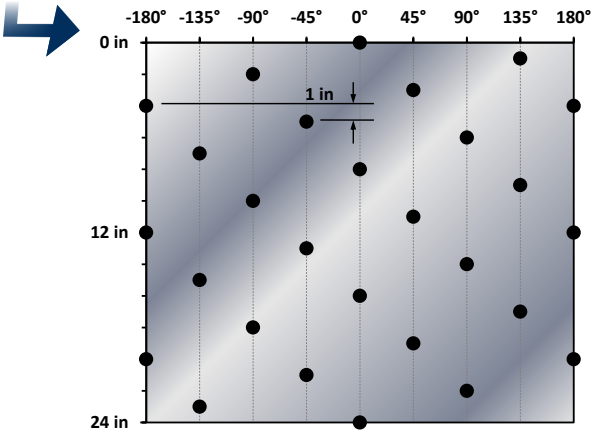
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8 SPF (26 SPM)

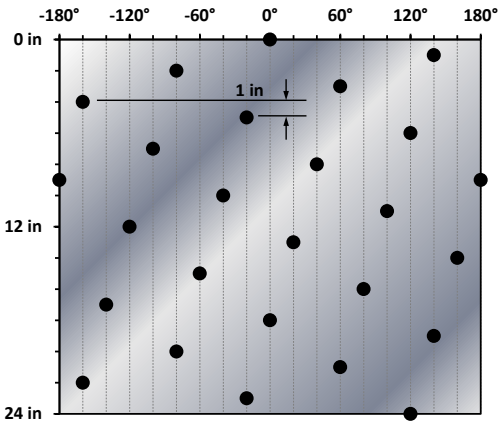


8 spf, 135/45° phasing

12 SPF (39 SPM)

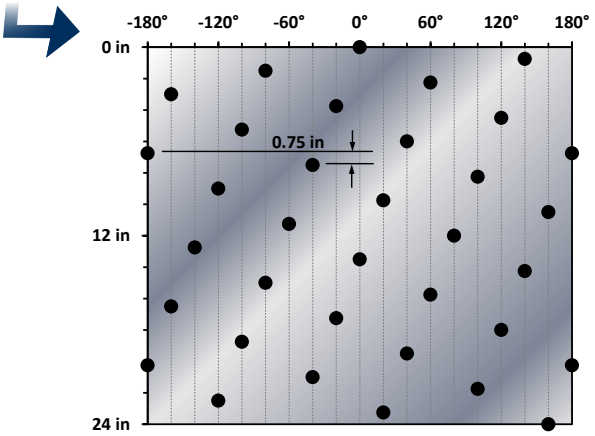


12 spf (39 spm) 135/45° phasing



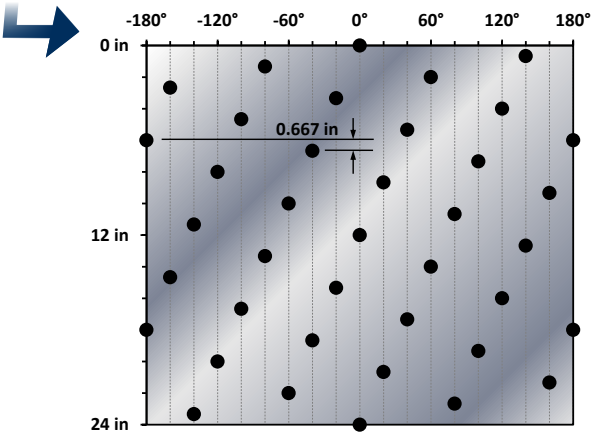
12 spf 140/20° phasing

16 SPF (52 SPM)



16 spf (52 spm) 140/20° phasing

18 SPF (59 SPM)



18 spf (59 spm) 140/20° phasing

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BOND TOOLS

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BOND TOOL 3'5' *A1*

BOND TOOL Radial Incremented (RIB) *A2*

BOND TOOL Radial Incremented 16 Sector (HD-RIB) *A3*

3ft-5ft Cement Bond Tool Family



The accurate evaluation of a wells cement bond to both casing and formation is necessary to confirm the integrity of isolation between zones and avoid production problems. The standard single transmitter Cement Bond Log (CBL) tool accurately determines casing bond by measuring the amplitude of the first arrival at the 3ft receiver. A deeper investigating 5ft receiver confirms the interpretation and also shows formation bond by a full Variable Density Log (VDL) wave display.

Hunting Titan's family of CBL tools come in a range of sizes to suite casings from 2-3/8 inch (60mm) to 14 inch (356mm). They can be configured to several timing schemes for different logging systems.

APPLICATIONS

- Assessment of cement bond quality and hydraulic isolation
- Locating top of cement (TOC)

FEATURES

- Piezoelectric crystals used in transmitters and receivers
- Wellbore and internal temperature sensors
- 450°F (204°C) flasked versions available
- Compatible with Hunting Titan Compensated Neutron, GR-Neutron and CCL

BENEFITS

- 16-20 kHz signal provides optimal casing signal and data transmission
- Canister architecture allows efficient and easy maintenance
- Temperature sensors allow real-time tool quality control

SPECIFICATIONS

Part Number	1-11/16 IN (43 MM)	2-3/4 IN (70 MM)	3-1/4 IN (83 MM)
Standard High Temperature	8010-1687HPE150-1.5-00 8010-1689HPE150-1.5-00	8010-2757HPE237-2.2-00 8010-2759HPE237-2.2-00	8010-3257HPE275-3.5-00 8010-3259HPE275-3.5-00
MEASUREMENTS			
Vertical Resolution	3 ft CBL and 5 ft VDL	3 ft CBL and 5 ft VDL	3 ft CBL and 5 ft VDL
Logging Speed (ft/min)[m/min]	60 [18.3]	60 [18.3]	60 [18.3]
Mud Type • Weight	Must be liquid • No limitations	Must be liquid • No limitations	Must be liquid • No limitations
Offset from bottom shoulder (in)[cm] Temperature • Transmitter 3ft Crystal • 5ft Crystal	 78.0 [198.1] • 71.0 [180.3] 53.0 [134.6] • 41.0 [104.1]	 77.0 [195.6] • 70.0 [177.8] 52.0 [132.1] • 40.0 [101.6]	 77.0 [195.6] • 70.0 [177.8] 52.0 [132.1] • 40.0 [101.6]
ENVIRONMENTAL			
Temperature rating Standard (°F)[°C] High Temperature (°F)[°C]	 -25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	 -25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	 -25 to 400 [-32 to 204] -25 to 450 [-32 to 232]
Pressure Rating (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]
Material	H_2S resistant construction	H_2S resistant construction	H_2S resistant construction
MECHANICAL			
Outside Diameter (in)[mm]	1.69 [42.9]	2.75 [69.9]	3.25 [82.6]
Length (ft)[m] {Hi Temp}	9.75 [2.97] {10.29 [3.14]}	9.13 [2.78] {10.50 [3.20]}	9.13 [2.78] {10.50 [3.20]}
Weight (lb)[kg] {Hi Temp}	52 [24] {75 [34]}	102 lb [46 kg] {120 lb [54 kg]}	122 lb (55 kg) {140 lb [64 kg]}
Max. Tension (lbf)[kN]	12,000 [54]	60,000 [267]	60,000 [267]
Min. • Max. Casing Size (in)[mm]	2.38 [60] • 7.00 [178]	4.50 [114] • 9.63 [244]	5.50 [140] • 12.75 [324]
Top/Bottom Connection	1-3/16" GO Box/Pin	1-3/16" GO Box/Pin	1-3/16" GO Box/Pin
ELECTRICAL			
Operating Voltage & Current	120 VDC @ 40±5 mA	120 VDC @ 55±5 mA	120 VDC @ 55±5 mA
Auxiliary Tool Input	Single or bi-level pulse	Single or bi-level pulse	Single or bi-level pulse
Input Pulse Height • Width	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max
Transmitter Frequency	20 kHz	18 kHz	16 kHz
Cable Type Conductor High Capacitance Lines	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)
Crystal Type	Piezoelectric	Piezoelectric	Piezoelectric
Temperature Sensor	Platinum RTD	Platinum RTD	Platinum RTD
Pressure Compensation	Sliding cans	Sliding cans	Sliding cans

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HUNTING
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6-8 Sector
Radial Incremented Bond Tool Family

Conventional dual spaced 3ft - 5ft CBL is an economical way to evaluate a cement job. However, if it shows less than perfect bonding, additional information is needed to correctly evaluate the cement bond. Hunting Titan's Radial Incremented Bond (RIB) tools provide the conventional CBL-VDL receivers plus additional directional radial receivers that can measure circumferential data necessary to determine if there is channeling in the cement, or to indicate low compressive strength.

Hunting Titan's unique 1.5ft transmitter to radial receiver spacing provides highly directional information without the averaging effect seen in traditional 3ft spacing, and is less susceptible to fast formation interference. The amplitude display of each directional receiver forms a detailed 360° cement map that can be used to identify channeling, voids and other bonding irregularities.

ADDITIONAL APPLICATIONS

- Identification of micro annulus and channeling

ADDITIONAL FEATURES

- 1.5ft spacing cement map sensors
- Slip joint and bi-metallic isolator bar construction

ADDITIONAL BENEFITS

- Less fast formation interference in cement mapping



SPECIFICATIONS

Part Number	1-11/16 IN (43 MM)	2-3/4 IN (70 MM)
Standard High Temperature	8012-1687HPE150-1.5-00 8012-1689HPE150-1.5-00	8012-2757HPE237-2.2-00 8012-2759HPE237-2.2-00
MEASUREMENTS		
Vertical Resolution	1.5 ft RIB 3 ft CBL and 5 ft VDL	1.5 ft RIB 3 ft CBL and 5 ft VDL
Azimuthal Resolution	60° Cement map	45 ° Cement map
Logging Speed (ft/min)[m/min]	60 [18.3]	60 [18.3]
Mud Type • Weight	Must be liquid • No limitations	Must be liquid • No limitations
Offset from bottom shoulder (in)[cm] Temperature • Transmitter 3ft Crystal • 5ft Crystal	78.0 [198.2] • 70.0 [177.8] 61 [154.9] 52.0 [132.1] • 40.0 [101.6]	76.5 [194.3] • 70.0 [177.8] 61 [154.9] 52.0 [132.1] • 40.0 [101.6]
ENVIRONMENTAL		
Temperature rating Standard (°F)[°C] High Temperature (°F)[°C]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]
Pressure Rating (psi)[MPa]	20,000 [138]	20,000 [138]
Material	H_2S resistant construction	H_2S resistant construction
MECHANICAL		
Outside Diameter (in)[mm]	1.69 [42.9]	2.75 [69.9]
Length (ft)[m] {Hi Temp}	9.13 [2.78] {10.34 [3.15]}	9.13 [2.78] {10.47 [3.19]}
Weight (lb)[kg] {Hi Temp}	63 [29] {73 [33]}	120 [54] {148 [67]}
Max. Tension (lbf)[kN]	40,000 [178]	60,000 [267]
Min. Casing Size (in)[mm]	2.38 [60]	4.50 [114]
Max. Casing Size (in)[mm]	6.13 [156] (RIB) 7.00 [178] (CBL/VDL)	8.63 [219] (RIB) 9.63 [244] (CBL/VDL)
Top/Bottom Connection	1-3/16" GO Box/Pin	1-3/16" GO Box/Pin
ELECTRICAL		
Operating Voltage & Current	120 VDC @ 40±5 mA	120 VDC @ 55±5 mA
Auxiliary Tool Input	Single or bi-level pulse	Single or bi-level pulse
Input Pulse Height • Width	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max
Transmitter Frequency	20 kHz	20 kHz (Sectors) 18 kHz (CBL/VDL)
Cable Type Conductor High Capacitance Lines	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)
Crystal Type	Piezoelectric	Piezoelectric
Temperature Sensor	Platinum RTD	Platinum RTD
Pressure Compensation	Sliding cans	Sliding cans

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12-16 Sector
High Definition Radial Incremented Bond

The industry standard 8 – Sector radial bond provides excellent cement evaluation between the casing and formation in most applications. However, as the casing size increase, the sector resolution of the 8 – Sector RIB tool decreases making it difficult to accurately identify channeling and other bonding irregularities. These unique challenges have been addressed by Hunting Titan's industry leading High Definition Radial Incremented Bond (HD-RIB) tools. The high sector azimuthal resolution, up to 22.5°, provides details necessary for identification of channeling, voids and other bonding irregularities in casing sizes of 7" (178 mm) or larger. A sonic receiver spaced 3ft from the transmitter provides quality information on casing to cement bonding. Amplitude display of the highly directional receivers allows a detailed 360° cement map of the wellbore to be created. A deeper investigating receiver confirms the data obtained from the 3ft receiver and shows formation bonding by a full VDL wave display.

FEATURES

- Wellbore and internal temperature sensors
- 450°F (204°C) flasked versions available
- VDL crystal on 4-1/2 in (114 mm) tool at 6 ft for increased depth of investigation
- Compatible with Hunting Titan Compensated Neutron, GR-Neutron and CCL

BENEFITS

- Up to 22.5° azimuthal resolution on cement maps
- Excellent sonic isolation
- Temperature sensors allow real-time tool quality control
- VDL spacing ideal for large boreholes



SPECIFICATIONS

Part Number	3-1/4 IN (83 MM)	4-1/2 IN (114 MM)
Standard High Temperature	8012-3257HPE300-3.0-00-S 8012-3259HPE300-3.0-00-S	8012-4507HPE400-03-00 8012-4509HPE400-03-00
MEASUREMENTS		
Vertical Resolution	1.5 ft RIB 3 ft CBL and 5 ft VDL	3 ft RIB 3 ft CBL and 6 ft VDL
Azimuthal Resolution	30° Cement map	22.5° Cement map
Logging Speed (ft/min)[m/min]	60 [18.3]	60 [18.3]
Mud Type • Weight	Must be liquid • No limitations	Must be liquid • No limitations
Offset from bottom shoulder (in)[cm] Temperature • Transmitter RIB 3ft Crystal • 5ft or 6ft Crystal	 76.5 [194.3] • 70.0 [177.8] 61.0 [154.9] 52.0 [132.1] • 40.0 [101.6]	 88.6 [225.0] • 81.2 [206.2] 63.2 [160.5] 63.2 [160.5] • 45.2 [114.8]
ENVIRONMENTAL		
Temperature rating Standard (°F)[°C] High Temperature (°F)[°C]	 -25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	 -25 to 400 [-32 to 204] -25 to 450 [-32 to 232]
Pressure Rating (psi)[MPa]	20,000 [138]	20,000 [138]
Material	H_2S resistant construction	H_2S resistant construction
MECHANICAL		
Outside Diameter (in)[mm]	3.25 [82.6]	4.50 [114.3]
Length (ft)[m] {Hi Temp}	9.13 [2.78 {10.75 [3.28]}	10.29 [3.14] {11.86 [3.61]}
Weight (lb)[kg] {Hi Temp}	135 [61] {160 [73]}	202 [92] {234 [106]}
Max. Tension (lbf)[kN]	60,000 [267]	60,000 [267]
Min. Casing Size (in)[mm]	5.50 [140]	8.63 [219]
Max. Casing Size (in)[mm]	10.75 [273] (RIB) 12.75 [324] (CBL/VDL)	18.00 [457]
Top • Bottom Connection	1-3/16" GO Box • 1-3/16" GO Pin	1-3/16" GO Box • 1-3/16" GO Pin
ELECTRICAL		
Operating Voltage & Current	120 VDC @ 30±5 mA (at tool head)	120 VDC @ 30±5 mA (at tool head)
Auxiliary Tool Input	Single or bi-level pulse	Single or bi-level pulse
Input Pulse Height • Width	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max
Transmitter Frequency	18 kHz	14 kHz
Cable Type Conductor High Capacitance Lines	 Single or multi-conductor 7/32 in 500°F (260°C)	 Single or multi-conductor 7/32 in 500°F (260°C)
Crystal Type	Piezoelectric	Piezoelectric
Temperature Sensor	Platinum RTD	Platinum RTD
Pressure Compensation	Sliding cans	Sliding cans

Right Tools. Right Location. Right Time.

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HUNTING
Hunting Titan

COLLAR LOCATORS

CONTENTS

SHOOTING CCL 1" (2.54 cm) B1

SHOOTING CCL 1 7/16" (3.65 cm) B2

SHOOTING CCL 1 11/16" (4.29 cm) B3

SHOOTING CCL 2" (5.08 cm) B4

SHOOTING CCL 2 1/8" (5.40 cm) B5

SHOOTING CCL 2 3/4" (6.99 cm) B6

SHOOTING CCL 3 1/8" (7.94 cm) B7

SHOOTING CCL 4 1/2" (11.43 cm) B8

AMPLIFIED CCL 1" (2.54 cm) B9

AMPLIFIED CCL 1 3/8" (3.49 cm) B10

AMPLIFIED CCL 1 11/16" (4.29 cm) B11

AMPLIFIED CCL 2 3/4" (6.99 cm) B12

AMPLIFIED CCL 3 1/8" (7.94 cm) B13

AMPLIFIED CCL 4 1/2" (11.43 cm) B14

CCL CHARGER B15

Amplified CCL's are available with Negative Power 400° (204.4° C)

TiTan®
INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
0262-000-020

TEMPERATURE RATING
500° F (260.0° C)

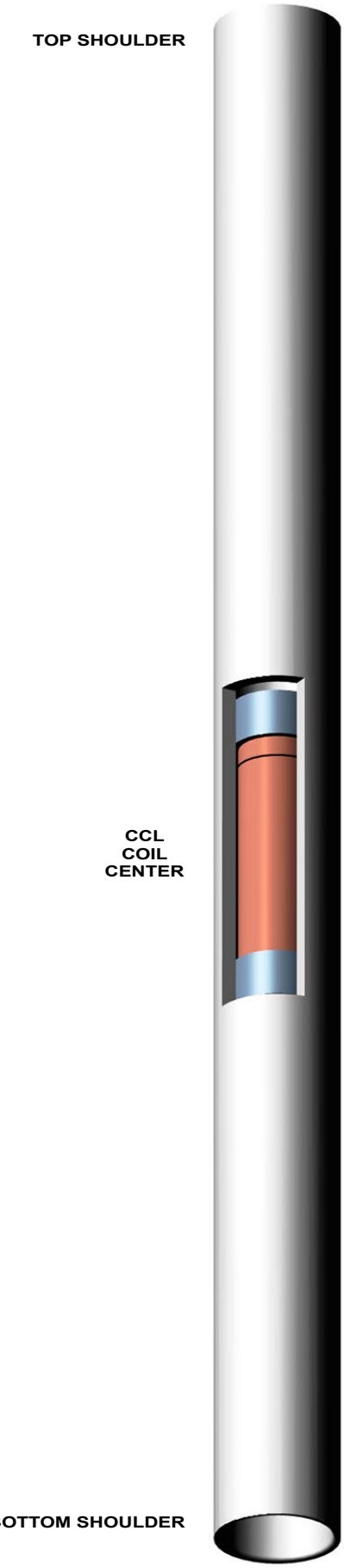
PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
2 lbs (0.91 kg) / 12.75” (32.39 cm)

LENGTH / DIMENSIONS
CCL to Top Shoulder: 7.00” (17.77 cm)
CCL to Bottom Shoulder: 5.75” (14.61 cm)

MAXIMUM VOLTAGE
500 Volts

STANDARD FEATURES
H_2S Resistant Material
No Subs



1”
(2.54 cm)

SHOOTING CCL

B

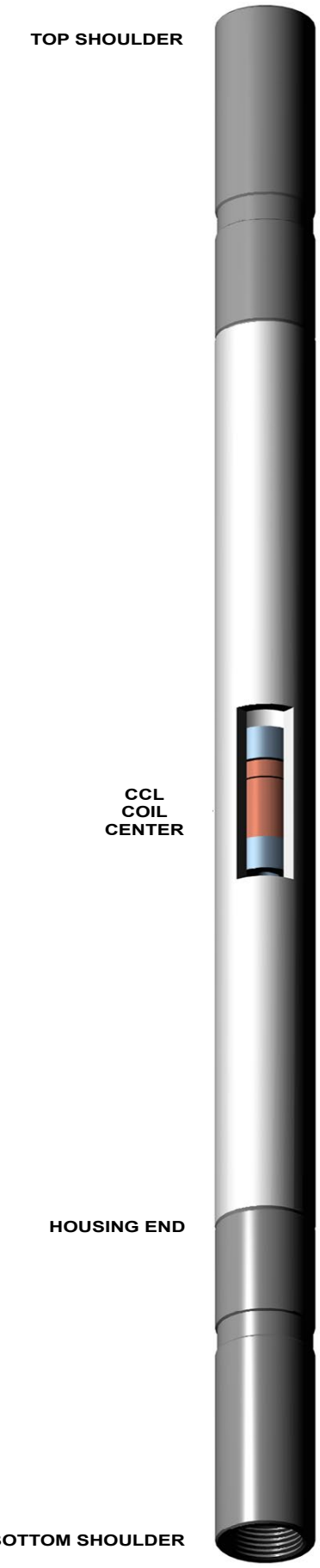
301B10A0 Jan-07

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SPECIFICATIONS

MODEL NUMBER *(As shown)*	**0263-500-000**
MODEL NUMBER *(No subs)*	**0263-500-020**
TEMPERATURE RATING	**500° F (260.0° C)**
PRESSURE RATING	**20,000 PSI (138 MPa)**
WEIGHT / LENGTH	**9 lbs (4.08 kg) / 24.11" (61.24 cm)**
TOOL SPACING	**CCL to Top Shoulder: 12.37" (31.43 cm)** **CCL to Housing End: 6.75" (17.14 cm)** **CCL to Bottom Shoulder: 11.74" (29.83 cm)**
MAXIMUM VOLTAGE	**500 Volts**
OPTIONAL FEATURES	**H_2S Resistant Material**



1 7/16"
(3.65 cm)

SHOOTING CCL

B

301B14A0 Mar-07

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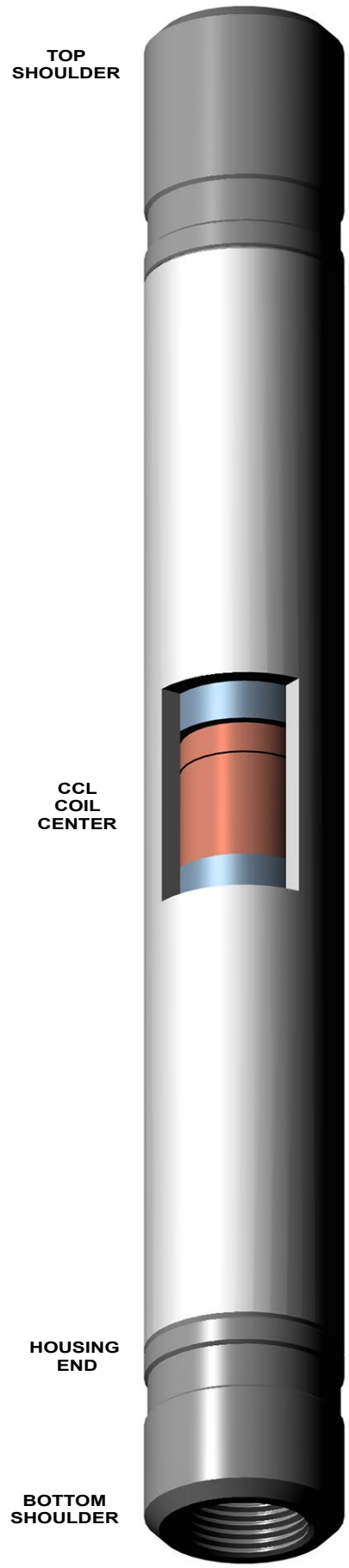
SHOOTING CCL

1 11/16”
(4.29 cm)

B

SPECIFICATIONS

MODEL NUMBER *(As shown)* **0264-500-000**
MODEL NUMBER *(Pin bottom sub)* **0264-500-010**
TEMPERATURE RATING **500° F (260.0° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
WEIGHT / LENGTH **7 lbs (3.17 kg) / 13.73” (34.88 cm)**
TOOL SPACING **CCL to Top Shoulder: 7.18” (18.28 cm)** **CCL to Housing End: 4.93” (12.52 cm)** **CCL to Bottom Shoulder: 6.55” (16.64 cm)**
MAXIMUM VOLTAGE **500 Volts**
OPTIONAL FEATURES **H_2S Resistant Material**



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SHOOTING CCL

2”
(5.08 cm)

B

SPECIFICATIONS

MODEL NUMBER
0264-500-200

TEMPERATURE RATING
500° F (260.0° C)

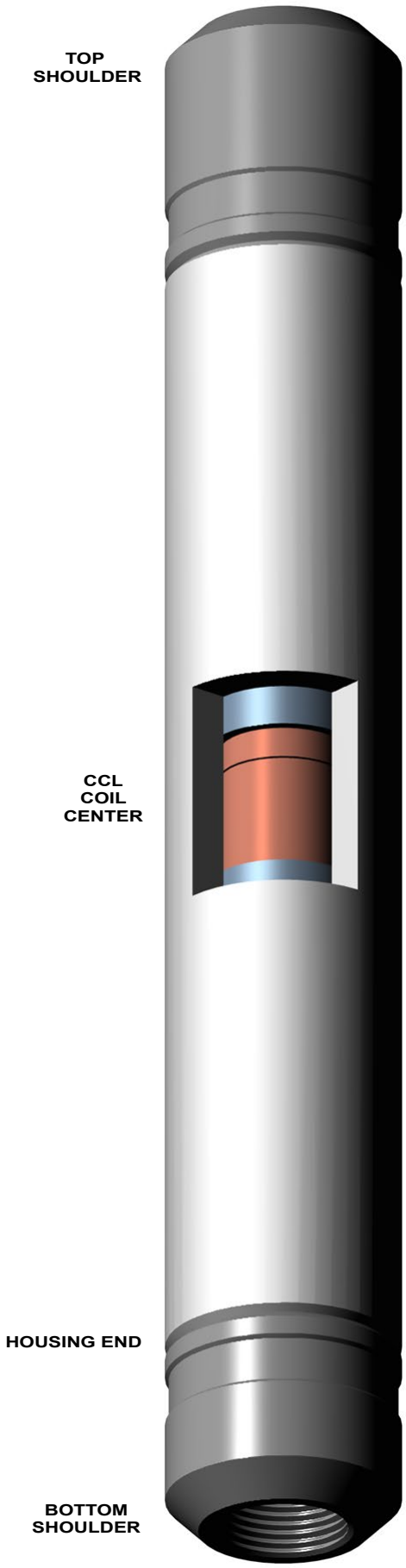
PRESSURE RATING
25,000 PSI (172 MPa)

WEIGHT / LENGTH
12 lbs (5.44 kg) / 13.73” (34.87 cm)

TOOL SPACING
CCL to Top Shoulder: 7.20” (18.28 cm)
CCL to Housing End: 4.90” (12.44 cm)
CCL to Bottom Shoulder: 6.53” (16.58 cm)

MAXIMUM VOLTAGE
500 Volts

OPTIONAL FEATURES
H_2S Resistant Material
High Pressure



301B20A0 Mar-07

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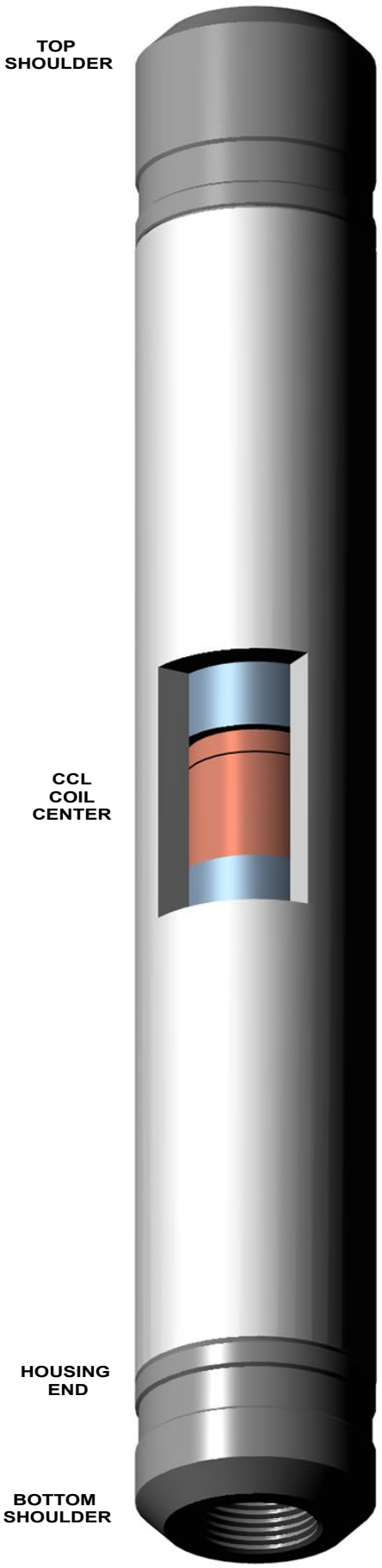
SHOOTING CCL

2 1/8”
(5.40 cm)

B

SPECIFICATIONS

MODEL NUMBER *(As shown)*	**0265-500-000**
MODEL NUMBER *(Pin bottom sub)*	**0265-500-010**
TEMPERATURE RATING	**500° F (260.0° C)**
PRESSURE RATING	**20,000 PSI (138 MPa)**
WEIGHT / LENGTH	**12 lbs (5.44 kg) / 14.25” (36.20 cm)**
TOOL SPACING	**CCL to Top Shoulder: 7.44” (18.89 cm)** **CCL to Housing End: 5.44” (13.81 cm)** **CCL to Bottom Shoulder: 6.81” (17.30 cm)**
MAXIMUM VOLTAGE	**500 Volts**
OPTIONAL FEATURES	**H_2S Resistant Material**



301B21A0 Mar-07

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SPECIFICATIONS

MODEL NUMBER
0268-500-001

TEMPERATURE RATING
500° F (260.0° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
28 lbs (12.70 kg) / 18.88" (47.94 cm)

TOOL SPACING
CCL to Top Shoulder: 9.25" (23.49 cm)
CCL to Housing End: 7.25" (18.42 cm)
CCL to Bottom Shoulder: 9.63" (24.45 cm)

MAXIMUM VOLTAGE
500 Volts

STANDARD FEATURES
Bottom accepts Quick Change

AVAILABLE OPTIONS
Can be purchased with 2 3/4" or 3 1/8" Quick Change Assembly

Fish Neck Top / Bottom accepts QC

Go Box Top / Go Box Bottom

H_2S Resistant Material



301B27A0 Mar-07

2 3/4"
(6.99 cm)

SHOOTING CCL

B

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SPECIFICATIONS

MODEL NUMBER
0257-500-001

TEMPERATURE RATING
500° F (260.0° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT LENGTH
36 lbs (16.33 kg) / 19.00" (48.26 cm)

TOOL SPACING
CCL to Top Shoulder: 9.37" (23.81 cm)
CCL to Housing End: 6.63" (16.83 cm)
CCL to Bottom Shoulder: 9.63" (24.45 cm)

MAXIMUM VOLTAGE
500 Volts

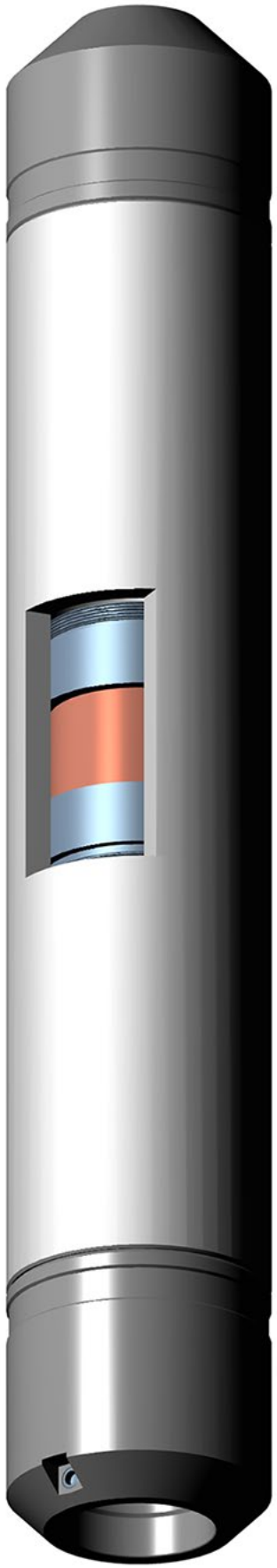
STANDARD FEATURES
Bottom accepts Quick Change

AVAILABLE OPTIONS
Can be purchased with Quick Change Assembly

Fish Neck Top / Bottom accepts QC

Go Box Top / Go Box Bottom

H_2S Resistant Material



3 1/8"
(7.94 cm)

SHOOTING CCL

B

301B31A0 Apr-07

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SPECIFICATIONS

MODEL NUMBER
0266-500-001

TEMPERATURE RATING
500° F (260.0° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
70 lbs (31.75 kg) / 18.25" (46.36 cm)

TOOL SPACING
CCL to Top Shoulder: 9.00" (22.86 cm)
CCL to Housing End: 6.50" (16.51 cm)
CCL to Bottom Shoulder: 9.25" (23.50 cm)

MAXIMUM VOLTAGE
500 Volts

STANDARD FEATURES
Bottom accepts Quick Change

AVAILABLE OPTIONS
Can be purchased with Quick Change Assembly

Fish Neck Top

H_2S Resistant Material



4 1/2"
(11.43 cm)

SHOOTING CCL

B

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AMPLIFIED CCL

1”
(2.54 cm)

B

SPECIFICATIONS

MODEL NUMBER
8130-10072MC073-03-00

TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

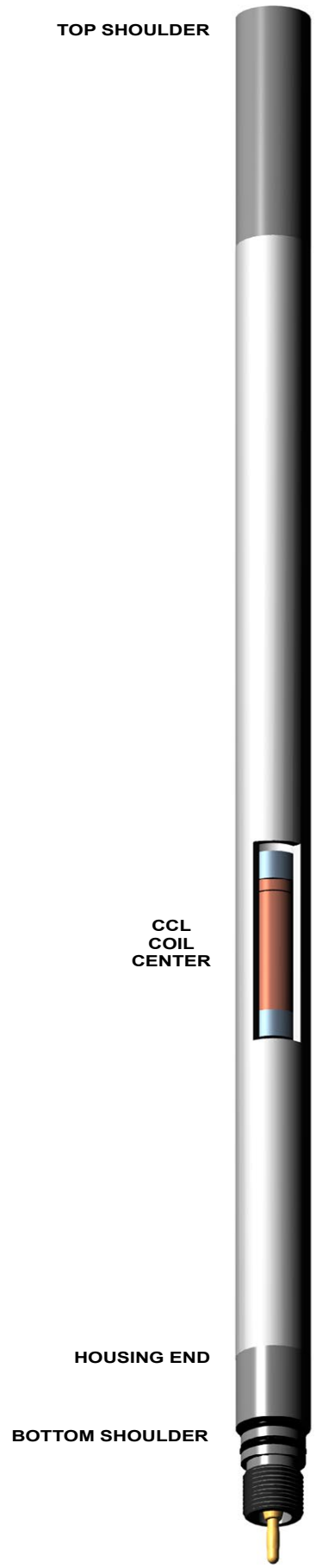
WEIGHT / LENGTH
3 lbs (1.36 kg) / 20.00” (50.80 cm)

TOOL SPACING
CCL to Top Shoulder: 13.18” (33.48 cm)
CCL to Housing End: 5.82” (14.78 cm)
CCL to Bottom Shoulder: 6.82” (17.32 cm)

OPERATING POWER
120 VDC, Positive @ ≈ 12 mA

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Negative Power



300B10A0 Aug-11 pressure updated. Tested JL 08-10-11

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AMPLIFIED CCL

1 3/8”
(3.49 cm)

B

SPECIFICATIONS

MODEL NUMBER
(As shown)

8130-13772MC103-02-00

OPERATING POWER

120 VDC, Positive @ ≈ 12 mA

MODEL NUMBER
(No bottom)

8130-13772MC103-02-0X

OPERATING POWER

50 VDC, Positive @ ≈ 12 mA

TEMPERATURE RATING

400° F (204.4° C)

PRESSURE RATING

20,000 PSI (138 MPa)

WEIGHT / LENGTH

7.5 lbs (3.40 kg) / 21.50” (54.61 cm)

TOOL SPACING

CCL to Top Shoulder: 13.18” (33.49 cm)
CCL to Housing End: 6.19” (15.73 cm)
CCL to Bottom Shoulder: 8.32” (21.12 cm)

STANDARD FEATURES

H_2S Resistant Material

AVAILABLE OPTIONS

Negative Power



300B13A0 Jan-07

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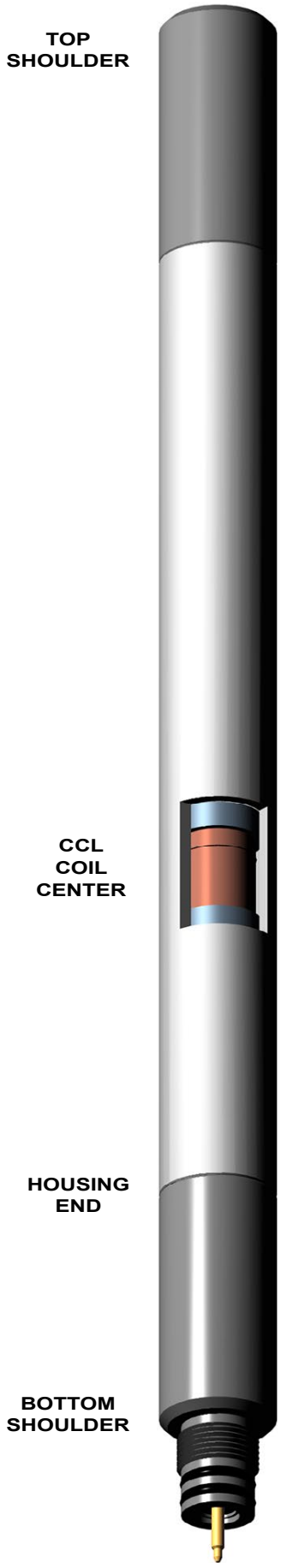
AMPLIFIED CCL

1 11/16”
(4.29 cm)

B

SPECIFICATIONS

MODEL NUMBER *(As shown)* **8130-168B2MC129-02-00**
MODEL NUMBER *(No bottom)* **8130-168B2MC129-02-0X**
OPERATING POWER **50 to 120 VDC, Positive @ ≈ 12 mA**
MAX TEMPERATURE RATING **500° F (260.0° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
WEIGHT / LENGTH **10 lbs (4.54 kg) / 22.00” (55.88 cm)**
LENGTH / DIMENSIONS **CCL to Top Shoulder: 13.45” (34.16 cm)** **CCL to Housing End: 4.93” (12.52 cm)** **CCL to Bottom Shoulder: 8.55” (21.72 cm)**
STANDARD FEATURES **H_2S Resistant Material**



300B16A0 Apr-07

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SPECIFICATIONS

MODEL NUMBER
(As shown)

8130-275B2MC210-03-00

MODEL NUMBER
(No bottom)

8130-275B2MC210-03-0X

OPERATING POWER

50 to 120 VDC, Positive @ ≈ 12 mA

MAX TEMPERATURE RATING

500° F (260.0° C)

PRESSURE RATING

20,000 PSI (138 MPa)

WEIGHT / LENGTH

30 lbs (13.60 kg) / 25.81" (65.56 cm)

LENGTH / DIMENSIONS

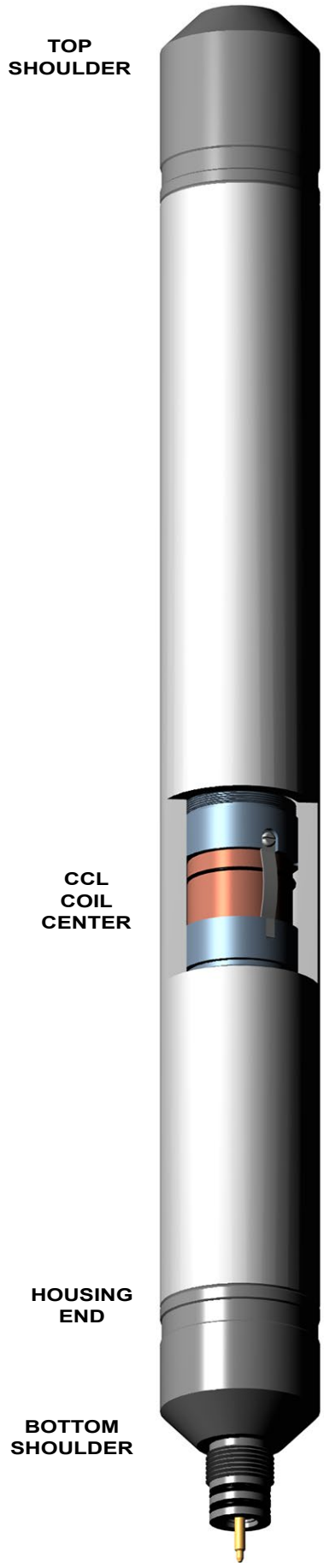
CCL to Top Shoulder: 15.85" (40.25 cm)
CCL to Housing End: 7.47" (18.96 cm)
CCL to Bottom Shoulder: 9.97" (25.31 cm)

STANDARD FEATURES

H_2S Resistant Material

AVAILABLE OPTIONS

Fish Neck Top Sub



2 3/4"
(6.99 cm)

AMPLIFIED CCL

B

300B27A0 Mar-08

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TITAN INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
(As shown)

8130-312B2MC250-03-00

MODEL NUMBER
(No bottom)

8130-312B2MC250-03-0X

OPERATING POWER

50 to 120 VDC, Positive @ ≈ 12 mA

MAX TEMPERATURE RATING

500° F (260.0° C)

PRESSURE RATING

20,000 PSI (138 MPa)

WEIGHT / LENGTH

36 lbs (16.32 kg) / 19.63" (49.85 cm)

LENGTH / DIMENSIONS

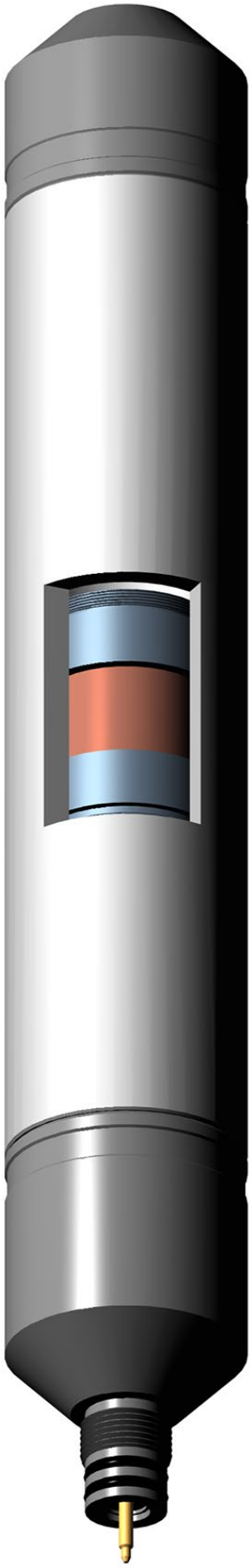
CCL to Top Shoulder: 10.16" (25.80 cm)
CCL to Housing End: 5.84" (14.84 cm)
CCL to Bottom Shoulder: 9.47" (24.05 cm)

STANDARD FEATURES

H_2S Resistant Material

AVAILABLE OPTIONS

Fish Neck Top Sub



3 1/8"
(7.94 cm)

AMPLIFIED CCL

B

300B31A0 Apr-07

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SPECIFICATIONS

MODEL NUMBER
8130-450B2MC350-03-00

TEMPERATURE RATING
500° F (260.0° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
75 lbs (34.01 kg) / 20.62" (52.39 cm)

TOOL SPACING
CCL to Top Shoulder: 10.25" (26.04 cm)
CCL to Housing End: 6.50" (16.51 cm)
CCL to Bottom Shoulder: 10.37" (26.35 cm)

OPERATING POWER
50 to 120 VDC, Positive @ ≈ 12 mA

STANDARD FEATURES
H_2S Resistant Material



4 1/2"
(11.43 cm)

AMPLIFIED CCL

B

300B45A0 Apr-07

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INSTRUMENT DIVISION

SPECIFICATIONS

Titan Instrument Division Announces

Portable C.C.L. Magnet Charger

This assembly was developed to provide an efficient and portable method of keeping your tools in their top condition. As you all know, accurate Depth Control is enough of a challenge without having to sort out the collars from the road noise, which in many cases, is caused by weak magnets.

Some of the features are:

- Simple to use.
- Accepts all CCL's from 1" through 4-1/2" (requires internal assembly removal from pressure housing).
- No coil spacing to set (pole pieces are in a fixed position).
- Housed in a rugged, lightweight, waterproof carrying case.
- Available in 110 (60 Hz) and 220 (50 Hz) VAC versions.
- Dimensions: Height 12" (30.5 cm) X Width 17" (43.2 cm) X Depth 13" (33 cm).
- Weight: 35 lbs (15.87 kg)



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GEIGER GR TOOLS

CONTENTS

1 3/8" (3.49 cm) PERFORATING GEIGER GR/CCL C1

1 11/16" (4.29 cm) PERFORATING GEIGER GR/CCL C2

2 3/4" (6.99 cm) PERFORATING GEIGER GR/CCL C3

3 1/8" (7.94 cm) PERFORATING GEIGER GR/CCL C4

1 3/8" (3.49 cm) LOGGING GEIGER GR C5

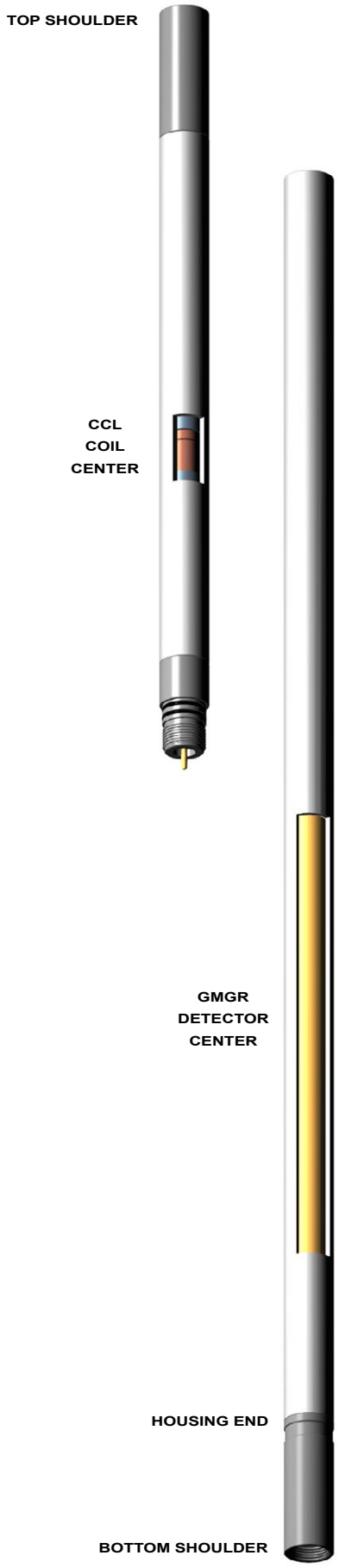
1 11/16" (4.29 cm) LOGGING GEIGER GR C6

2 3/4" (6.99 cm) LOGGING GEIGER GR C7

Switching, Bond Gate, and Temperature Gate Circuits are available with Logging Gamma Rays

PERFORATING GEIGER GR/CCL

1 3/8”
(3.49 cm)



SPECIFICATIONS

MODEL NUMBER
8100-13777GM100-12-06

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
17 lbs (7.71 kg) / 61.56” (156.37 cm)

TOOL SPACING
CCL to Top Shoulder: 13.18” (33.49 cm)
GR to CCL: 33.19” (84.31 cm)
GR to Housing End: 11.25” (28.58 cm)
GR to Bottom Shoulder: 15.19” (38.58 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material

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1 11/16”
(4.29 cm)

PERFORATING GEIGER GR/CCL

C

SPECIFICATIONS

MODEL NUMBER
8100-16877GM137-18-06

MAX TEMPERATURE RATING
400° F (204.4° C)

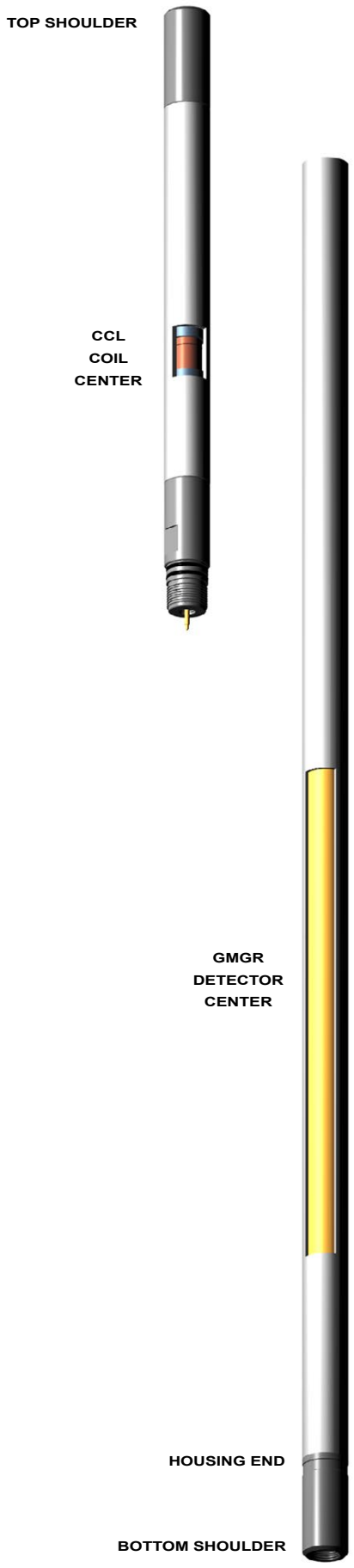
PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
28 lbs (12.70 kg) / 75.88” (192.72 cm)

TOOL SPACING
CCL to Top Shoulder: 13.45” (34.16 cm)
GR to CCL: 41.43” (105.23 cm)
GR to Housing End: 17.25” (43.82 cm)
GR to Bottom Shoulder: 21.00” (53.34 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material

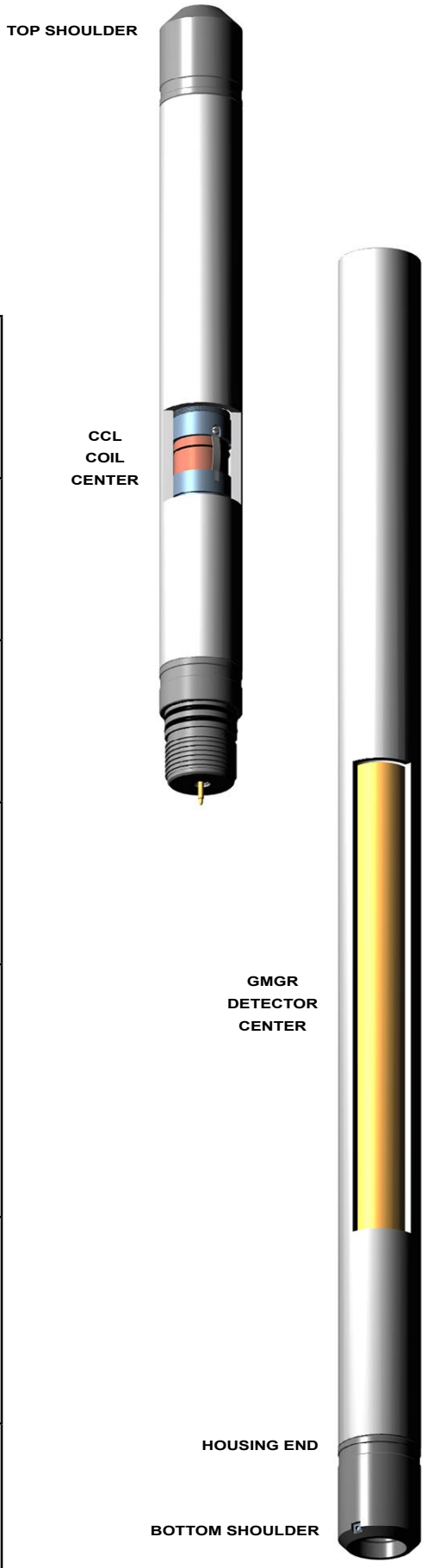


007B16A0 Mar-07

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PERFORATING GEIGER GR/CCL

2 3/4”
(6.99 cm)



SPECIFICATIONS

MODEL NUMBER
8100-27577GM200-16-01

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
76 lbs (34.47 kg) / 70.31” (178.59 cm)

TOOL SPACING
CCL to Top Shoulder: 15.93” (40.45 cm)
GR to CCL: 35.26” (89.56 cm)
GR to Housing End: 15.62” (39.69 cm)
GR to Bottom Shoulder: 19.12” (48.58 cm)

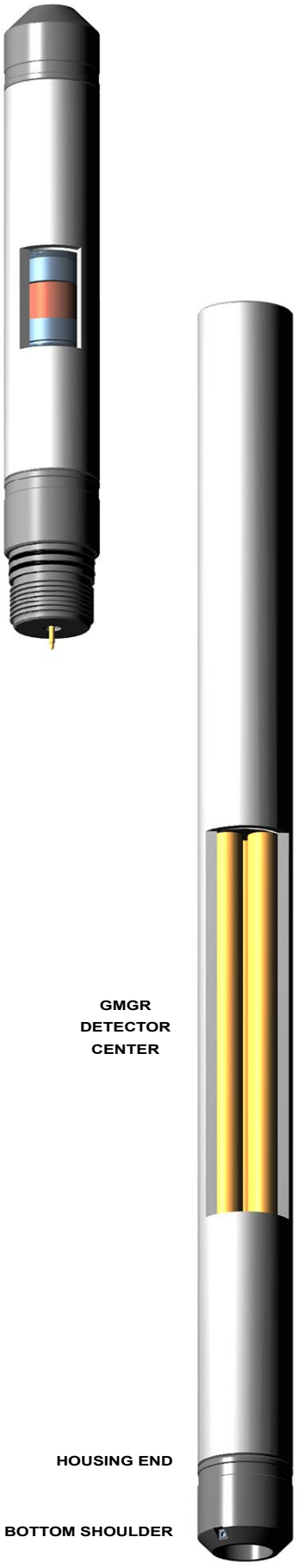
OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material

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PERFORATING GEIGER GR/CCL

3 1/8”
(7.94 cm)



SPECIFICATIONS

MODEL NUMBER
8100-31277GM100-12-01

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT LENGTH
90 lbs (40.82 kg) / 60.63” (154.00 cm)

TOOL SPACING
CCL to Top Shoulder: 10.22” (25.96 cm)
GR to CCL: 32.69” (83.03 cm)
GR to Housing End: 14.84” (37.70 cm)
GR to Bottom Shoulder: 17.72” (45.01 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Other Subs available

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LOGGING GEIGER GR

1 3/8”
(3.49 cm)

C

SPECIFICATIONS

MODEL NUMBER
8100-13772GM100-12-00

RECOMMENDED EQUIPMENT
8130-13772MC103-02-00
see CCL section B

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

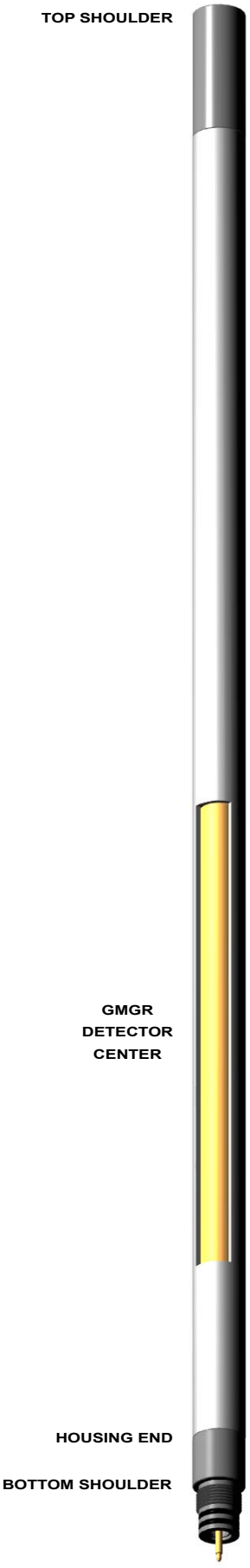
WEIGHT / LENGTH
11 lbs (4.98 kg) / 41.88” (106.36 cm)

TOOL SPACING
GR to Top Shoulder: 29.25” (74.30 cm)
GR to Housing End: 11.25” (28.58 cm)
GR to Bottom Shoulder: 12.63” (32.07 cm)

OPERATING POWER
120 VDC, Positive @ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Other Subs available
Available with Switching, Bond Gate, & Temp Gate Circuits



002B13A0 Mar-07

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LOGGING GEIGER GR

1 11/16”
(4.29 cm)

SPECIFICATIONS

MODEL NUMBER
8100-16872GM137-18-00

RECOMMENDED EQUIPMENT
8130-168B2MC129-02-00
see CCL section B

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
18,000 PSI (124 MPa)

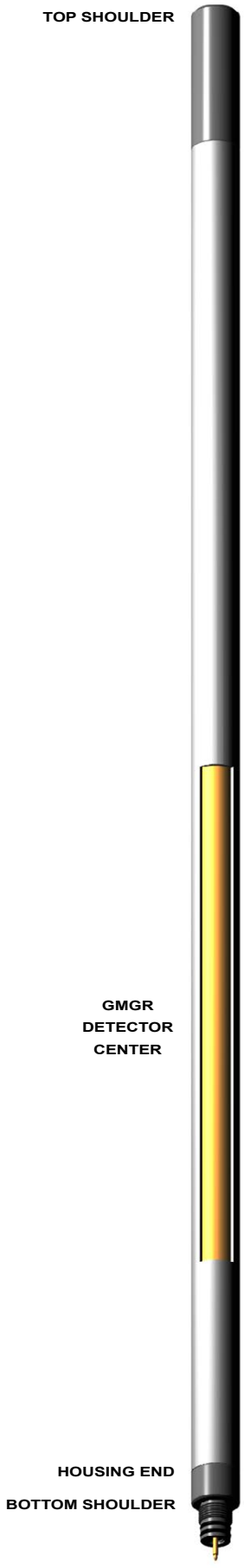
WEIGHT / LENGTH
19 lbs (8.61 kg) / 57.00” (144.78 cm)

TOOL SPACING
GR to Top Shoulder: 38.50” (97.79 cm)
GR to Housing End: 17.25” (43.82 cm)
GR to Bottom Shoulder: 18.50” (46.99 cm)

OPERATING POWER
120 VDC, Positive @ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Other Subs available
Available with Switching, Bond Gate, & Temp Gate Circuits



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LOGGING GEIGER GR

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8100-27572GM200-16-00

RECOMMENDED EQUIPMENT
8130-275B2MC210-03-00
see CCL section B

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

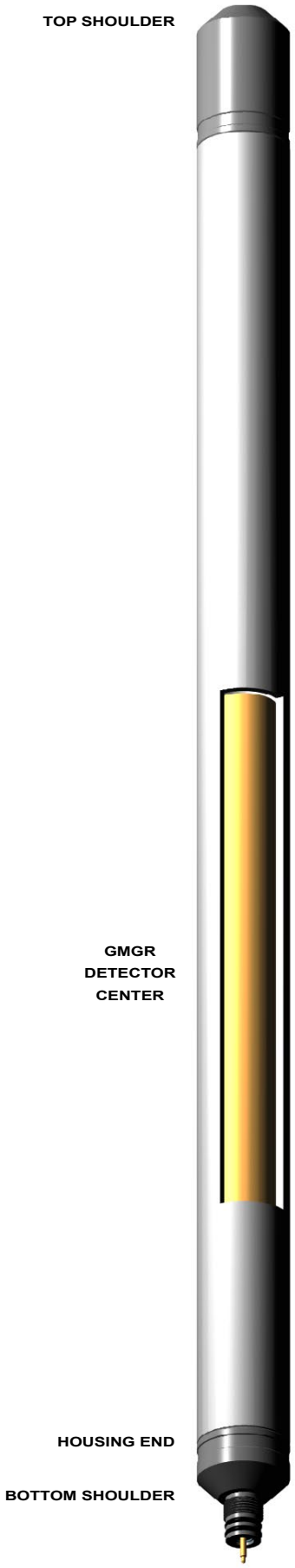
WEIGHT / LENGTH
47 lbs (21.31 kg) / 48.13” (122.24 cm)

TOOL SPACING
GR to Top Shoulder: 30.75” (78.11 cm)
GR to Housing End: 15.62” (39.69 cm)
GR to Bottom Shoulder: 17.38” (44.14 cm)

OPERATING POWER
120 VDC, Positive @ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Other Subs available
Available with Switching, Bond Gate, & Temp Gate Circuits



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SCINTILLATION GR TOOLS

CONTENTS

1" (2.54 cm) LOGGING SCINTILLATION GR D1

1 3/8" (3.49 cm) LOGGING SCINTILLATION GR D2

1 11/16" (4.29 cm) LOGGING SCINTILLATION GR D3

1 11/16" (4.29 cm) HT LOGGING SCINTILLATION GR D4

2 3/4" (6.99 cm) LOGGING SCINTILLATION GR D5

3 1/8" (7.94 cm) LOGGING SCINTILLATION GR D6

1 11/16" (4.29 cm) PERF. SCINTILLATION GR/CCL D7

1 11/16" (4.29 cm) HT PERF. SCINTILLATION GR/CCL/SHK D8

2" (5.08 cm) PERF. SCINTILLATION GR D9

2 3/4" (6.99 cm) PERF. SCINTILLATION GR D10

2 3/4" (6.99 cm) HT PERF. SCINTILLATION GR/CCL/SHK D11

2 3/4" (6.99 cm) TELEMETRY GR D12

3 1/8" (7.94 cm) PERF. SCINTILLATION GR D13

3 1/8" (7.94 cm) HT PERF. SCINTILLATION GR/CCL/SHK D14

1 3/4" (4.45 cm) MWD STEERING GR D15

1 1/2" (3.81 cm) MWD SCINTILLATION GR D16

Switching, Bond Gate, and Temperature Gate Circuits are available with Logging Gamma Rays

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Petitioner GR Energy Services - Ex. 1009, p. 159

LOGGING SCINTILLATION GR

1”
(2.54 cm)

D

SPECIFICATIONS

MODEL NUMBER
8100-10052SH062-06-00

RECOMMENDED EQUIPMENT
8130-10072MC073-03-00
see CCL section B

MAX TEMPERATURE RATING
350° F (176.7° C) *

PRESSURE RATING
15,000 PSI (103 MPa)

WEIGHT / LENGTH
10 lbs (4.54 kg) / 35.88” (91.12 cm)

TOOL SPACING
GR to Top Shoulder: 28.24” (71.73cm)
GR to Housing End: 6.63” (16.85 cm)
GR to Bottom Shoulder: 7.63” (19.39 cm)

OPERATING POWER
120 VDC, Positive @ ≈ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower temperature models Available with Switching, Bond Gate, & Temp Gate Circuits**



022B10A0 Mar-07

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LOGGING SCINTILLATION GR

1 3/8”
(3.49 cm)

D

SPECIFICATIONS

MODEL NUMBER
8100-13752SH062-06-00

RECOMMENDED EQUIPMENT
8130-13772MC103-02-00
see CCL section B

MAX TEMPERATURE RATING
350° F (176.7° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
27 lbs (12.25 kg) / 41.88” (106.36 cm)

TOOL SPACING
GR to Top Shoulder: 31.50” (80.01 cm)
GR to Housing End: 9.00” (22.86 cm)
GR to Bottom Shoulder: 10.38” (26.35cm)

OPERATING POWER
120 VDC, Positive @ ≈ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower temperature models**
Available with Switching, Bond Gate, & Temp Gate Circuits



022B13A0 Mar-07

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LOGGING SCINTILLATION GR

1 11/16”
(4.29 cm)

D

SPECIFICATIONS

MODEL NUMBER
8100-16872SH084-06-00

RECOMMENDED EQUIPMENT
8130-168B2MC129-02-00
see CCL section B

MAX TEMPERATURE RATING
400° F (204.4° C) *

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
20 lbs (9.07 kg) / 57.00” (144.78 cm)

TOOL SPACING
GR to Top Shoulder: 39.88” (101.28 cm)
GR to Housing End: 15.88” (40.32 cm)
GR to Bottom Shoulder: 17.13” (43.50 cm)

OPERATING POWER
120 VDC, Positive @ ≈ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower temperature models**
Available with Switching, Bond Gate, & Temp Gate Circuits



022B16A0 Mar-07

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HT LOGGING SCINTILLATION GR

1 11/16”
(4.29 cm)



022B16AH Jun-07

SPECIFICATIONS

MODEL NUMBER
8100-16892SH087-06-00

RECOMMENDED EQUIPMENT
8130-168B2MC129-02-00
see CCL section B

MAX TEMPERATURE RATING
450° F (232.2° C)*

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
20 lbs. (9.7 kg) / 57” (144.78 cm)

TOOL SPACING
GR to Top Shoulder: 16.10” (40.90 cm)
GR to Housing End: 39.65” (100.70 cm)
GR to Bottom Shoulder: 40.90” (103.88 cm)

OPERATING POWER
120 VDC, Positive @ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material
Anti-Coincedence
(GR/N pulses will not Collide)

AVAILABLE OPTIONS
*** Lower Temperature Ratings**

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LOGGING SCINTILLATION GR

2 3/4”
(6.99 cm)

D

SPECIFICATIONS

MODEL NUMBER
8100-27572SL125-04-00

RECOMMENDED EQUIPMENT
8130-275B2MC210-03-00
see CCL section B

MAX TEMPERATURE RATING
400° F (204.4° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
77 lbs (34.9 kg) / 48.13” (122.24 cm)

TOOL SPACING
GR to Top Shoulder: 31.05” (78.86 cm)
GR to Housing End: 15.33” (38.93 cm)
GR to bottom shoulder: 17.08” (43.38 cm)

OPERATING POWER
120 VDC, Positive @ ≈ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower temperature models**
Available with Switching, Bond Gate,
& Temp Gate Circuits
Fish Neck Top Optional



022B27A0 Mar-07

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LOGGING SCINTILLATION GR

3 1/8”
(7.94 cm)

D

SPECIFICATIONS

MODEL NUMBER
8100-31272SL137-03-00

RECOMMENDED EQUIPMENT
8130-312B2MC250-03-00
see CCL section B

MAX TEMPERATURE RATING
400° F (204.4° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
77 lbs (34.9 kg) / 45.88” (116.52cm)

TOOL SPACING
GR to Top Shoulder: 31.08” (78.94 cm)
GR to Housing End: 12.67” (32.18 cm)
GR to Bottom Shoulder: 14.80” (37.58 cm)

OPERATING POWER
120 VDC, Positive @ ≈ 45 mA
(Add 15 mA for CCL)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower temperature models**
Available with Switching, Bond Gate, & Temp Gate Circuits
Fish Neck Top Optional



022B31A0 Mar-07

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1 11/16”
(4.29 cm)

PERF. SCINTILLATION GR/CCL

D

SPECIFICATIONS

MODEL NUMBER
8100-16857SC084-06-06
Perforating GR with CCL

RECOMMENDED EQUIPMENT
3100-168-S200
see Shock Absorber section H

MAX TEMPERATURE RATING
350° F (176.7° C)

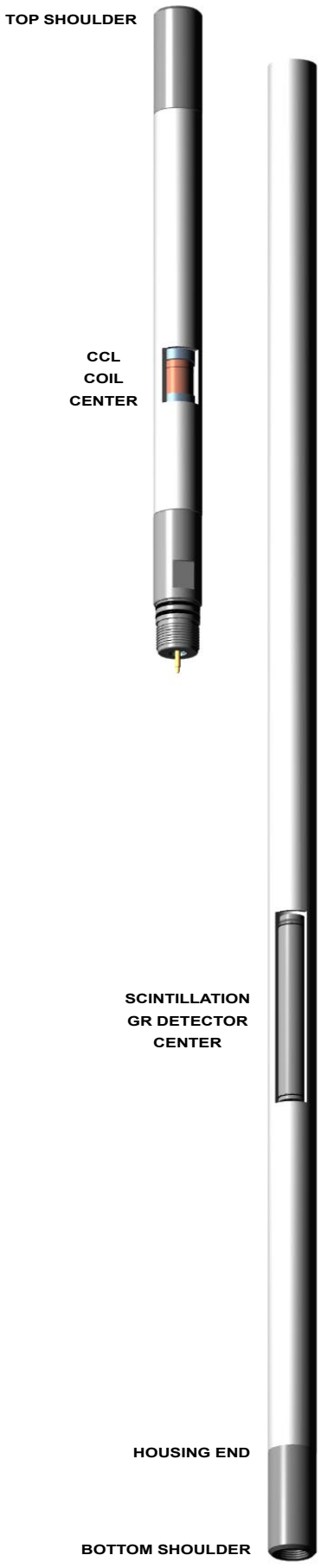
PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
28 lbs (12.7 kg) / 75.88” (192.72 cm)

TOOL SPACING
CCL to Top Shoulder: 13.45” (34.16 cm)
GR to CCL: 42.80” (108.72 cm)
GR to Housing End: 15.88” (40.32 cm)
GR to Bottom Shoulder: 19.63” (49.85 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material



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1 11/16” (4.29 cm)

HT PERF. SCINTILLATION GR/CCL/SHK

SPECIFICATIONS

MODEL NUMBER
8100-168B7SF070-06-0C-A

MAX TEMPERATURE RATING
500° F (260.0° C) *
* Lower Temperature Models Available

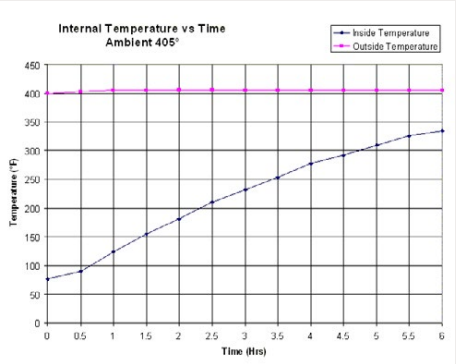
PRESSURE RATING
18,000 PSI (124 MPa)

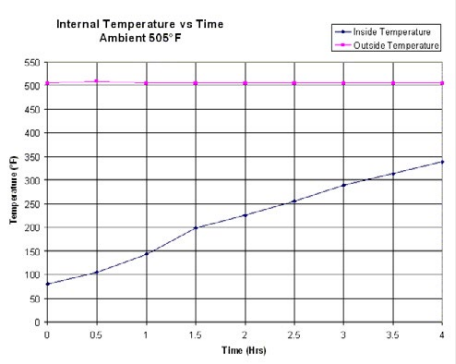
WEIGHT / LENGTH
43 lbs (19.50 kg) / 102.75” (260.98 cm)

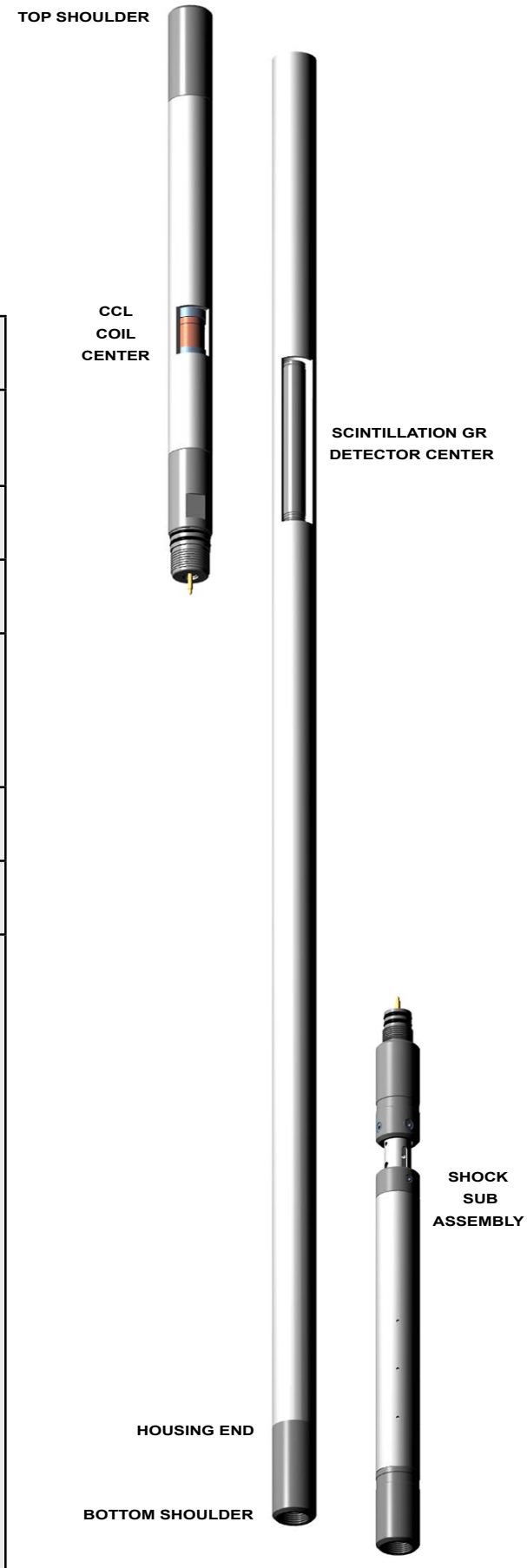
TOOL SPACING
CCL to Top Shoulder: 13.45” (34.16 cm)
GR to CCL: 24.03” (61.04 cm)
GR to Housing End: 40.77” (103.56 cm)
GR to Bottom Shoulder: 44.52” (113.08 cm)

OPERATING POWER
50 VDC, Pos @ ≈ 60 mA (Gun fires on Neg Voltage)

STANDARD FEATURES
H_2S Resistant Material & Includes Shock







02KB16AH Mar-07

D

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PERF. SCINTILLATION GR

2”
(5.08 cm)

SPECIFICATIONS

MODEL NUMBER
8100-20057SC084-06-06-A

MAX TEMPERATURE RATING
350° F (176.7° C)

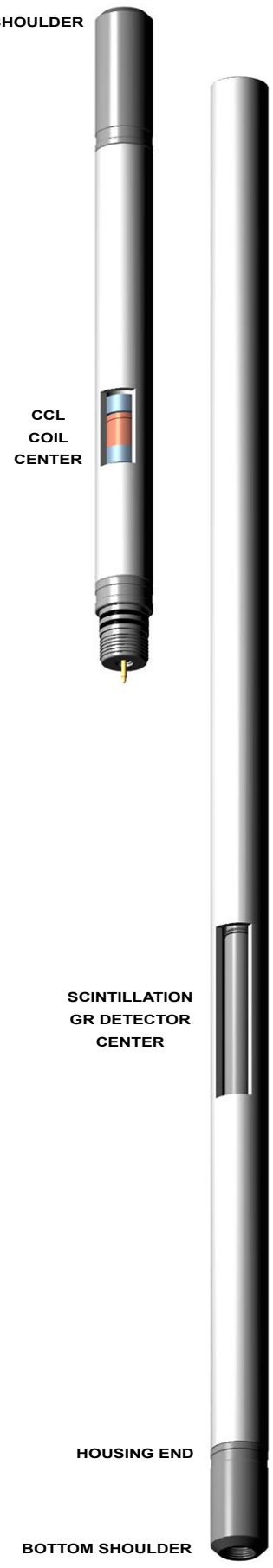
PRESSURE RATING
25,000 PSI (172 MPa)

WEIGHT / LENGTH
36 lbs (16.3 kg) / 75.75” (192.40 cm)

TOOL SPACING
CCL to Top Shoulder: 15.20” (38.61 cm)
GR to CCL: 40.89” (103.86 cm)
GR to Housing End: 15.91” (40.42 cm)
GR to Bottom Shoulder: 19.66” (49.94 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material
High Pressure



027B20A0 Apr-08

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PERF. SCINTILLATION GR

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8100-27557SC100-04-01

MAX TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
20,000 PSI (138 MPa)

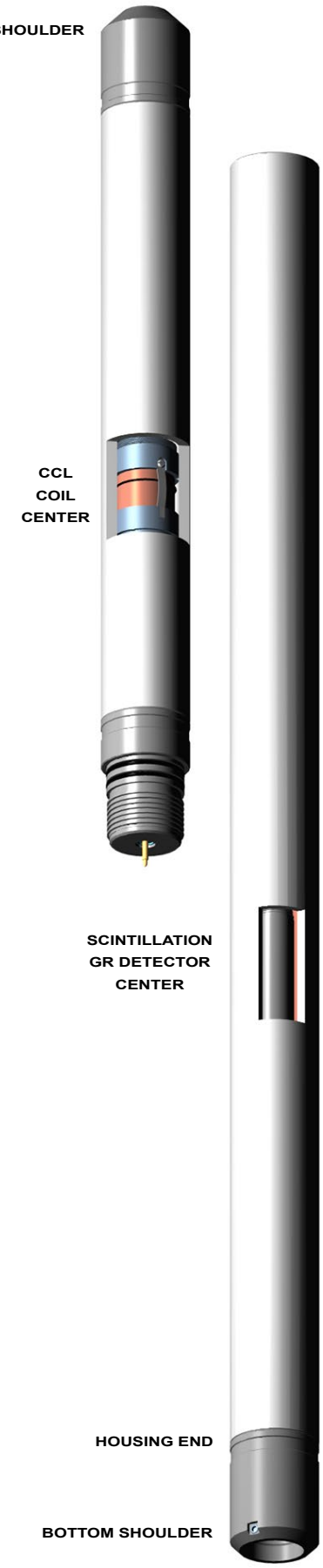
WEIGHT / LENGTH
80 lbs. (36.24 kg) / 70.31” (178.59 cm)

TOOL SPACING
CCL to Top Shoulder: 15.93” (40.45 cm)
GR to CCL: 35.55” (90.28 cm)
GR to Housing End: 15.34” (38.96 cm)
GR to Bottom Shoulder: 18.84” (47.85 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Fish Neck Top Optional



027B27A0 Mar-07

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HT PERF. SCINTILLATION GR/CCL/SHK

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8100-275B7SF100-04-0C-A

MAX TEMPERATURE RATING
500° F (260.0° C) *
* Lower Temperature Models Available

PRESSURE RATING
20,000 PSI (138 MPa)

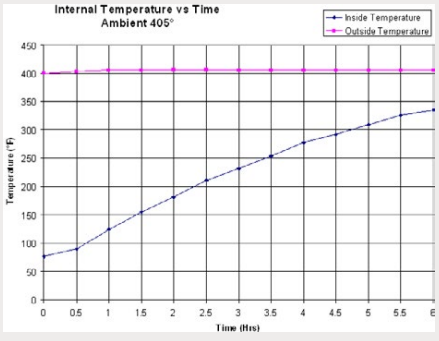
WEIGHT / LENGTH
102 lbs (46.26 kg) / 105.95” (269.11 cm)

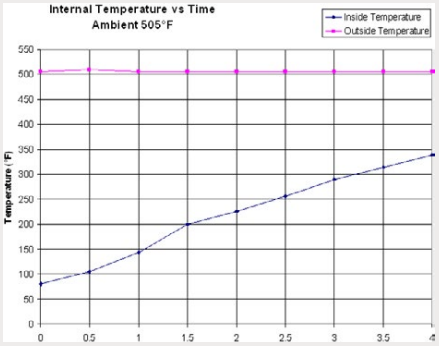
TOOL SPACING
CCL to Top Shoulder: 15.91” (40.40 cm)
GR to CCL: 25.46” (64.66 cm)
GR to Housing End: 38.32” (97.33 cm)
GR to Bottom Shoulder: 41.82” (106.23 cm)

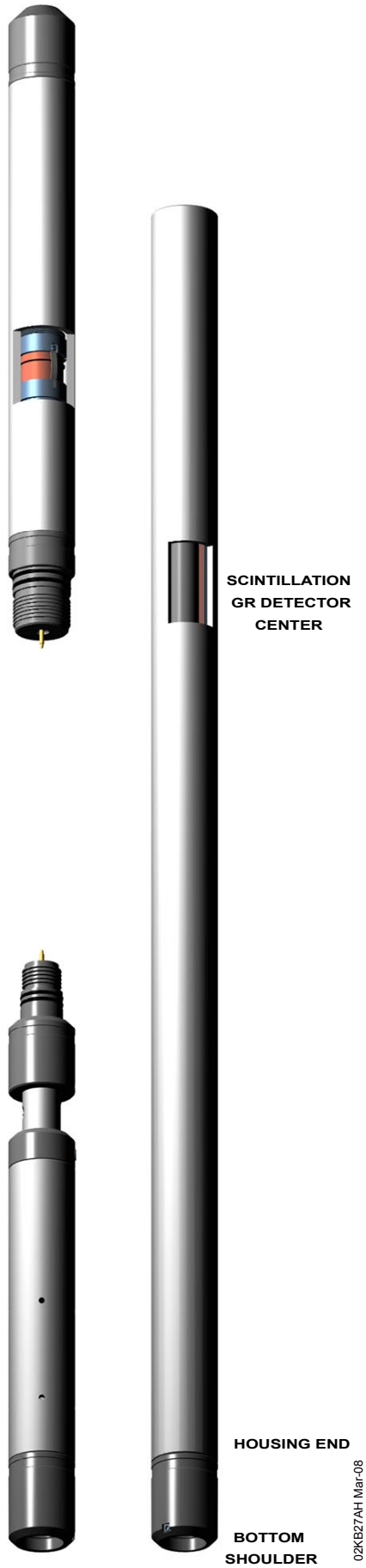
OPERATING POWER
50 VDC, Pos @ ≈ 60 mA (Gun fires on Neg Voltage)

STANDARD FEATURES
H_2S Resistant Material
Shock Sub Included

AVAILABLE OPTIONS
Fish Neck Top Optional







02KB27AH Mar-08

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TELEMETRY GR

2 3/4”
(6.99 cm)

D

SPECIFICATIONS

MODEL NUMBER
8100-2755GSC100-04-00

RECOMMENDED EQUIPMENT
8106-27552HE200-08-0B
see Compensated Neutron section J

MAX TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
77 lbs (34.92 kg) / 48.13” (122.24 cm)

TOOL SPACING
GR to Top Shoulder: 31.05” (78.86 cm)
GR to Housing End: 15.33” (38.93 cm)
GR to Bottom Shoulder: 17.08” (43.38 cm)

OPERATING POWER
120 VDC, Positive @ 60 mA
Do not apply Negative power to this tool

FEATURES
This Telemetry GR tool can be used with other pulse tools



02TB27A0 Mar-07

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PERF. SCINTILLATION GR

3 1/8”
(7.94 cm)

SPECIFICATIONS

MODEL NUMBER
8100-31257SC100-04-01

MAX TEMPERATURE RATING
350° F (176.7° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
73 lbs. (33.11 kg) / 60.63” (154.00 cm)

TOOL SPACING
CCL to Top Shoulder: 10.12” (25.69 cm)
GR to CCL: 34.51” (87.66 cm)
GR to Housing End: 13.12” (33.33 cm)
GR to Bottom Shoulder: 16.00” (40.63 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower temperature models**
Fish Neck Top Optional



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HT PERF. SCINTILLATION GR/CCL/SHK

3 1/8”
(7.94 cm)

SPECIFICATIONS

MODEL NUMBER
8100-312B7SF100-04-0C-A

MAX TEMPERATURE RATING
500° F (260.0° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

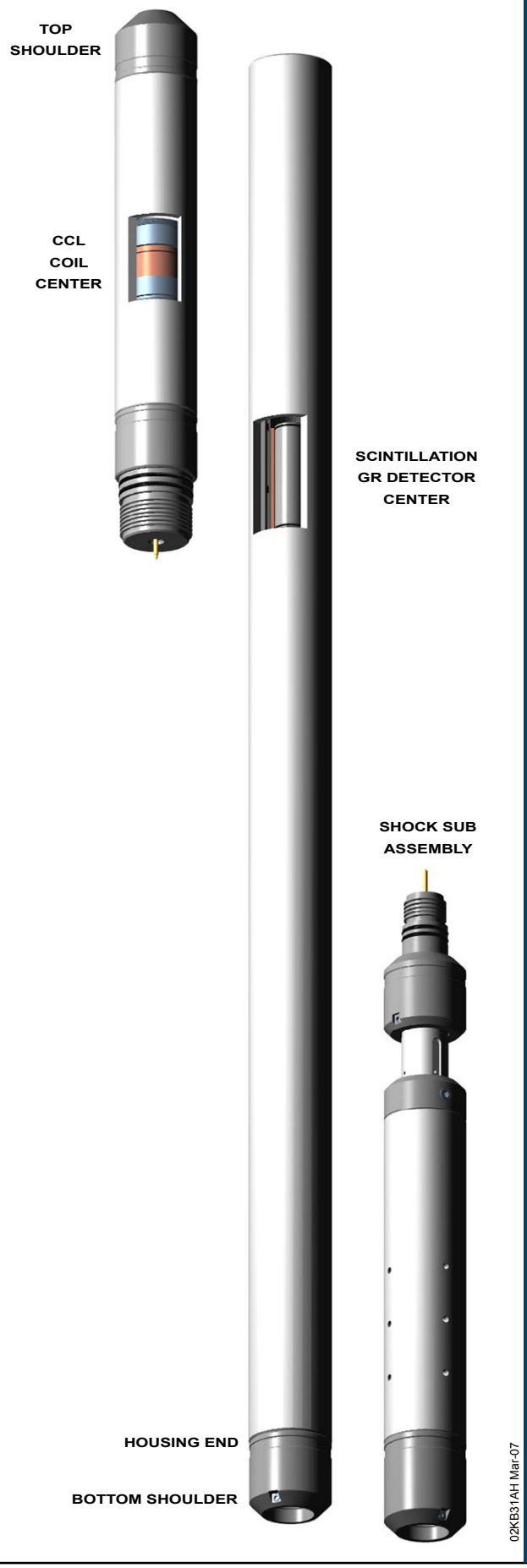
WEIGHT / LENGTH
130 lbs. (58.96 kg) / 99.19” (251.94 cm)

TOOL SPACING
CCL to Top Shoulder: 10.12” (25.70 cm)
GR to CCL: 24.89” (63.21 cm)
GR to Housing End: 38.50” (97.78 cm)
GR to Bottom Shoulder: 41.37” (105.09 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 60 mA
(Gun fires on Negative Voltage)

STANDARD FEATURES
H_2S Resistant Material
Shock Sub included

AVAILABLE OPTIONS
*** Lower temperature models**
Fish Neck Top Optional



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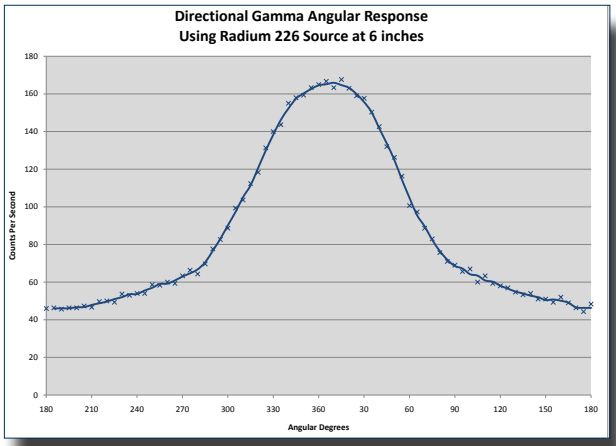
MWD Gamma Detector Module

With the increasing complexity of directional drilling operations, timely and accurate downhole measurements are vital to achieve a wells objective.

Hunting Titan's ruggedized MWD Gamma Detector Module (MWD-GDM) has been field proven in both conventional MWD drilling applications and in the harsh multiphase drilling environments associated with electromagnetic (EM-MWD) systems. Scintillation crystals and integral PMT assemblies are manufactured in-house using proprietary assembly and shock-mounting technology. This technology provides outstanding protection at higher shock and vibration loads, and minimizes detector failures associated with severe downhole drilling conditions.

The MWD-GDM can be fully customized upon request. Some of the options available include choice of negative or positive pulse outputs, standard or directional (focused) GR and floating or ungrounded chassis for EM applications

Solid, reliable and backed by a company with a history of durable products, Hunting Titan's MWD-GDM provides the best detectors for downhole MWD systems.



MWD SPECIFICATIONS

Part Number Series Standard Ruggedized MWD Focused MWD	 8100-17558SH 8100-17558DG
MEASUREMENTS	
Thin Bed Resolution 8 in. hole diameter @ 50% points	6.8 in (173 mm)
Measurement Range	0 to 5000 API
Accuracy	±5% to 150 °C (302 °F) ±10% to 175 °C (347 °F)
Sensitivity (beryllium copper housing)	0.82 counts per API
Effective Angular Window	±45°
ENVIRONMENTAL	
Operating Temperature Rating	-40 to 175 °C (-40 to 347 °F)
Survival Temperature	200 °C (392 °F)
Max. Heat/Cool Range	3 °C/min (5.4 °F/min)
Vibration (3 Axis)	30 G RMS (50 – 1000 Hz sweep)
Shock (Z Axis)	500 G (0.5 ms)
Shock (X-Y Axis)	1000 G (0.5 ms)
MECHANICAL	
O.D. with Shock Rings	1.49 in (37.8 mm)
Length	15.38 in (39.1 mm)
Electrical Connections	MDM 15-pin male/female
ELECTRICAL (WITH HAMAMATSU PMT)	
Operating Voltage Range	18-38 VDC
Max. Voltage Input	40 VDC
Operating Current (constant power)	10±5 mA
Output Pulse TTL or CMOS	Negative (+5 to 0 V)
Output Pulse Width	2 to 5 µs
Active NaI Crystal Size	0.84 x 4.18 in (21.3 x 106.2 mm)
Front/Back Count Ratio	3.5

APPLICATIONS

- Conventional MWD/LWD systems
- Electromagnetic MWD systems
- Retrievable and collar mounted tools

FEATURES

- Industry exclusive shock and vibration technology†
- Continuous operation at 175 °C (347 °F)
- High sensitivity and repeatability
- Low power operations
- Industry standard MDM 15 pin connectors

BENEFITS

- Compact and rugged
- High survivability in underbalanced and air drilling environments
- Not affected by pulser electrical noise
- Detector design minimizes vibration induced noise
- Maximizes battery life
- Standard connectors allow drop-in replacement capabilities



D

Right Tools. Right Location. Right Time.

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HUNTING
Hunting Titan

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
8100-15038SL081-04-XX

MAX TEMPERATURE RATING
302° F (150° C)

WEIGHT / LENGTH
2 lbs (.91 cm) / 26.92” (68.37 cm)

TOOL SPACING
GR to Top: 21.84” (55.47 cm)

GR to Bottom: 5.08” (12.90 cm)

Overall Dia: 1.18” (3.00 cm)
O.D. with Shock includes O-Rings:
1.20” (3.05 cm)

VOLTAGE INPUT
+20 to 30 VDC

CURRENT INPUT
12.75 ± .75 mA @ 25 Volts

FEATURES
Sensitivity
.9 Counts / API

Accuracy
0-150 API - ± 4 API *
150-500 API - ± 8 API *

**ROP of 180 ft/hr, 2 samples/ft, 10 sec. samples*

Vertical Resolution
8” (20.32 cm) given proper formation contrast

Maximum Heat / Cool Range
3° C / Minute

Vibration
25 G rms 500 – 1000 Hz

Operating Shock)
750 G, 1/2 sine 1 mS

Digital Interface
5 – 0 Volts negative pulse



1 1/2”
(3.81 cm)

MWD SCINTILLATION GR

D

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DUAL FIRE TOOLS

CONTENTS

DF 1 11/16" (4.29 cm) SCINTILLATION GR / SHK (350F) E1

DF 1 11/16" (4.29 cm) SCINTILLATION GR / SHK (500F) E2

DF 1 11/16" (4.29 cm) GEIGER GR / SHK E3

DF 1 11/16" (4.29 cm) PRESS / TEMP / CCL / SHK I4

DF 1 11/16" (4.29 cm) SCINTILLATION GPT / CCL / SHK E5

DF 2 3/4" (6.99 cm) SCINTILLATION GR / SHK E6

DF 2 3/4" (6.99 cm) SCINTILLATION GR / SHK E7

DF 2 3/4" (6.99 cm) GEIGER GR / SHK E8

DF 2 3/4" (6.99 cm) PRESS / TEMP / CCL / SHK E9

DF 2 3/4" (6.99 cm) SCINTILLATION GPT / CCL / SHK E10

DF 3 1/8" (7.94 cm) SCINTILLATION GR / SHK E11

Dual Fire Tools: General Information and Caution

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DUAL FIRE TOOLS

E

The temperature rating of Titan Gamma Ray tools can be up to 500° F (260° C) for the Scintillation Gamma Ray and up to 400° F (204° C) for the Geiger Gamma Ray. The temperature rating for the Tool covered is located on the Specification Sheet.

- Titan policy requires companies running both single- and dual-fire systems to convert all perforating gamma rays to operate on the same cablehead voltage (50 volts).
- Titan Dual-Fire Gamma Ray tools will be distinguished from Single Fire tools by a **GREEN BAND** on the bottom sub marked **"CAUTION: DUAL FIRE"**.
- **UNDER NO CIRCUMSTANCES SHOULD A.C. VOLTAGE EVER BE APPLIED TO ANY TITAN PERFORATING GAMMA RAY TOOL STRING.**

CAUTION:

THIS TOOL IS DESIGNED TO FIRE A PERFORATING GUN USING BOTH POSITIVE AND NEGATIVE VOLTAGES. DO NOT APPLY MORE THAN +65 VDC UNLESS YOU INTEND TO FIRE THE POSITIVE GUN.

• See Titan Website for Selective Fire Policy.

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1 11/16”
(4.29 cm)

DF SCINTILLATION GR / SHK

SPECIFICATIONS

MODEL NUMBER
8100-1685FSC084-06-0C
DF Scintillation GR / CCL / Int. Shock

MAX TEMPERATURE RATING
350° F (176.67° C)

PRESSURE RATING
18,000 PSI (124 MPa)

OPERATING VOLTAGE
50 VDC, Positive @ ≈ 50 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
43 lbs (19.50 kg) / 94.13” (239.08 cm)

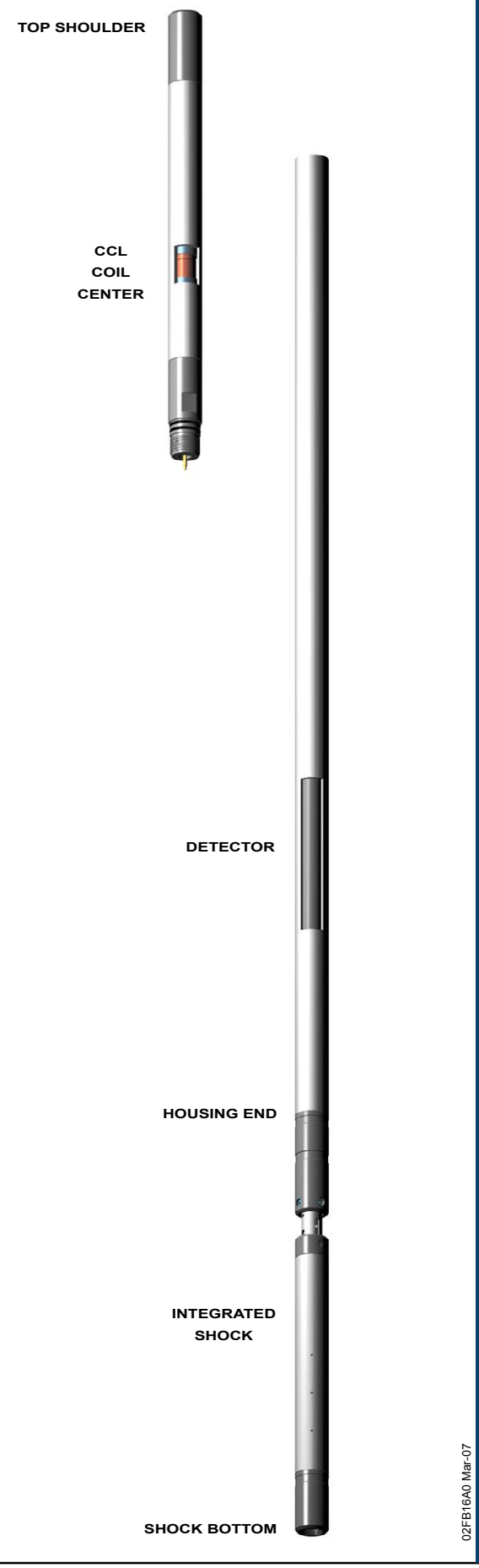
TOOL SPACING
Top Shoulder to CCL:
13.45” (34.16 cm)

CCL to Detector:
46.88” (119.07 cm)

Detector to Housing End:
11.80” (29.97 cm)

Housing End to Shock Bottom:
22.00” (55.88 cm)

STANDARD FEATURES
H_2S Resistant Material



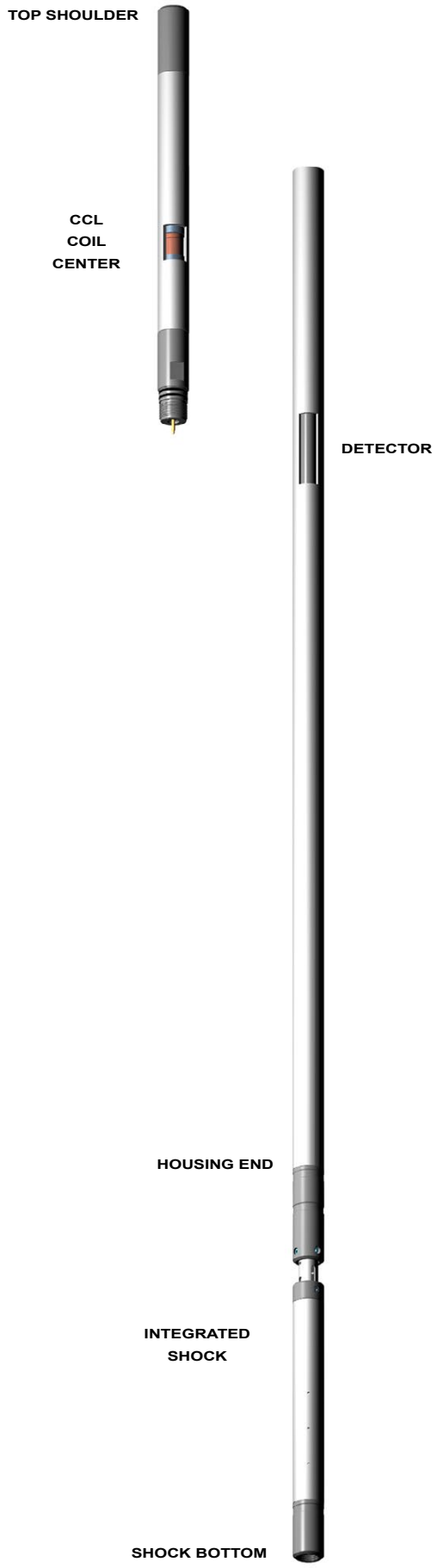
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DF SCINTILLATION GR / SHK

1 11/16”
(4.29 cm)



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SPECIFICATIONS

MODEL NUMBER
8100-168BFSF070-06-0C
DF Scintillation GR / CCL / Int. Shock

MAX TEMPERATURE RATING
500° F (260° C)

PRESSURE RATING
18,000 PSI (124 MPa)

OPERATING VOLTAGE
50 VDC, Positive @ ≈ 60 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
43 lbs (19.50 kg) / 100.25” (254.64 cm)

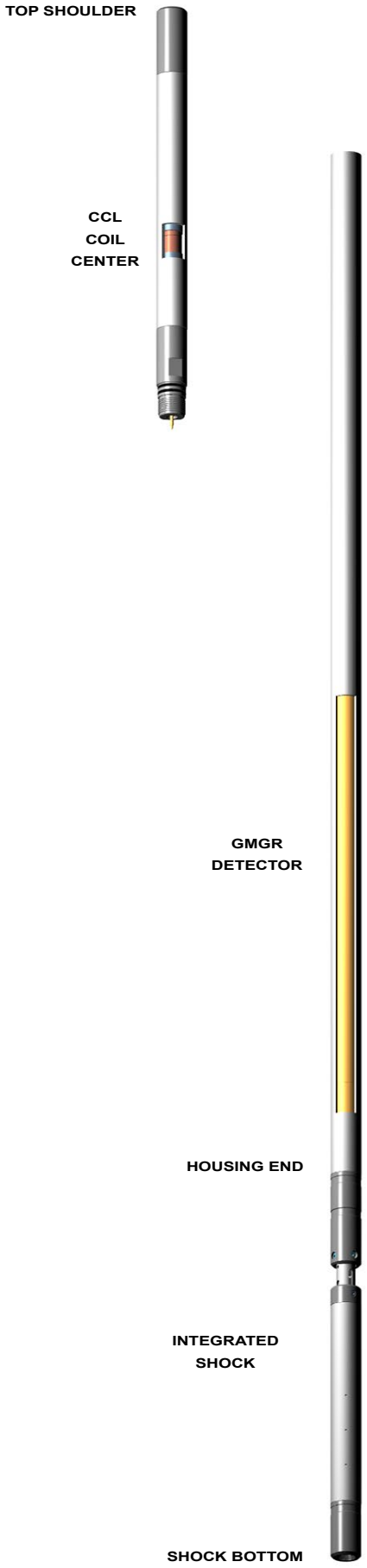
TOOL SPACING
Top Shoulder to CCL: 13.45” (34.16 cm)
CCL to Detector: 24.03” (61.04 cm)
Detector to Housing End: 40.77” (103.56 cm)
Housing End to Shock Bottom: 22.00” (55.88 cm)

STANDARD FEATURES
H_2S Resistant Material

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DF GEIGER GR / SHK

1 11/16”
(4.29 cm)



SPECIFICATIONS

MODEL NUMBER
8100-1687FGM137-18-0C
DF Geiger GR / CCL / Int. Shock

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
18,000 PSI (124 MPa)

OPERATING VOLTAGE
50 VDC, Positive @ ≈ 50 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
43 lbs (19.50 kg) / 102.26” (259.71 cm)

TOOL SPACING
Top Shoulder to CCL: 13.45” (34.15 cm)
CCL to Detector: 49.59” (125.95 cm)
Detector to Housing End: 17.22” (43.73 cm)
Housing End to Shock Bottom: 22.00” (55.88 cm)

STANDARD FEATURES
H_2S Resistant Material

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SPECIFICATIONS

MODEL NUMBER

8135-168BFPSXXX-XX-0C
Dual Fire configuration with CCL & Shock

MAX TEMPERATURE RATING

500° F (260° C) *

PRESSURE RATING

18,000 PSI (124 MPa)

WEIGHT / LENGTH

40 lbs (18.14 kg) / 117.00" (297.18 cm)

TOOL SPACING

CCL to Top Shoulder: 13.45" (34.17 cm)
CCL to Plug: 9.73" (24.71 cm)
Plug to Housing End: 73.44" (186.54 cm)
Plug to Press Bottom: 77.07" (195.75 cm)
Press Bottom to Shock Bottom: 16.75" (42.55 cm)

OPERATING POWER

50 VDC, Positive @ ≈ 55 mA
Dual Fire: Gun fires on Positive
(over voltage) and Negative voltage

ACCURACY

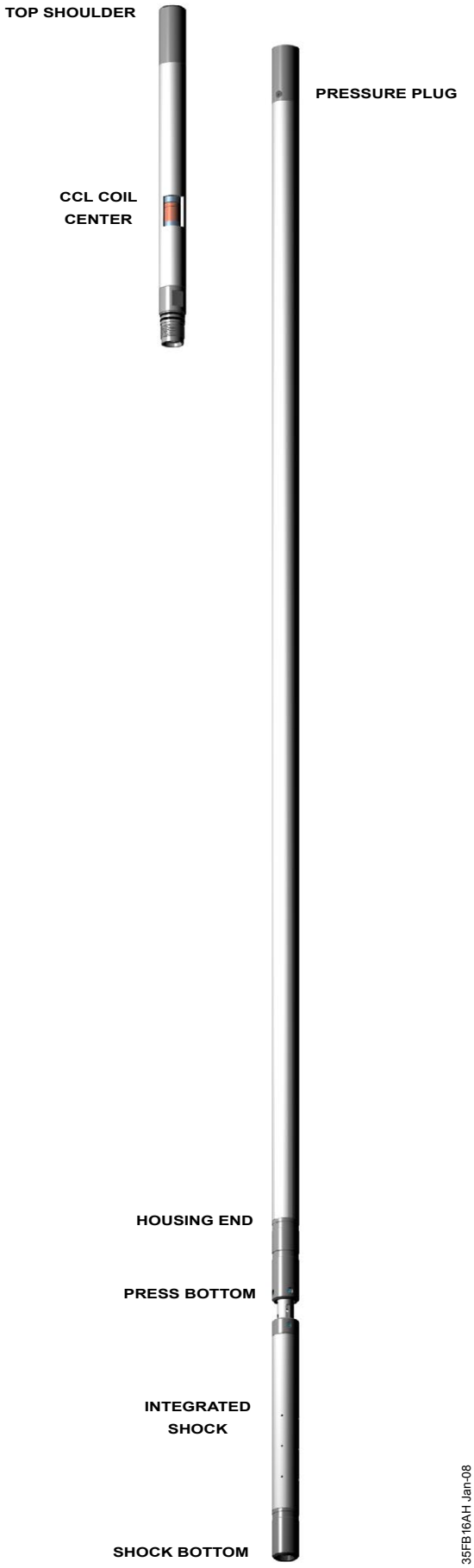
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES

H_2S Resistant Material

AVAILABLE OPTIONS

*** Lower Temp Models available**
Pulse or Telemetry configuration



1 11/16"
(4.29 cm)

DF PRESS / TEMP / CCL / SHK

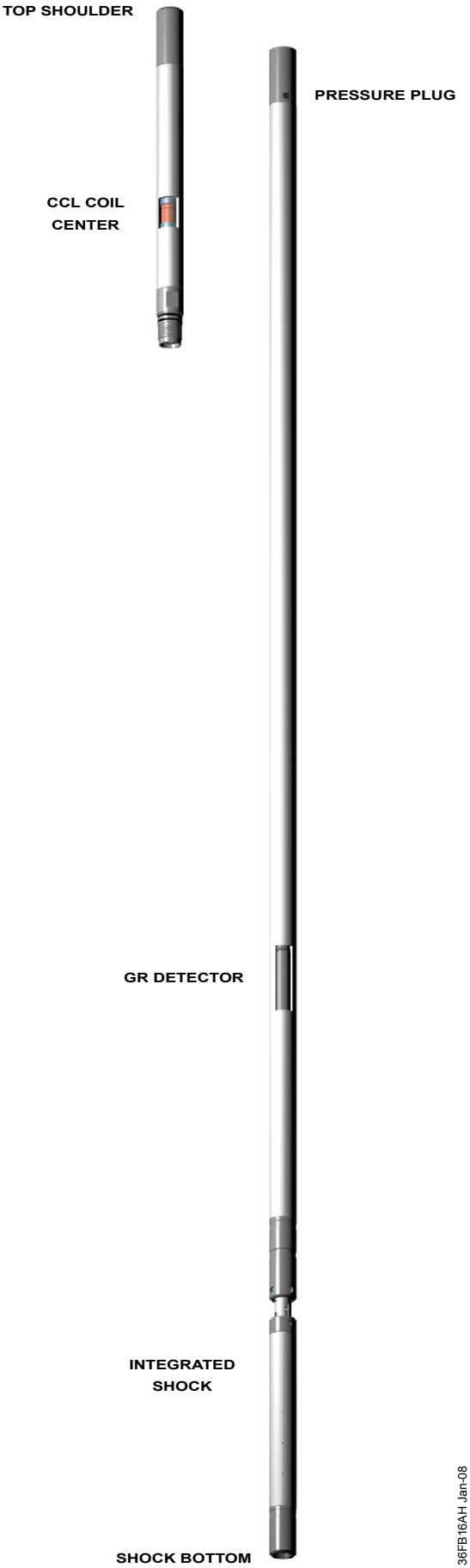
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DF SCINTILLATION GPT / CCL / SHK

1 11/16”
(4.29 cm)



SPECIFICATIONS

MODEL NUMBER
8136-168BFSF070-06-0C
Dual Fire configuration with CCL & Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
40 lbs (18.14 kg) / 117.00” (297.18 cm)

TOOL SPACING
CCL to Top Shoulder: 13.45” (34.17 cm)
CCL to Plug: 9.73” (24.71 cm)
Plug to GR Detector: 57.81” (146.85 cm)
GR Detector to CCL: 67.54” (171.56 cm)
GR to Shock Bottom: 36.00” (91.45 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 55 mA
Dual Fire: Gun fires on Positive
(over voltage) and Negative voltage

ACCURACY
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower Temp Models available**

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DF SCINTILLATION GR / SHK

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8100-2755FSC100-04-0C
DF Scintillation GR / CCL / Int. Shock

MAX TEMPERATURE RATING
350° F (176.66° C)

PRESSURE RATING
20,000 PSI (138 MPa)

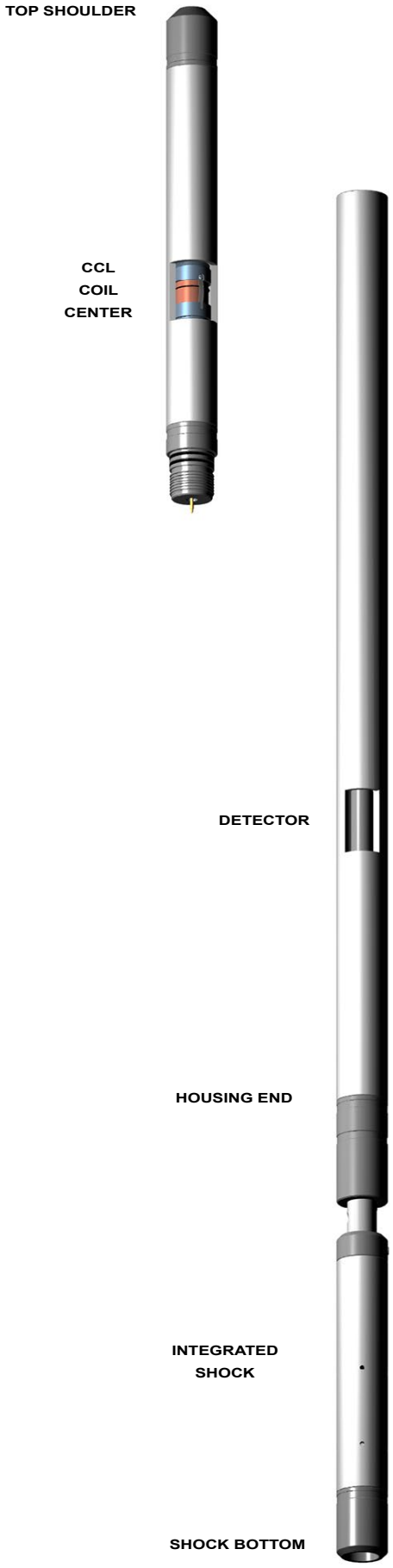
OPERATING VOLTAGE
50 VDC, Positive @ ≈ 50 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
88 lbs (39.92 kg) / 100.59” (255.50 cm)

TOOL SPACING
Top Shoulder to CCL: 15.93” (40.46 cm)
CCL to Detector: 43.98” (111.72 cm)
Detector to Housing End: 15.36” (39.00 cm)
Housing End to Shock Bottom: 25.32” (64.32 cm)

STANDARD FEATURES
H_2S Resistant Material

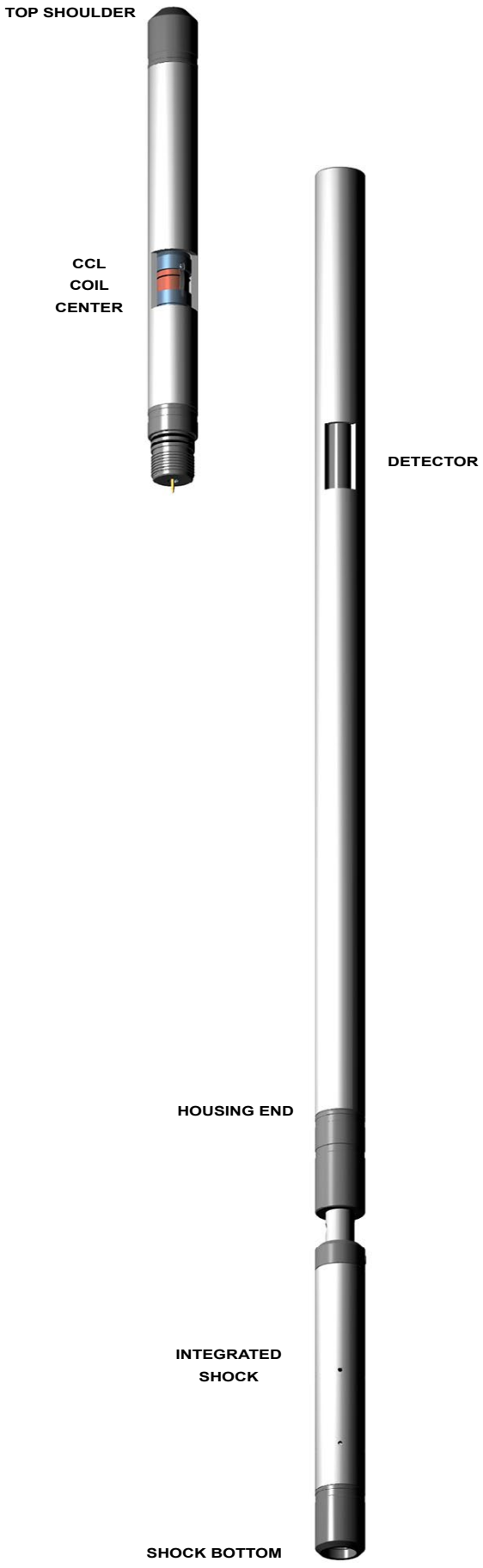


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DF SCINTILLATION GR / SHK

2 3/4”
(6.99 cm)



SPECIFICATIONS

MODEL NUMBER
8100-275BFSF100-04-0C
DF Scintillation GR / CCL / Int. Shock

MAX TEMPERATURE RATING
500° F (260° C)

PRESSURE RATING
20,000 PSI (138 MPa)

OPERATING VOLTAGE
50 VDC, Positive @ ≈ 50 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
102 lbs (46.27 kg) / 105.01” (266.72 cm)

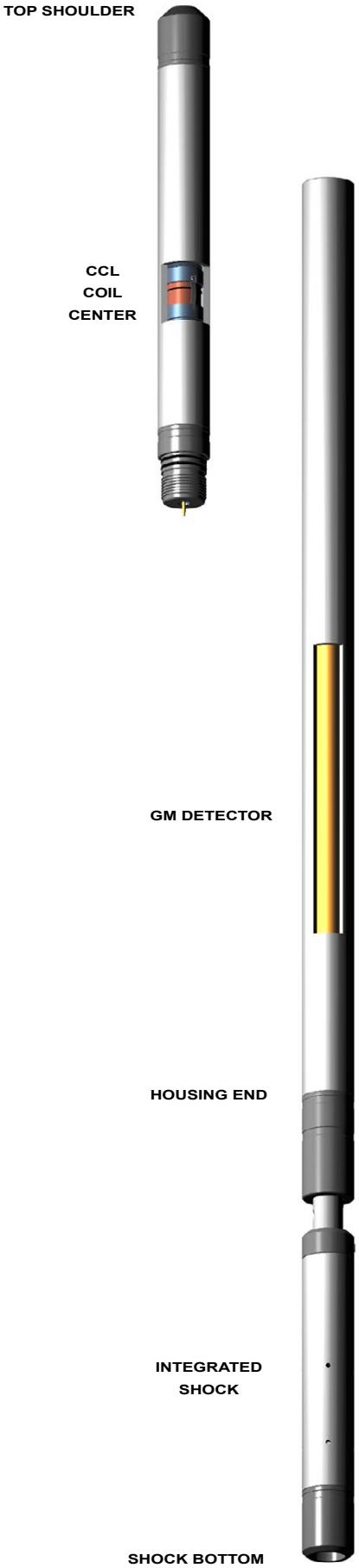
TOOL SPACING
Top Shoulder to CCL: 15.91” (40.40 cm)
CCL to Detector: 25.46” (64.66 cm)
Detector to Housing End: 38.32” (97.34 cm)
Housing End to Shock Bottom: 25.32” (64.32 cm)

STANDARD FEATURES
H_2S Resistant Material

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DF GEIGER GR / SHK

2 3/4”
(6.99 cm)



SPECIFICATIONS

MODEL NUMBER
8100-2757FGM137-18-0C
DF Geiger GR / CCL / Int. Shock

MAX TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

OPERATING VOLTAGE
50 VDC, Positive @ ≈ 50 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
80 lbs (36.29 kg) / 100.64” (255.61 cm)

TOOL SPACING
Top Shoulder to CCL: 15.91” (40.40 cm)
CCL to Detector: 42.64” (108.30 cm)
Detector to Housing End: 16.77” (42.59 cm)
Housing End to Shock Bottom: 25.32” (64.32 cm)

STANDARD FEATURES
H_2S Resistant Material

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SPECIFICATIONS

MODEL NUMBER

8135-275BFPSXXX-XX-0C
Dual Fire configuration with CCL & Shock

MAX TEMPERATURE RATING

500° F (260° C) *

PRESSURE RATING

20,000 PSI (138 MPa)

WEIGHT / LENGTH

125 lbs (56.70 kg) / 116.58" (296.10 cm)

TOOL SPACING

CCL to Top Shoulder: 15.91" (40.40 cm)
CCL to Plug: 13.59" (34.53 cm)
Plug to Housing End: 64.19" (163.04 cm)
Plug to Press Bottom: 67.38" (171.14 cm)
Press Bottom to Shock Bottom: 22.89" (58.13 cm)

OPERATING POWER

50 VDC, Positive @ 60 mA
Dual Fire: Gun fires on Positive
(over voltage) and Negative voltage

ACCURACY

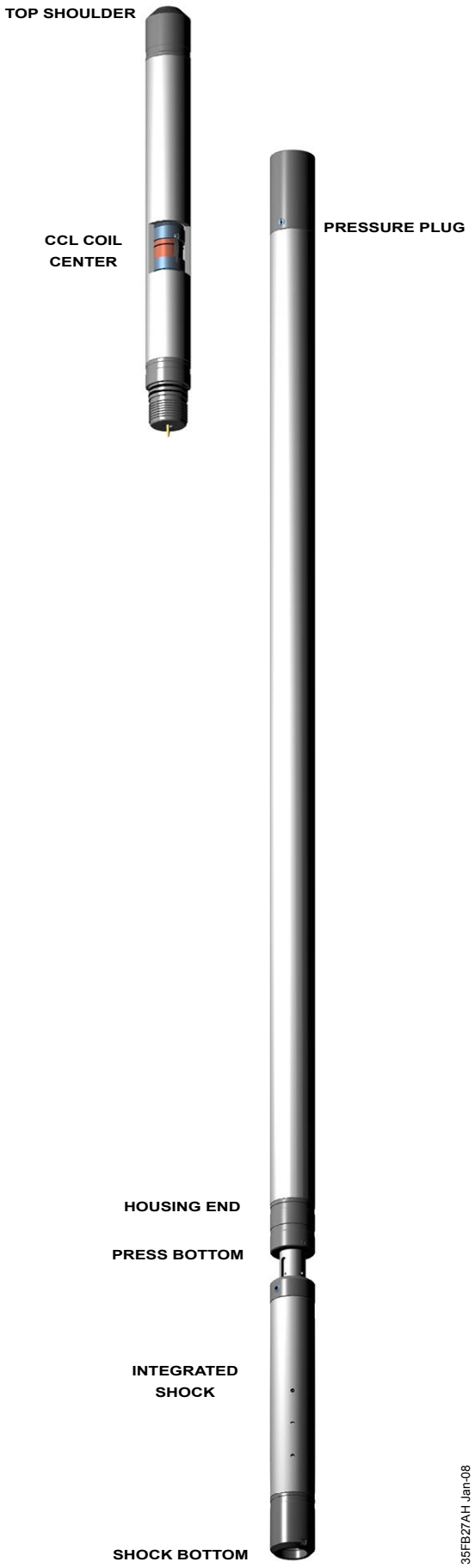
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES

H_2S Resistant Material

AVAILABLE OPTIONS

*** Lower Temp Models available**
Pulse or Telemetry configuration



2 3/4"
(6.99 cm)

DF PRESS / TEMP / CCL / SHK

E

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DF SCINTILLATION GPT / CCL / SHK

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8136-275BFSF100-04-0C
Dual Fire configuration with CCL & Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
125 lbs (56.70 kg) / 116.58” (296.10 cm)

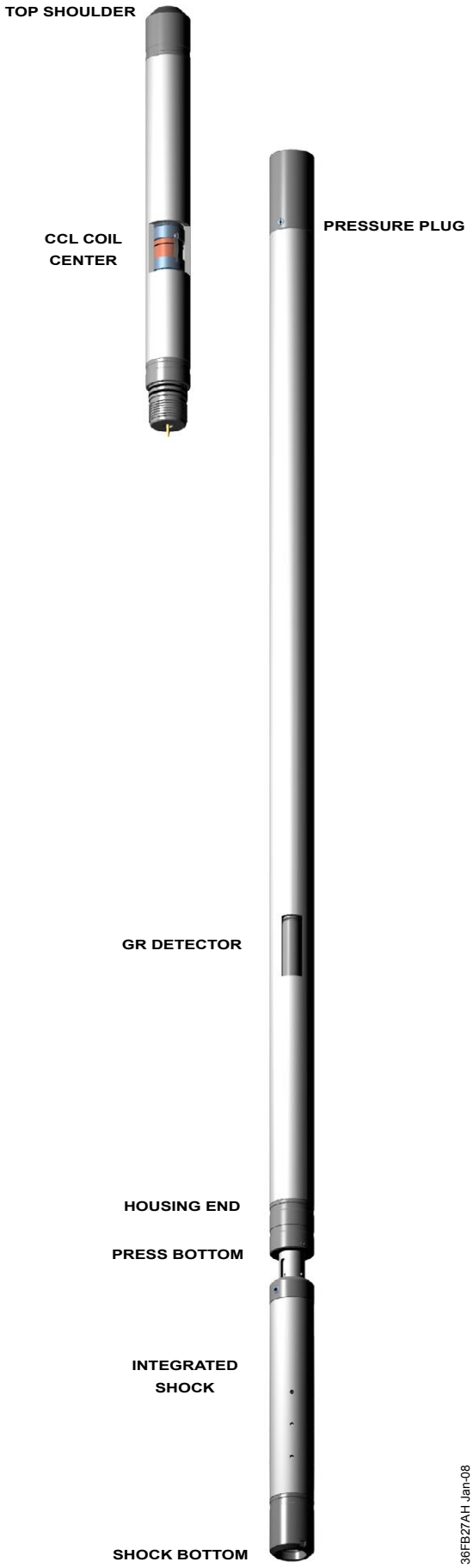
TOOL SPACING
CCL to Top Shoulder: 15.91” (40.40 cm)
CCL to Plug: 13.59” (34.53 cm)
Plug to GR: 47.65” (121.04 cm)
GR to CCL: 61.24” (155.57 cm)
GR to Shock Bottom: 39.43” (100.13 cm)

OPERATING POWER
50 VDC, Positive @ 60 mA
Dual Fire: Gun fires on Positive
(over voltage) and Negative voltage

ACCURACY
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** Lower Temp Models available**
Pulse or Telemetry configuration



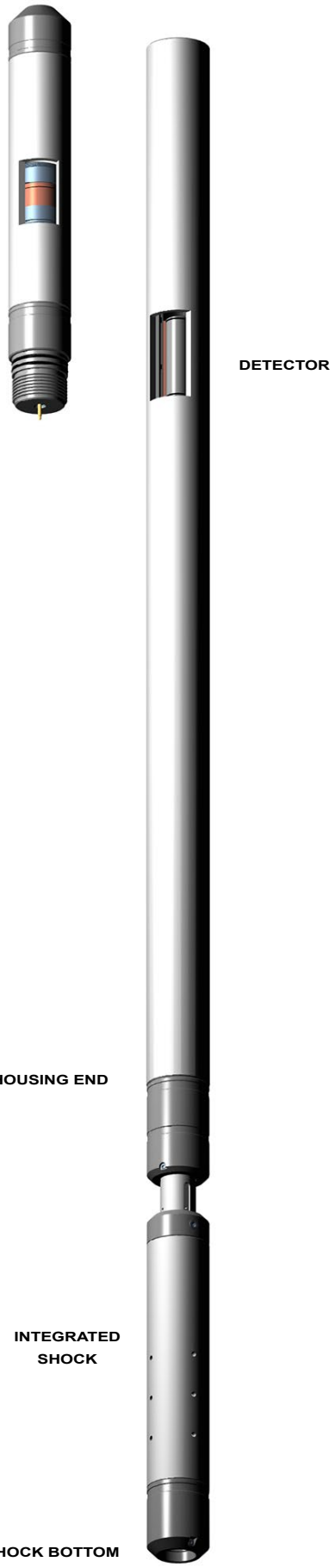
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DF SCINTILLATION GR / SHK

3 1/8”
(7.94 cm)



02FB31AH Mar-07

SPECIFICATIONS

MODEL NUMBER
8100-312BFSF100-04-0C
DF Scintillation GR / CCL / Int. Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

OPERATING VOLTAGE
50 VDC, Positive @ ≈ 50 mA

Gun Fires on Positive (over voltage) and Negative voltage: - Dual Fire

WEIGHT / LENGTH
130 lbs (58.96 kg) / 98.39” (249.87 cm)

TOOL SPACING
Top Shoulder to CCL: 10.12” (25.70 cm)
CCL to Detector: 24.89” (63.21 cm)
Detector to Housing End: 38.50” (97.78 cm)
Housing End to Shock Bottom: 24.88” (63.18 cm)

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
*** 350° F (176.7° C) rated tool**
Fish Neck Top Sub

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PRODUCTION LOGGING TOOLS

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WIRELINE TELEMETRY.....F1
PRODUCTION LOGGING CCL.....F2
PL GAMMA RAY.....F3
PL TEMPERATURE.....F4
PL FLUID CAPACITANCE.....F5
PL FLOW METER SPINNER.....F6
STRAIN GAUGE PRESSURE.....F7

WIRELINE TELEMETRY

F

SPECIFICATIONS

MODEL NUMBER
8160-SERIES

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
7 lbs (3.2 kg) / 19.88" (50.48 cm)

TOOL SPACING
Top Shoulder to Housing End:
18.62" (47.31 cm)
Housing End to Bottom Shoulder:
1.25" (3.18 cm)

OPERATING POWER
60 - 100 VDC @ 7 mA
(Alone)

60 - 100 VDC @ 18 mA
(With tools attached)

FEATURES
Tool Connections
Reverse pin / receptacle GOI

H_2S Resistant Material

Available in
1 7/16" (3.65 cm) O.D.
1 11/16" (4.29 cm) O.D.



Provides two-way serial communication between the surface equipment and the Production Logging tool string through a standard single conductor wireline. Data from surface equipment to tool string encoded into 8 bit word. Data from tool string to surface equipment encoded into either 12 bit or 24 bit word. Data verification provided by a transmission of a checksum word with every data frame. 20 12 bit channels available for data*. One channel used to provide a control word echo from tool string to surface equipment – providing operator with immediate confirmation that the tool string has received a control command.

*The 20 12 bit data channels can be combined to produce 10 channels of 24 bit data, or any other combination available for logging tool data.

600B16A0 Jan-07

PRODUCTION LOGGING CCL

F

SPECIFICATIONS

MODEL NUMBER
8161-SERIES

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
11 lbs (4.9 kg) / 22.00” (55.88 cm)

TOOL SPACING
CCL to Top Shoulder: 13.45” (34.16 cm)
CCL to Housing End: 4.92” (12.51 cm)
CCL to Bot. Shoulder: 8.55” (21.72 cm)

OPERATING POWER
12 VDC @ 8 mA

FEATURES
Tool Connections
Reverse pin / receptacle GOI

H_2S Resistant Material

Available in
1 7/16” (3.65 cm) O.D.
1 11/16” (4.29 cm) O.D.



The Casing Collar Locator (CCL) responds to metallic mass changes in the borehole such as at tubing collars and perforations. Two versions are available: one that transmits data to the surface as line voltage modulation, and one that sends digital data to the telemetry section. The line voltage modulation CCL must be run above and the digital CCL must be run below the PL Wireline Telemetry tool. The CCL may be run simultaneously with all other Titan Production Logging Tools.

Applications:

- Depth correlation
- Locating perforations, packers, nipples, and other mechanical components of the borehole

610B16A0 Jan-07

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PL GAMMA RAY

F

SPECIFICATIONS

MODEL NUMBER
8162-SERIES

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
8.5 lbs (3.9 kg) / 25.06" (63.66 cm)

TOOL SPACING
Detector to Top Shoulder: 17.05" (43.31 cm)
Detector to Housing End: 6.76" (17.18 cm)
Detector to Bot. Shoulder: 8.01" (20.35 cm)

OPERATING POWER
12 VDC @ 26 mA

FEATURES
Tool Connections
Reverse pin / receptacle GOI

H_2S Resistant Material

Available in
1 7/16" (3.65 cm) O.D.
1 11/16" (4.29 cm) O.D.



The Gamma Ray Tool uses a sensitive Scintillation detector and measures natural radioactivity of well formations. The Gamma Ray Tool is run below a Telemetry Section which supplies power to the tool and transmits the gamma ray data to the surface. The tool may be run simultaneously with all other Titan Production Logging Tools.

Applications:

- Depth correlation
- Evaluation of shale content of formations
- Locating radioactive frac sand
- Locating radioactive markers in casing collars

620B16A0 Jan-07

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PL TEMPERATURE

F

SPECIFICATIONS

MODEL NUMBER
8163-SERIES

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
7 lbs (3.2 kg) / 15.38” (39.05 cm)

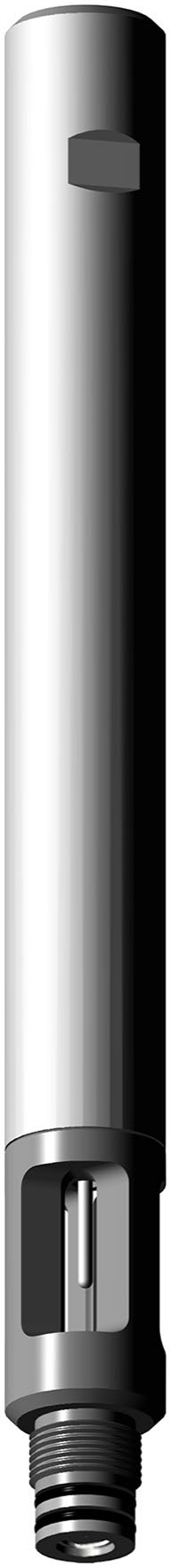
TOOL SPACING
Sensor to Top Shoulder:
13.28” (33.73 cm)

Sensor to Bottom Shoulder:
2.10” (5.32 cm)

OPERATING POWER
12 VDC @ 10 mA

FEATURES
Tool Connections
Reverse pin / receptacle GOI
H_2S Resistant Material

Available in
1 7/16” (3.65 cm) O.D.
1 11/16” (4.29 cm) O.D.



The Temperature Tool uses a platinum RTD sensor that has a fast response to temperature changes. The Temperature Tool is run below a Telemetry Section which supplies power to the tool and transmits the temperature data to the surface. The Temperature Tool may be run simultaneously with all other Titan Production Logging Tools.

Applications:

- Defining cement placement and tops
- Find a lost circulation zone in a currently drilling well
- Finding fluid entry and exit points in production and injection wells
- Indicate flow behind casing or tubing

630B16A0 Jan-07

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PL FLUID CAPACITANCE

F

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SPECIFICATIONS

MODEL NUMBER
8164-SERIES

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
13 lbs (5.9 kg) / 27.38" (69.53 cm)

TOOL SPACING
Capacitance Tube to Top Shoulder:
19.56" (49.69 cm)

Capacitance Tube to Housing End:
6.25" (15.87 cm)

Capacitance Tube to Bot. Shoulder:
7.81" (19.84 cm)

OPERATING POWER
12 VDC @ 10 mA

FEATURES
Tool Connections
Reverse pin / receptacle GOI

H_2S Resistant Material

Available in
1 7/16" (3.65 cm) O.D.
1 11/16" (4.29 cm) O.D.



The Fluid Capacitance Tool (also sometimes referred to as a Water Hold-Up Tool) measures the dielectric constant of bore hole fluid. The tool distinguishes between water and hydrocarbon by measuring the difference between the dielectric constant of water (~80) and that of oil and gas (~2-6). The Fluid Capacitance Tool is run below a Telemetry Section which supplies power to the tool and transmits the tool data to the surface. The tool may be run simultaneously with all other Titan Production Logging Tools.

Applications:

- Hydrocarbon / Water Hold-Up calculations
- Multi-Phase Production Profiling
- Analysis of water loaded up wells.

640B16A0 Jan-07

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PL FLOW METER SPINNER

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
8166-SERIES
shown with 1.687" (4.29 cm) cage

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
as shown
8 lbs (3.6 kg) / 23.50" (59.70 cm)

TOOL SPACING
Ctr of Impeller to Top Shoulder:
20.75" (52.71 cm)
Ctr of Impeller to Bot. Shoulder:
2.75" (6.99 cm)

OPERATING POWER
12 VDC @ 22 mA

OUTPUT
12 pulses / revolution
Flow direction indicated

THRESHOLD
approx 5 ft / min

FEATURES
Cage sizes available
1.68" (4.29 cm)
2.125" (5.40 cm) & 3.00" (7.62 cm)

Tool Connections
Reverse pin / receptacle GOI

H_2S Resistant Material
Available in
1 7/16" (3.65 cm) O.D.
1 11/16" (4.29 cm) O.D.



The Continuous Flow Meter Spinner incorporates an impeller rotated by moving fluid. The impeller is mounted on precision bearings. Rotation is detected with three zero drag Hall Effect devices. The Flow Meter is run below a Telemetry Section which supplies power to the tool and transmits flow data to the surface. The Flow Meter operates in vertical or horizontal positions and outputs both up and down flow. The Flow Meter may be run simultaneously with all other Titan Production Logging Tools.

Applications:

- Production profiles
- Injection profiles
- Casing and tubing leak detection
- Gauging effectiveness of well treatments

660B16A0 Jan-07

F

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STRAIN GAUGE PRESSURE

F

SPECIFICATIONS

MODEL NUMBER
816F-SERIES

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

WEIGHT / LENGTH
8 lbs (3.6 kg) / 20.00" (50.80 cm)

TOOL SPACING
Top Shoulder to Pressure Plug:
19.00" (48.26 cm)

Pressure Plug to Bottom Shoulder:
1.00" (2.54 cm)

OPERATING POWER
12 VDC @ 14 mA

FEATURES
Tool Connections
Reverse pin / receptacle GOI

H_2S Resistant Material

Available in
1 7/16" (3.65 cm) O.D.
1 11/16" (4.29 cm) O.D.



The Pressure Tool uses an accurate Strain gauge sensor to measure pressure in the bore hole. The tool is run below a Telemetry Section which supplies power to the tool and transmits the tool data to the surface. The tool may be run simultaneously with all other Titan Production Logging Tools.

Applications:

- Down-Hole Pressure Gradient Measurement
- Build-Up Pressure Transient Analysis

6F0B16A0 Jan-07

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CENTRALIZERS

CONTENTS

1 3/8" (3.49 cm)
BOW SPRING CENTRALIZER G1

1 11/16" (4.29 cm)
UPPER CENTRALIZER G2

1 11/16" (4.29 cm)
ROLLER CENTRALIZER G3

2 7/16" (6.19 cm)
BOW SPRING CENTRALIZER G4

2 7/16" (6.19 cm)
HIGH STRENGTH BOW SPRING G5

2 3/4" (6.99 cm)
ADJUSTABLE CENTRALIZER G6

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER	**5419-000-000**
TEMPERATURE RATING	**400° F (204.4° C)**
PRESSURE RATING	**15,000 PSI (103 MPa)**
WEIGHT	**8 lbs (3.6 kg)**
MAKE UP LENGTH	**26.25” (66.68 cm)**
DIAMETER	**Collapsed: 1.62” (4.11 cm)** **Relaxed.: 7.50” (19.05 cm)**
APPLICATIONS	**Centralizes CBL’s and PLT tool strings in vertical and deviated wells, while minimizing mechanical noise**
FEATURES	**3 Bow Spring Design**



99CB13A0 Apr-07

1 3/8”
(3.49 cm)

BOW SPRING CENTRALIZER

G

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1 11/16”
(4.29 cm)

UPPER CENTRALIZER

G

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
As Shown
5419-168-200

Reversed Contacts for Production Logging Tools
5419-168-220

TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
15,000 PSI (103 MPa)

WEIGHT
11 lbs (4.9 kg)

MAKE UP LENGTH
29.50” (74.93 cm)

DIAMETER
Collapsed: 1.81” (4.59 cm)
Relaxed: 8.00” (20.32 cm)

APPLICATIONS
Centralizes CBL’s and PLT tool strings in vertical and deviated wells, while minimizing mechanical noise

FEATURES
3 Bow Spring Design



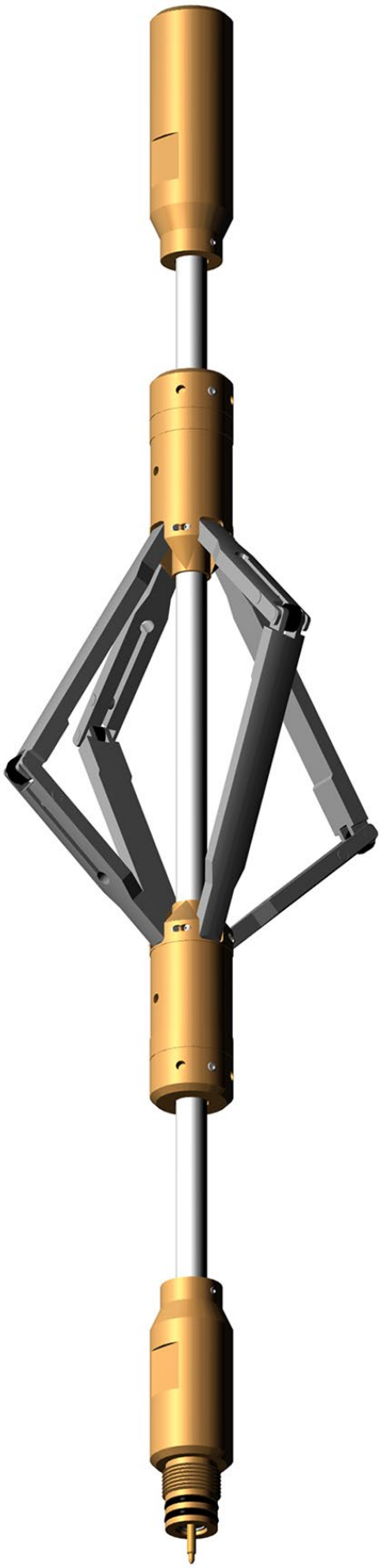
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INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER *As Shown* **8170-168-100** *Reversed Contacts for Production Logging Tools* **8170-168-120**
MAX TEMPERATURE RATING **400° F (204.4° C)**
MAX SERVICE PRESSURE **15,000 PSI (103 MPa)**
WEIGHT **14 lbs (6.3 kg)**
MAKE UP LENGTH **29.875" (75.88 cm)**
CENTRALIZING FORCE **44 lbf in 5 1/2" Csg; 35 lbf in 7" Csg** **25 lbf in 9 5/8" Csg** **Actual centralizing force is dependent on hole size, condition, and tool string configuration**
DIAMETER **Collapsed: 1.75" (4.44 cm)** **Relaxed: 9.00" (22.86 cm)**
APPLICATIONS **Centralizes CBLs and PLT tool strings in vertical and deviated wells, while minimizing mechanical noise** **Provides strong lifting force to facilitate tool string entry into deviated liner tops** **Centralize setting tool strings when setting high expansion plugs and packers** **Centralize the bottom end of high expansion plugs and packers during setting cycles**
FEATURES **Staggered roller design eliminates centralizer sticking and jumping at casing couplings.** **Provides maximum centralizing force and minimal re-entry force.** **On retrieval, when the centralizer contacts the tubing and re-entry force is reached, the centralizer collapses and enters the tubing without further resistance.**



1 11/16"
(4.29 cm)

ROLLER CENTRALIZER

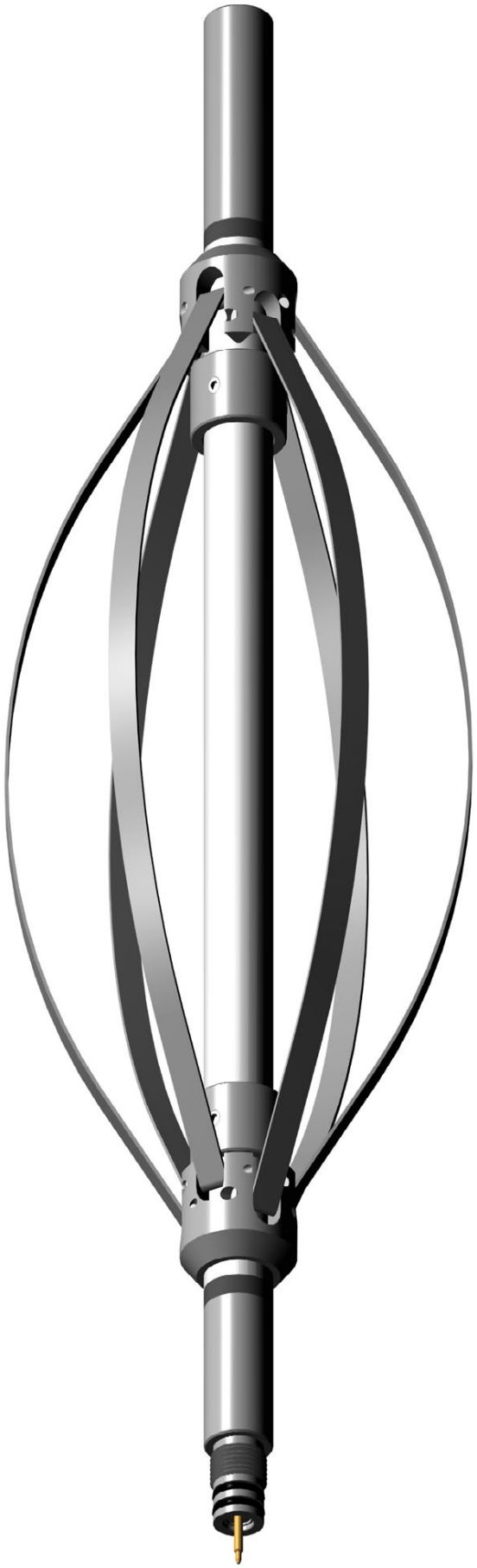
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BOW SPRING CENTRALIZER

2 7/16”
(6.19 cm)



10CB24AB Apr-07

SPECIFICATIONS

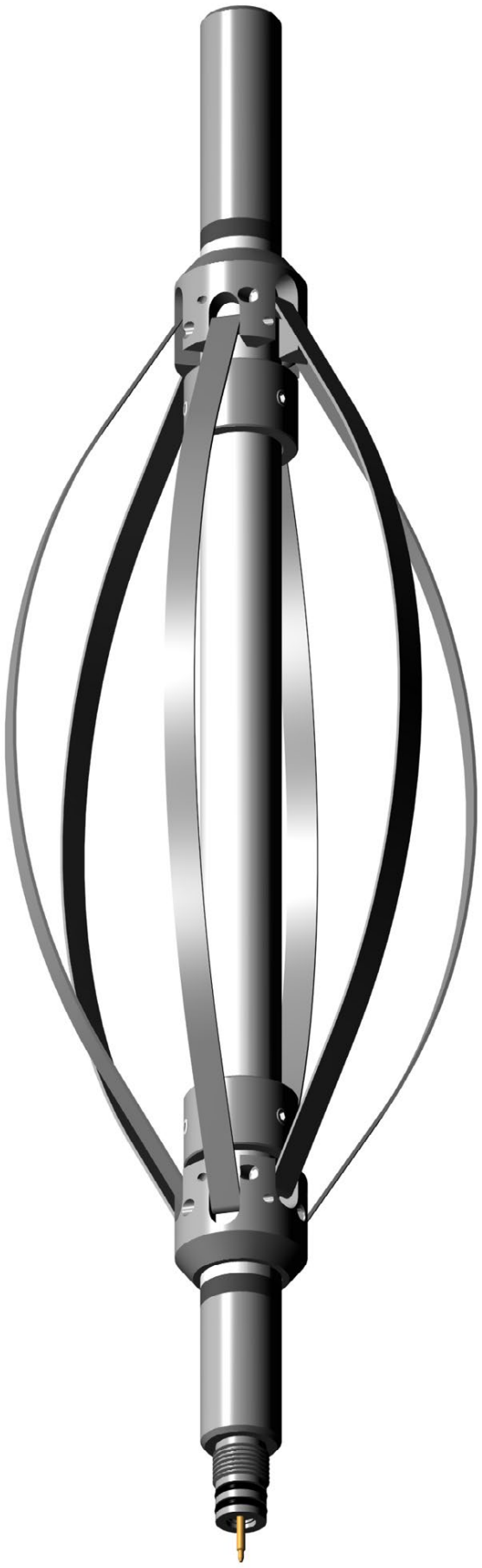
MODEL NUMBER	**8110-243-130**
TEMPERATURE RATING	**400° F (204.4° C)**
PRESSURE RATING	**18,000 PSI (124 MPa)**
WEIGHT	**17 lbs (7.7 kg)**
MAKE UP LENGTH	**26.00” (66.04 cm)**
DIAMETER	**Collapsed: 2.63” (6.68 cm)** **Relaxed: 9.60” (24.38 cm)**
APPLICATIONS	**Centralizes CBL’s and PLT tool strings in vertical and deviated wells, while minimizing mechanical noise**
FEATURES	**6 Bow Spring Design** **Special for Bond Tools** **1 7/16” (3.65 cm) Body**

G

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HIGH STRENGTH BOW SPRING

2 7/16”
(6.19 cm)



10CB24AC Apr-07

SPECIFICATIONS

MODEL NUMBER **8110-243-140**
TEMPERATURE RATING **400° F (204.4° C)**
PRESSURE RATING **18,000 PSI (124 MPa)**
WEIGHT **22 lbs (9.9 kg)**
MAKE UP LENGTH **26.00” (66.04 cm)**
DIAMETER **Collapsed: 2.88” (7.31 cm)** **Relaxed: 10.00” (25.40 cm)**
APPLICATIONS **Centralizes CBL’s and PLT tool strings in vertical and deviated wells, while minimizing mechanical noise**
FEATURES **6 Bow Spring Design** **Special for Bond Tools** **1 11/16” (4.29 cm) Body** **High Strength**

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ADJUSTABLE CENTRALIZER

2 3/4”
(6.99 cm)

G

SPECIFICATIONS

MODEL NUMBER **5419-275-100**
TEMPERATURE RATING **400° F (204.4° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
WEIGHT **28 lbs (12.7 kg)**
MAKE UP LENGTH **34.31” (87.16 cm)**
DIAMETER **Collapsed: 2.88” (7.31 cm)** **Relaxed: 12.00” (30.48 cm)**
APPLICATIONS **Centralizes CBL’s and PLT tool strings in vertical and deviated wells, while minimizing mechanical noise**
FEATURES **4 Bow Spring Design** **Manually adjustable**



99CB27A0 Apr-07

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SHOCK-SUB TOOLS

CONTENTS

1 11/16" (4.29 cm)
SHOCK ASSY (BOX / BOX) H1

1 11/16" (4.29 cm)
SHOCK ASSY (PIN / BOX) H2

2 3/4" (6.99 cm)
SHOCK ASSEMBLY H3

3 1/8" (7.94 cm)
SHOCK ASSEMBLY H4

Petitioner GR Energy Services - Ex. 1009, p. 204

1 11/16” (4.29 cm) SHOCK ASSY (BOX / BOX)

INSTRUMENT DIVISION

Max Voltage
750 V @ 2,000 mA



SPECIFICATIONS

MODEL NUMBER	3100-168-S100
TEMPERATURE RATING	Continuous Operation: 350° F (176.7° C) Maximum 4 Hour Operation: 500° F (260° C)
PRESSURE RATING	20,000 PSI (138 MPa)
MAXIMUM WEIGHT CAPACITY	400 lbs (181.44 kg)
WEIGHT	12 lbs (5.44 kg)
OAL (STATIC) LENGTH	21.87” (55.55 cm)
EXTENDED LENGTH WITH 400 LB LOAD	22.25” (56.52 cm)
TENSION STRENGTH	50,000 lbs / in² (3515.35 kg / cm²)
FEATURES	Can be run in tandem Stainless Steel Subs & Housings

99KB16AA Apr-08

H

1 11/16”
(4.29 cm)

SHOCK ASSY (PIN / BOX)

H

SPECIFICATIONS

MODEL NUMBER
3100-168-S200

TEMPERATURE RATING
Continuous Operation:
350° F (176.7° C)

Maximum 1 Hour Operation:
425° F (218.3° C)

PRESSURE RATING
20,000 PSI (138 MPa)

MAXIMUM WEIGHT CAPACITY
400 lbs (181.44 kg)

WEIGHT
12 lbs (5.44 kg)

OAL (STATIC) LENGTH
20.75” (52.71 cm)

EXTENDED LENGTH WITH 400 LB LOAD
21.12” (53.64 cm)

TENSION STRENGTH
50,000 lbs / in² (3515.35 kg / cm²)

FEATURES
Can be run in tandem
Stainless Steel Subs & Housings



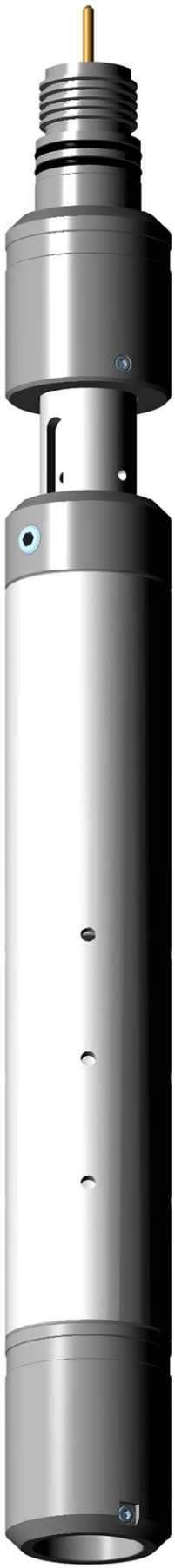
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SPECIFICATIONS

MODEL NUMBER **3100-275-S000**
TEMPERATURE RATING **Continuous Operation:** **350° F (176.7° C)** **Maximum 1 Hour Operation:** **425° F (218.3° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
MAXIMUM WEIGHT CAPACITY **1,450 lbs (657.71 kg)**
WEIGHT **30 lbs (13.60 kg)**
OAL (STATIC) LENGTH **22.76” (57.81 cm)** EXTENDED LENGTH WITH 1,450 LB LOAD **23.26” (59.08 cm)**
TENSION STRENGTH **125,000 lbs / in² (8788.37 kg / cm²)**
FEATURES **Can be run in tandem** **Stainless Steel Subs & Housings**



2 3/4”
(6.99 cm)

SHOCK ASSEMBLY

H

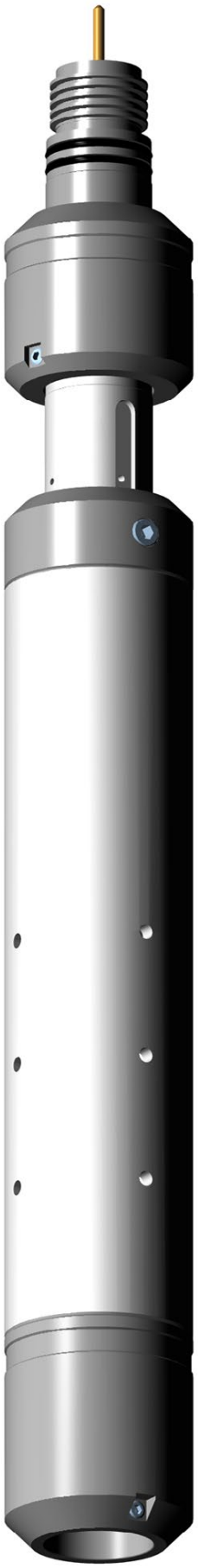
99KB27A0 Apr-08

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INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER **3100-312-S000B**
TEMPERATURE RATING **Continuous Operation:** **350° F (176.7° C)** **Maximum 1 Hour Operation:** **425° F (218.3° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
MAXIMUM WEIGHT CAPACITY **1,450 lbs (657.71 kg)**
WEIGHT **40 lbs (18.14 kg)**
OAL (STATIC) LENGTH **22.81” (57.94 cm)** EXTENDED LENGTH WITH 1,450 LB LOAD **23.31” (59.21 cm)**
TENSION STRENGTH **125,000 lbs / in² (8788.37 kg / cm²)**
FEATURES **Can be run in tandem** **Stainless Steel Subs & Housings**



3 1/8”
(7.94 cm)

SHOCK ASSEMBLY

H

99KB31A0 Apr-08

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TEMP-PRESS TOOLS

CONTENTS

1 ” (2.54 cm) TEMPERATURE TOOL I1

1 3/8 ” (3.49 cm) TEMPERATURE TOOL I2

1 3/8 ” (3.49 cm) GAMMA TEMPERATURE I3

1 11/16 ” (4.29 cm) TEMPERATURE TOOL I4

1 11/16 ” (4.29 cm) HIGH TEMPERATURE TOOL I5

1 11/16” (4.29 cm) GAMMA TEMPERATURE I6

1 11/16” (4.29 cm) PERF PRESS / TEMP / CCL / SHK I7

1 11/16” (4.29 cm) PERF SCINTILLATION GPT/CCL/SHK I8

2 3/4” (6.99 cm) PERF PRESS / TEMP / CCL / SHK I9

2 3/4” (6.99 cm) PERF SCINTILLATION GPT/CCL/SHK I10

TELEMETRY GPT SET UP BOX I11

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SPECIFICATIONS

MODEL NUMBER
Non Feed Through

8115-10052RT016-01-0X

MAX TEMPERATURE RATING

350° F (176.7° C)

PRESSURE RATING

15,000 PSI (103 MPa)

WEIGHT / LENGTH

4 lbs (1.81 kg) / 22.56” (57.31)

TOOL SPACING

Housing End to Top Shoulder: 19.56” (49.69 cm)
Sensor to Top Shoulder: 20.54” (52.18 cm)
Sensor to Bottom Shoulder: 2.02” (5.13 cm)

OPERATING POWER

120 VDC, Positive @ 45 mA

RESPONSE TIME

Less than 2 Sec.



1 ”
(2.54 cm)

TEMPERATURE TOOL

150B10A0 Jan-07

I

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TEMPERATURE TOOL

1 3/8 ”
(3.49 cm)

SPECIFICATIONS

MODEL NUMBER *Feed Through* **8115-13772RT016-01-00**
MAX TEMPERATURE RATING **400° F (204.4° C) ***
PRESSURE RATING **18,000 PSI (124 MPa)**
WEIGHT / LENGTH **6 lbs (2.72 kg) / 14.25” (36.20 cm)**
TOOL SPACING **Housing End to Top Shoulder: 11.50” (29.21 cm)** **Sensor to Top Shoulder: 12.47” (31.67 cm)** **Sensor to Bottom Shoulder: 1.78” (4.53 cm)**
OPERATING POWER **120 VDC, Positive @ 45 mA**
RESPONSE TIME *Liquid Filled Hole* **Less than 2 Sec.**
AVAILABLE OPTIONS **Non Feed Through** **Negative Power** *** Lower Temperature Ratings**



150B13A0 Mar-07

I

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GAMMA TEMPERATURE

1 3/8 ”
(3.49 cm)

SPECIFICATIONS

MODEL NUMBER
Feed Through
8116-13752SH075-06-00

RECOMMENDED EQUIPMENT
8130-137B2MC103-02-00
See CCL Section B

MAX TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
18,000 PSI (124 MPa)

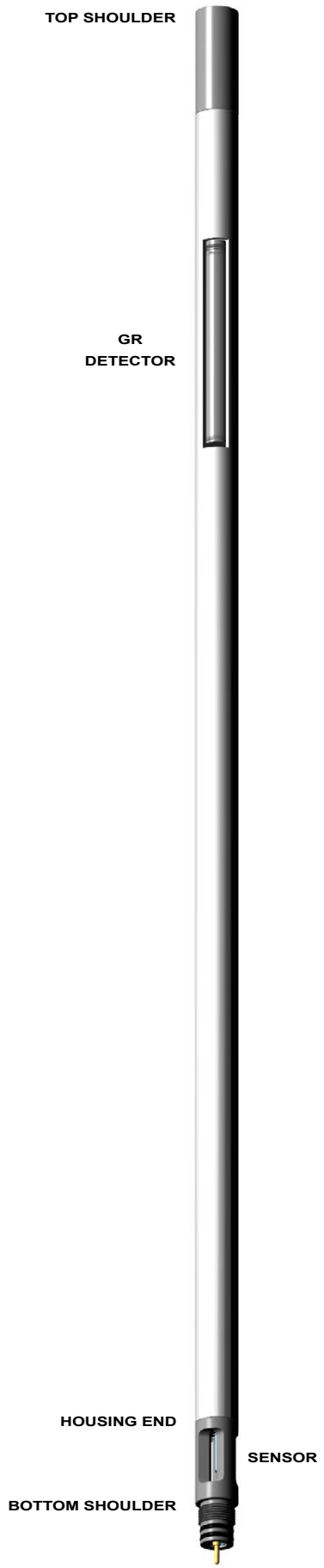
WEIGHT / LENGTH
25 lbs (11.34 kg) / 45.81” (116.36 cm)

TOOL SPACING
GR to Top Shoulder: 11.43” (29.04 cm)
GR to Housing End: 31.63” (80.33 cm)
GR to Sensor: 32.91” (83.58 cm)
Sensor to Bottom Shoulder: 1.47” (3.73 cm)

OPERATING POWER
120 VDC, Positive @ 63-64 mA
(Add 9-12 mA for CCL)

FEATURE
Measure Scintillation G.R. and Temperature simultaneously.

AVAILABLE OPTIONS
Voltage from 50 – 150 VDC



162B13A0 Mar-07

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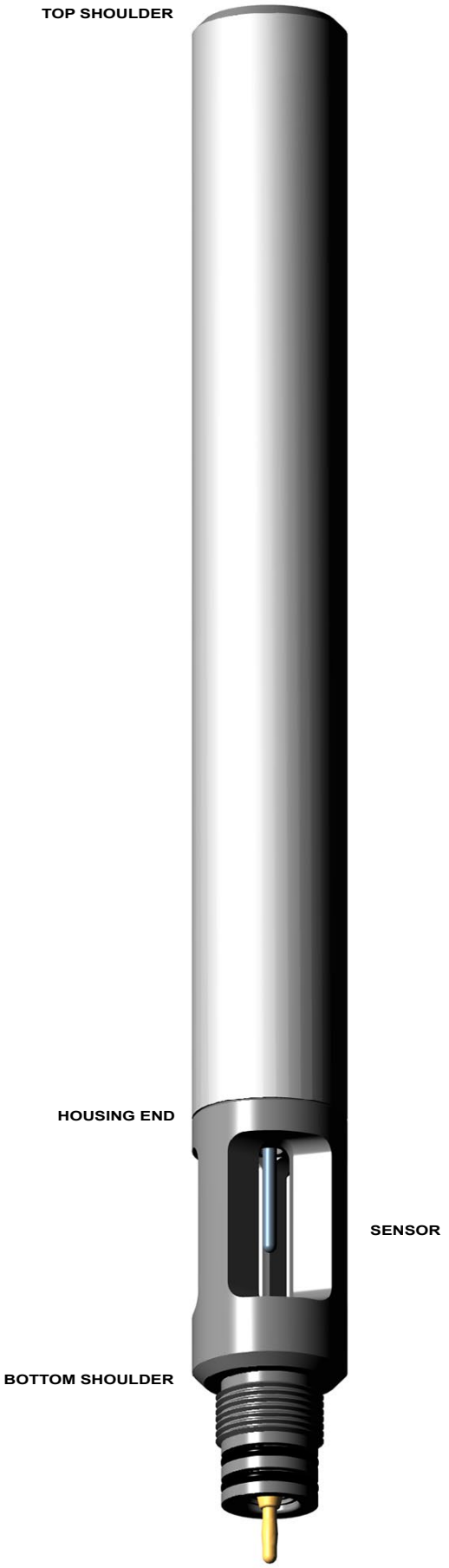
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TEMPERATURE TOOL

1 11/16 ”
(4.29 cm)

SPECIFICATIONS

MODEL NUMBER *Feed Through*	**8115-16852RT016-01-00**
MAX TEMPERATURE RATING	**400° F (204.4° C)**
PRESSURE RATING	**18,000 PSI (124 MPa)**
WEIGHT / LENGTH	**7 lbs (3.17 kg) / 15.38” (39.05 cm)**
TOOL SPACING	**Housing End to Top Shoulder: 12.38” (31.43 cm)** **Sensor to Top Shoulder: 13.24” (33.63 cm)** **Sensor to Bottom Shoulder: 2.14” (5.42 cm)**
OPERATING POWER	**120 VDC, Positive @ 45 mA** **(57 mA with CCL-sold separately)**
RESPONSE TIME	**Less than 2 Sec.**
AVAILABLE OPTIONS	**Non Feed Through** **Negative Power**



150B16A0 Oct-08

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HIGH TEMPERATURE TOOL

1 11/16 ”
(4.29 cm)

SPECIFICATIONS

MODEL NUMBER *Feed Through* **8115-168B2RT016-01-00**
MAX TEMPERATURE RATING **500° F (260.0° C)**
PRESSURE RATING **18,000 PSI (124 MPa)**
OPERATING POWER **120 VDC, Positive**
RESPONSE TIME **Less than 2 Sec.**
AVAILABLE OPTIONS **Non Feed Through** **Negative Power**



150B16AH Mar-07

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SPECIFICATIONS

MODEL NUMBER
Feed Through

8116-168B2SF070-06-00

MAX TEMPERATURE RATING

500° F (260.0° C)

PRESSURE RATING

18,000 PSI (124 MPa)

WEIGHT / LENGTH

25 lbs (11.34 kg) / 66.89” (169.90 cm)

TOOL SPACING

Detector to Top Shoulder: 16.06” (40.78 cm)
Detector to Housing End: 47.83” (121.50 cm)
Detector to Sensor: 48.68” (123.65 cm)
Sensor to Bottom Shoulder: 2.15” (5.47 cm)

OPERATING POWER

120 VDC, Positive @ 63-64 mA

ACCURACY

Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

AVAILABLE OPTIONS

Telemetry or Pulse Output
Non Feed Through



1 11/16”
(4.29 cm)

GAMMA TEMPERATURE

162B16AH Jan-08

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1 11/16” (4.29 cm)

PERF PRESS / TEMP / CCL / SHK

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
8135-168B7PSXXX-XX-0C
Perforating configuration with CCL & Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RANGE
200 PSI (1.38 MPa) to 18,000 PSI (124 MPa)

WEIGHT / LENGTH
40 lbs (18.14 kg) / 122.62” (311.47 cm)

TOOL SPACING
CCL to Top Shoulder: 13.45” (34.17 cm)
CCL to Plug: 9.73” (24.71 cm)
Plug to Housing End: 73.44” (186.54 cm)
Plug to Press Bottom: 78.69” (199.88 cm)
Press Bottom to Shock Bottom: 20.75” (52.70 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 55 mA
(Gun fires on Negative Voltage)

ACCURACY
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Pressure Temp Tool & Shock may be purchased separately
*** Lower Temp Models available**
Pulse or Telemetry configuration



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1 11/16” (4.29 cm)

PERF SCINTILLATION GPT/CCL/SHK

SPECIFICATIONS

MODEL NUMBER
8136-168B7SF070-06-0C
Perforating configuration with CCL & Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RANGE
200 PSI (1.38 MPa) to 18,000 PSI (124 MPa)

WEIGHT / LENGTH
40 lbs (18.14 kg) / 122.62” (311.47 cm)

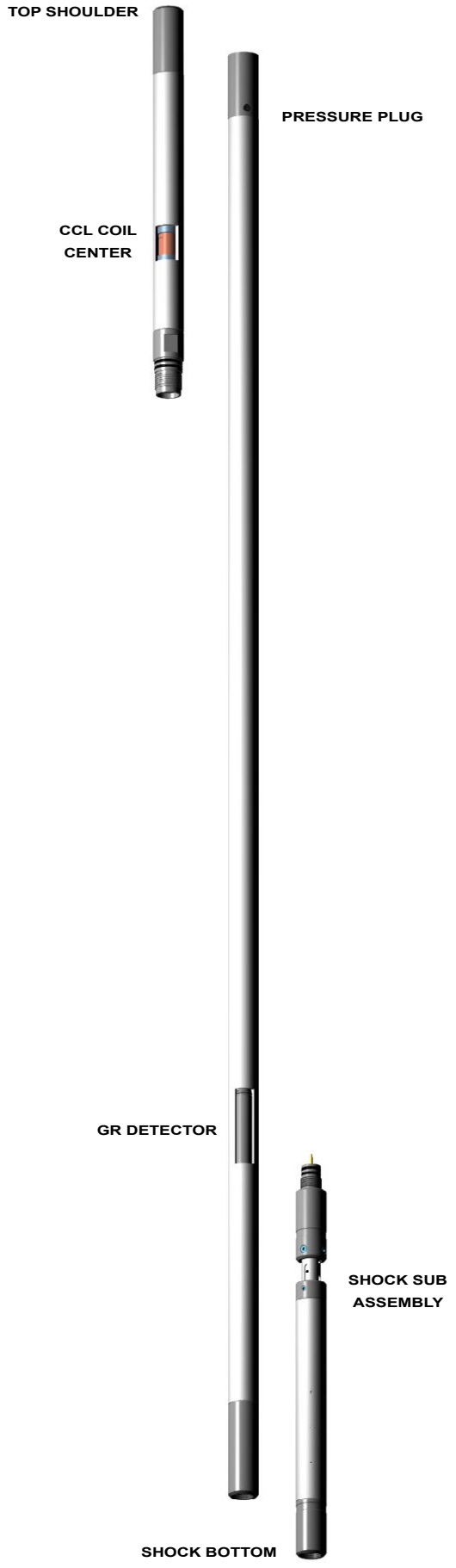
TOOL SPACING
CCL to Top Shoulder: 13.45” (34.17 cm)
CCL to Plug: 9.73” (24.71 cm)
Plug to GR: 57.81” (146.85 cm)
GR to CCL: 67.54” (171.56 cm)
GR to Shock Bottom: 41.63” (105.74 cm)

OPERATING POWER
50 VDC, Positive @ ≈ 55 mA
(Gun fires on Negative Voltage)

ACCURACY
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
GPT & Shock may be purchased separately
*** Lower Temp Models available**



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2 3/4” (6.99 cm)

PERF PRESS / TEMP / CCL / SHK

SPECIFICATIONS

MODEL NUMBER
8135-275B7PSXXX-XX-0C
Perforating configuration with CCL & Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RANGE
200 PSI (1.38 MPa) to 20,000 PSI (138 MPa)

WEIGHT / LENGTH
130 lbs (58.97 kg) / 120.64” (306.42 cm)

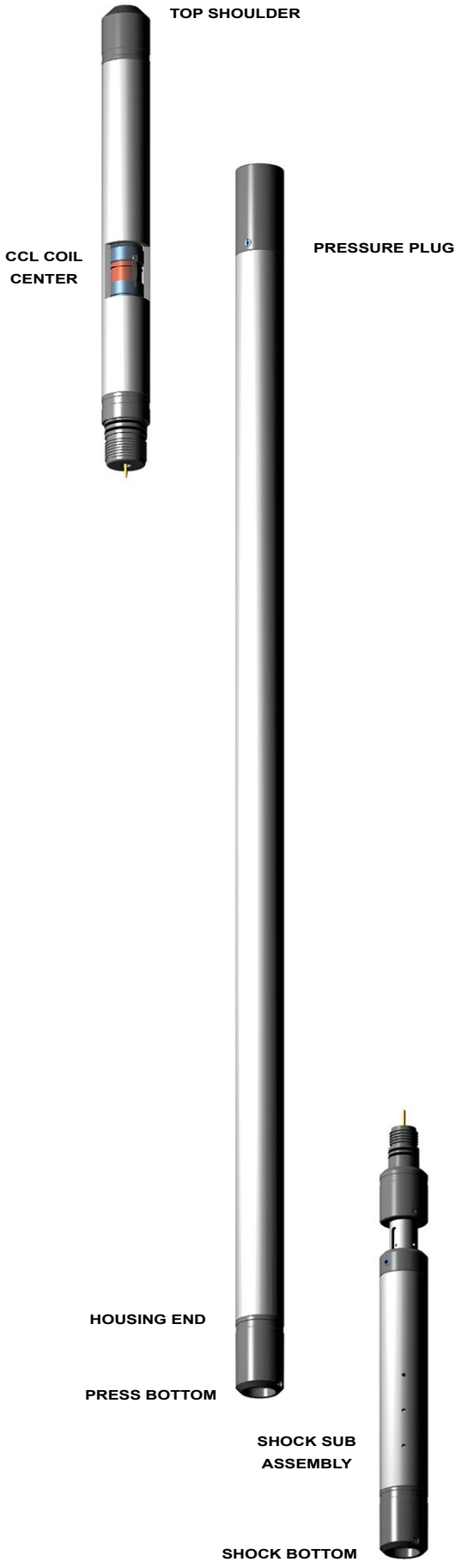
TOOL SPACING
CCL to Top Shoulder: 15.91” (40.40 cm)
CCL to Plug: 13.59” (34.53 cm)
Plug to Housing End: 64.19” (163.04 cm)
Plug to Press Bottom: 68.38” (173.68 cm)
Press Bottom to Shock Bottom: 22.76” (57.81 cm)

OPERATING POWER
50 VDC, Positive @ 60 mA
(Gun fires on Negative Voltage)

ACCURACY
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
Pressure Temp Tool & Shock may be purchased separately
*** Lower Temp Models available**
Pulse or Telemetry configuration



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2 3/4” (6.99 cm)

PERF SCINTILLATION GPT/CCL/SHK

SPECIFICATIONS

MODEL NUMBER
8136-275B7SF100-04-0C
Perforating configuration with CCL & Shock

MAX TEMPERATURE RATING
500° F (260° C) *

PRESSURE RANGE
200 PSI (1.37 MPa) to 20,000 PSI (138 MPa)

WEIGHT / LENGTH
130 lbs (58.97 kg) / 120.64” (306.42 cm)

TOOL SPACING
CCL to Top Shoulder: 15.91” (40.40 cm)
CCL to Plug: 13.59” (34.53 cm)
Plug to GR: 47.65” (121.04 cm)
GR to CCL: 61.24” (155.57 cm)
GR to Shock Bottom: 43.49” (110.45 cm)

OPERATING POWER
50 VDC, Positive @ 60 mA
(Gun fires on Negative Voltage)

ACCURACY
Temperature: +/- 1%
Pressure: +/- 2% Uncharacterized
+/- 0.5% Characterized

STANDARD FEATURES
H_2S Resistant Material

AVAILABLE OPTIONS
GPT & Shock may be purchased separately
*** Lower Temp Models available**
Pulse or Telemetry configuration



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TELEMETRY GPT SET UP BOX

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER	WEIGHT
816T-000-000	1.37 lbs (0.62 kg)

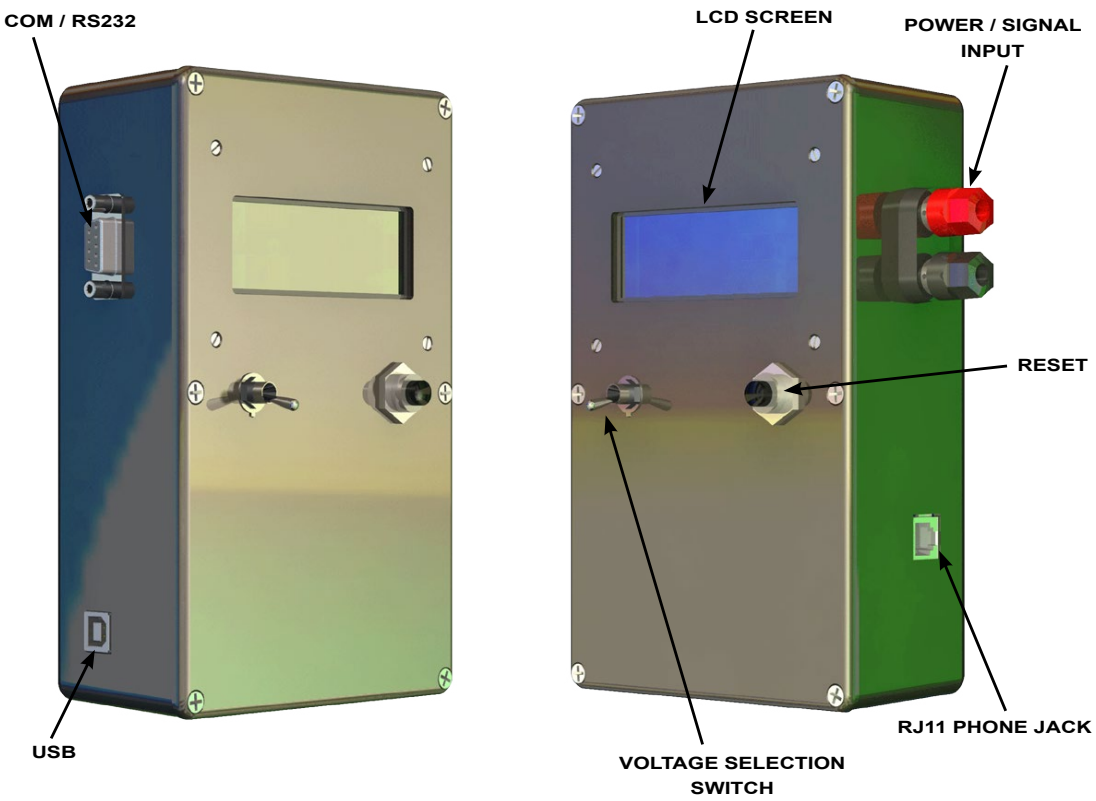
Titan GPT Telemetry Reader

The Titan GPT Telemetry Reader captures the output of a telemetry style Titan Gamma/ Pressure/Temp tool and displays the data in engineering units (pressure, temperature, line voltage and, gamma count rate) on an LCD. This facilitates the repair and testing of the tool without the need of a data acquisition system or computer.

While the RJ11 and USB ports are disabled, the 9 pin D sub connector can be used to transmit the raw data output of the tool to a remote computer using an RS232 communication program.

The box is able to accommodate a wide variety of tool operation voltages with the voltage select toggle switch, and the unit can be reset using the push button switch.

The 4 X 16 character LCD display allows the data to be read easily, with a total data frame counter and a data error counter provided along with the tool output data.



6TPB00A0 Jul-08

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NEUTRON TOOLS

CONTENTS

1 11/16" (4.29 cm) NEUTRON TOOL J1

1 11/16" (4.29 cm) HT NEUTRON TOOL J2

2 3/4" (6.99 cm) NEUTRON TOOL J3

2 3/4" (6.99 cm) COMPENSATED NEUTRON J4

2 3/4" (6.99 cm) COMPENSATED NEUTRON GR / CCL J5

Petitioner GR Energy Services - Ex. 1009, p. 221

1 11/16”
(4.29 cm)

NEUTRON TOOL

SPECIFICATIONS

MODEL NUMBER
8105-16872HE100-XX-0A-16
Bottom GO source sub included

RECOMMENDED EQUIPMENT
8130-168B2MC129-02-00
see CCL section B

8100-16872SH075-06-00
see GR section D

TEMPERATURE RATING
400° F (204.4° C) *

PRESSURE RATING
18,000 PSI (124 MPa)

OPERATING POWER
120 VDC, Positive @ 47 mA

WEIGHT / LENGTH
18 lbs (8.16 kg) / 52.12” (132.38 cm)
Length with Source: 56.78” (144.22 cm)

TOOL SPACING
Detector to Top Shoulder: 37.50” (95.26 cm)
Detector to Source: 16.87” (42.85 cm)

SOURCE
Supplied by customer
3 to 5 Ci AmBe

AVAILABLE OPTIONS
SIE source sub

Multiple Source to Detector spacings

*** Lower temperature models**

Voltage from 50 – 150 VDC



050B16A0 Apr-07

J

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HT NEUTRON TOOL

1 11/16”
(4.29 cm)

SPECIFICATIONS

MODEL NUMBER
8105-16892HE100-XX-0A-A16
Bottom GO source sub included

TEMPERATURE RATING
450° F (232.2° C)*

PRESSURE RATING
18,000 PSI (124 MPa)

OPERATING POWER
120 VDC, Positive @ 47 mA

WEIGHT / LENGTH
20 lbs (9.1 kg) / 55.50” (140.96 cm)
Length with Source: 60.15” (152.79 cm)

TOOL SPACING
Detector to Top Shoulder: 43.56” (110.64 cm)
Detector to Source: 14.19” (36.05 cm)

SOURCE
Supplied by customer
3 to 5 Ci AmBe

STANDARD FEATURES
H_2S Resistant Material
Anti-Coincidence
(GR/N pulses will not Collide)

AVAILABLE OPTIONS
SIE source sub
Multiple Source to Detector spacings
Voltage from 50 – 150 VDC
***Lower Temperature Ratings**



050B16AH Jun-07

J

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NEUTRON TOOL

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8105-27572HE100-16-0A-15
Shown with Bottom SIE source sub
(sold separately)

TEMPERATURE RATING
400° F (204.4° C)

PRESSURE RATING
20,000 PSI (138 MPa)

OPERATING POWER
120 VDC, Positive @ 45 mA

WEIGHT / LENGTH
46 lbs (21 kg) / 55.51” (140.98 cm)

TOOL SPACING
Detector to Top Shoulder: 37.20” (94.49 cm
Detector to Source: 15.13” (38.42 cm)

SOURCE
Supplied by customer
3 to 5 Ci AmBe

AVAILABLE OPTIONS
Go or SIE source sub

Multiple Source to Detector spacings

Voltage from 50 – 150 VDC



050B27A0-A15 Mar-07

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COMPENSATED NEUTRON

2 3/4”
(6.99 cm)

SPECIFICATIONS

MODEL NUMBER
8106-27552HE200-08-0A
Bottom SIE source sub included

RECOMMENDED EQUIPMENT
8100-2755GSC100-04-00
see Scintillation GR section D

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
20,000 PSI (138 MPa)

OPERATING POWER
120 VDC, Positive @ ≈ 58 mA

WEIGHT / LENGTH
48 lbs (21.77 kg) / 57.63” (146.38 cm)
Length with Source: 61.63” (156.54 cm)

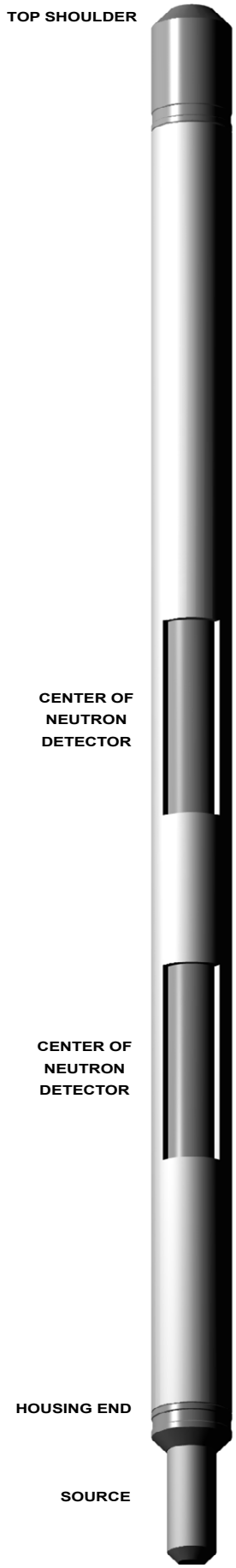
TOOL SPACING
Top Detector to Top Shoulder: 31.53” (80.10 cm)
Top Detector to Bt. Detector: 12.24” (31.08cm)
Bt. Detector to Source: 15.85” (40.27 cm)

SOURCE
Supplied by customer
15 to 20 Ci AmBe

AVAILABLE OPTIONS
Go or SIE source sub

Multiple Source to Detector spacings

Voltage from 50 – 150 VDC



The Compensated Neutron incorporates two large thermal neutron detectors which are designed to minimize the effects of the borehole environment.

Two neutron data channels and the one gamma ray data channel are sent to the surface computer which takes the ratio of the two neutron count rates and calculates a Neutron Porosity along with a Gamma Ray curve.

060B27A0 Jan-08

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2 3/4” (6.99 cm)

COMPENSATED NEUTRON GR / CCL

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
8106-2755TSL100-04-0A
Bottom SIE source sub included

TEMPERATURE RATING
350° F (176.7° C)

PRESSURE RATING
20,000 PSI (138 MPa)

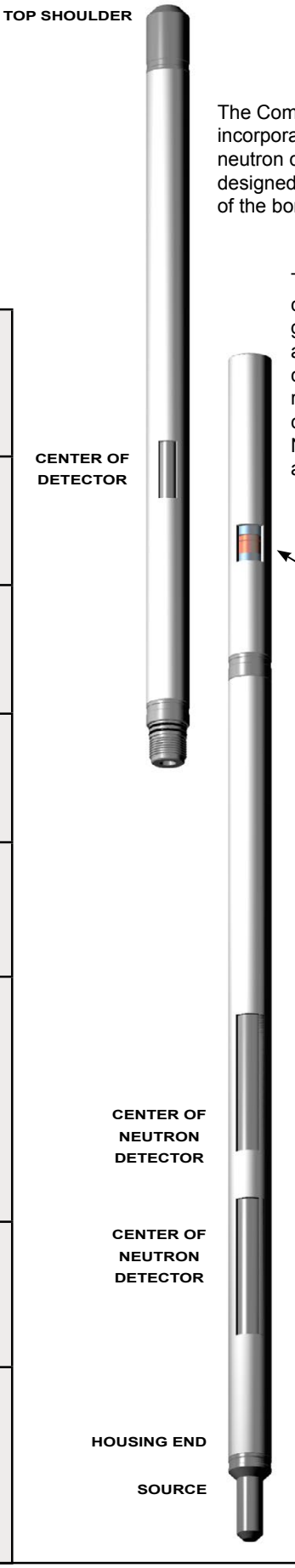
OPERATING POWER
120 VDC, Positive @ ≈ 58 mA

WEIGHT / LENGTH
127 lbs (57.60 kg) / 122.31” (310.67 cm)
Length with Source: 126.31” (320.83 cm)

TOOL SPACING
GR Detector to Top Shoulder: 31.04” (78.83 cm)
Top N. Detector to Bt. N. Detector: 12.24” (31.08cm)
GR Detector to CCL: 29.26” (74.32 cm)
Top N. Detector to CCL: 35.92” (91.25 cm)
Bt. N. Detector to Source: 15.85” (40.27 cm)

SOURCE
Supplied by customer
15 to 20 Ci AmBe

AVAILABLE OPTIONS
Go or SIE source sub
Multiple Source to Detector spacings
Voltage from 50 – 150 VDC



The Compensated Neutron incorporates two large thermal neutron detectors which are designed to minimize the effects of the borehole environment.

Two neutron data channels and the one gamma ray data channel are sent to the surface computer which takes the ratio of the two neutron count rates and calculates a Neutron Porosity along with a Gamma Ray curve.

069B27A0 Jan-08

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MORE TOOLS

CONTENTS

SELECT FIRE SHOOTING BOX K1

1 3/8" (3.49 cm)
NOISE TOOL K2

1 3/8" (3.49 cm)
NOISE TEMP CCL K3

1 7/16" (3.65 cm)
FREE POINT TOOL K4

1 11/16" (4.29 cm)
GRAVEL PACK DENSITY K5

1 11/16" (4.29 cm)
STAND ALONE FLOWMETER K6

1 11/16" (4.29 cm)
ROLLER ASSEMBLY K7

2" (5.08 cm)
ROLLER ASSEMBLY K8

3D HVR DIODE
HV REGULATING DIODE K9

1 3/4" (4.44 cm)
COMPENSATED SWIVEL ASSY. K10

2 1/8" (5.40 cm)
COMPENSATED SWIVEL ASSY. K11

K

Petitioner GR Energy Services - Ex. 1009, p. 227

SELECT FIRE SHOOTING BOX

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER
RACK MOUNT

9001-000-100

SPECIAL FEATURES
Stainless Steel Face
Digital Ohmmeter
Sensitive CCL Meter
Amplified CCL
Audible Cap Fire Indicator
Safety Key Operation
Handles on Rack Mount plus Steel Brackets

OPERATING VOLTAGE
120 VAC, 60 Hz

DIMENSIONS
RACK MOUNT

Height: 10.5" (26.7 cm)
Width: 17" (43.2 cm)
Depth: 13.0" (33.0 cm)
Mount Standard 19" Rack
Weight: 55 lbs (24.94 kg)

OHMMETER
Range: 8,000 ohms
Resolution: 1 ohm

OUTPUT
Positive or Negative Voltage
0 to 500 volts @ 2 amps



S90B00A0 Apr-08

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NOISE TOOL

1 3/8”
(3.49 cm)

SPECIFICATIONS

MODEL NUMBER
8150-13772PE010-01-0X

MAX TEMPERATURE RATING
400° F (204.4° C) *

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
13 lbs (5.89 kg) / 44.75” (113.67 cm)

TOOL SPACING
ND to Top Shoulder: 30.84” (78.33 cm)
ND to Housing End: 12.04” (30.57 cm)
ND to Bottom Shoulder: 13.91” (35.33 cm)

OPERATING VOLTAGE
120 VDC (+ or -) @ 35 mA (+ or -)

Momentarily increase voltage to 150 V, then decrease back to 120 V. This will cut the Gain in half

SENSITIVITY
Noise Spectrum: 20 Hz – 3,000 Hz

DETECTOR TYPE
Piezo Electric Crystal

OUTPUT CONFIGURATION
Analog

GENERAL INFORMATION
The noise logging tool is essentially a sensitive high-fidelity microphone. The piezoelectric crystals are housed in an oil filled chamber. A piston is used for pressure compensation.

This tool works with all multiple band noise logging systems. The Warrior Logging System™ divides the frequency spectrum into four frequency ranges.

The option is available for cutting the gain of the downhole tool by a factor of 10 for use in wells with very high noise levels.

Warrior Logging System™ is a trademark of Scientific Data Systems Inc.

AVAILABLE OPTIONS
*** Lower temperature models available**



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NOISE TEMP CCL

1 3/8”
(3.49 cm)

SPECIFICATIONS

MODEL NUMBER
NOISE / TEMP / CCL

8151-13772PE010-01-0X

MAX TEMPERATURE RATING
400° F (204.4° C)

***Lower temperature models available**

PRESSURE RATING
20,000 PSI (138 MPa)

WEIGHT / LENGTH
24 lbs (10.88 kg) / 80.50” (204.47 cm)

TOOL SPACING
CCL to Top Shoulder: 13.18” (33.49 cm)
CCL to Temp Probe: 21.10” (53.59 cm)
Temp Probe to ND: 32.31” (82.06 cm)
ND to Housing End: 12.04” (30.57 cm)
ND to Bottom Shoulder: 13.91” (35.33 cm)

OPERATING VOLTAGE
Temperature: 120 VDC @ 35 mA Negative
Noise: 120 VDC @ 35 mA Positive
CCL: 120 VDC, Pos. or Neg.

Momentarily increase voltage to 150 V, then decrease back to 120 V. This will cut the Gain in half

SENSITIVITY
Noise Spectrum: 20 Hz – 3,000 Hz

DETECTOR TYPE
Temperature: RTG
Noise: Piezo Electric Crystal

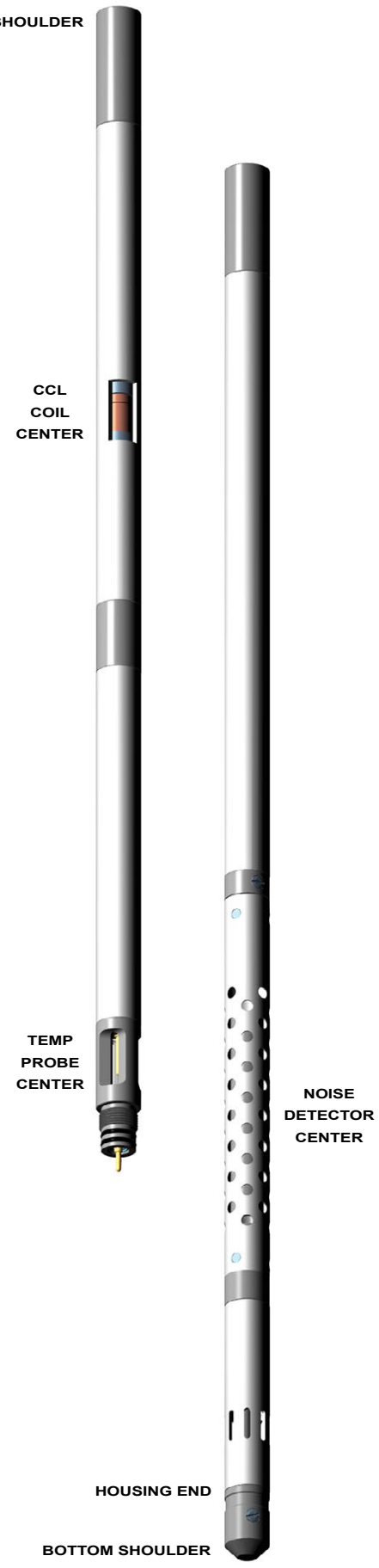
OUTPUT CONFIGURATION
Temperature: Pulses, Pos. or Neg.
Noise: Analog
CCL: Line Current Modulation

GENERAL INFORMATION
The noise logging tool is essentially a sensitive high-fidelity microphone. The piezoelectric crystals are housed in an oil filled chamber. A piston is used for pressure compensation.

This tool works with all multiple band noise logging systems. The Warrior Logging System™ divides the frequency spectrum into four frequency ranges.

The option is available for cutting the gain of the downhole tool by a factor of 10 for use in wells with very high noise levels.

Warrior Logging System™ is a trademark of Scientific Data Systems Inc.



510B13A0 Mar-07

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Motorized Free Point Tool



Many factors can contribute to a drilling or workover string getting stuck in the well. Some examples are borehole conditions, wellbore fluid properties, formation characteristics and assembly problems.

Hunting Titan's Motorized Free Point Tool accurately determines the stuck point in pipe, tubing or a casing string. The real-time data allows the operator to make rapid and informed decisions in determining the next steps to recover the stuck downhole assembly.

The sensor picks up movements in the assembly associated with tension, compression or torque measurements and converts that to an AC signal. This signal is then processed at the surface by the Free Point Panel for display and recording for permanent records.

APPLICATIONS

- Stuck pipe determination

FEATURES

- Tension, compression and torque measurements
- Built in Casing Collar Locator (CCL)
- Solid-state electronic motor control
- Full open/close sensors
- Seven anchor sizes available for most applications

BENEFITS

- Real-time data assists in optimizing pipe recovery methods
- Accurate depth determination of stuck assembly
- Controlled electronics protect damage to gear and drive assemblies
- Interchangeable anchors for different assemblies

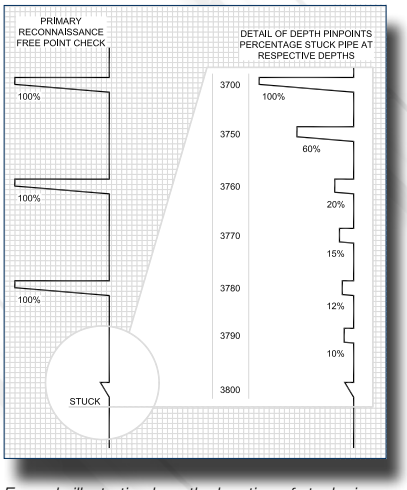
ANCHOR SELECTION CHART

LEG PART NUMBER	Closed Diameter (in)[mm]	Open Diameter (in)[mm]
8140-143-016-1	1.43 [37]†	2.74 [70] @ 45°
8140-143-016-2	1.43 [37]†	4.17 [106] @ 45°
8140-143-016-3	1.43 [40]†	5.56 [141] @ 45°
8140-143-016-4	4.10 [104]	5.28 [134] @ 30°
8140-143-016-5	4.10 [104]	6.43 [163] @ 30°
8140-143-016-6	5.86 [149]	8.40 [213] @ 30° 9.17 [233] @ 45°
8140-143-016-7	7.38 [187]	10.52 [267] @ 30° 11.27 [286] @ 45°

† *1.56 in (40 mm) for 18,000 psi (124 MPa) version*

SPECIFICATIONS

Part Number	1-7/16 in (37 mm)	1-9/16 in(40 mm)
With Panel Without Panel	8140-14342-600-00 8140-14342-630-00	8140-15642-600-00 8140-15642-630-00
MEASUREMENTS		
Vertical Resolution	4.03 [1.23]	4.03 [1.23]
Logging Speed CCL (ft/min)[m/min]	60 [18.3]	60 [18.3]
Mud Type • Weight	No limitations	No limitations
ENVIRONMENTAL		
Temperature rating (°F)[°C]	325 [163]	325 [163]
Pressure Rating (psi)[MPa]	15,000 [103]	18,000 [124]
Material	Nedox® coated steel	Nedox® coated steel
MECHANICAL		
Outside Diameter (in)[mm]	1.43 [36.5]	1.56 [39.7]
Length (ft)[m]	8.32 [2.54]	8.32 [2.54]
Weight (lb)[kg]	45 [20]	50 [23]
Fishing Strength (lbf)[kN]	22,000 [98]	22,000 [98]
Min. • Max. Pipe I.D. (in)[mm]	1.77 [45] • 11.27 [287]	1.90 [48] • 11.27 [287]
Top Connection	1-3/16" GO Box	1-3/16" GO Box
ELECTRICAL		
Operating Voltage & Current Operating Anchors Operating Sensors	 32 VDC @ 240±20 mA 40 VDC @ 200±10 mA	 32 VDC @ 240±20 mA 40 VDC @ 200±10 mA
Output Signal (Peak to Peak)	1.0 V variable frequency	1.0 V variable frequency
Cable Type	Single conductor	Single conductor
Stretch/Torque Sensor	Magnetic flux gap	Magnetic flux gap



Example illustrating how the location of stuck pipe can be determined by the Motorized Free Point Tool. The ideal depth to perform backoff operations will be somewhere between 3700ft and 3750ft.



The Free Point Panel (8140-000-500) provides control functionality to the tool and processes signals coming from the tool. The panel is available separately.

K

[FreePointMod 09131300 42

Right Tools. Right Location. Right Time.

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HUNTING
Hunting Titan

1 11/16”
(4.29 cm)

GRAVEL PACK DENSITY

SPECIFICATIONS

MODEL NUMBER	8145-16852SH075-06-0X
MAX TEMPERATURE RATING	350° F (176.7° C)
PRESSURE RATING	18,000 PSI (124 MPa)
WEIGHT / LENGTH	30 lbs (13.6 kg) / 61.26” (155.59 cm)
TOOL SPACING	Detector to Top Shoulder: 39.75” (100.96 cm) Detector to Source: 19.00” (48.25 cm) Detector to Bottom Shoulder: 21.51” (54.63 cm)
OPERATING VOLTAGE	120 VDC, Positive
OPERATING CURRENT	45 mA
SOURCE	50 to 100 millici of Cs 137 (Supplied by Customer)



450B16A0 Mar-07

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SPECIFICATIONS

MODEL NUMBER

8169-16852FM168-05-0X-A
shown with 1.687" (4.28 cm) Cage

TEMPERATURE RATING

350° F (176.7° C)

PRESSURE RATING

18,000 PSI (124 MPa)

WEIGHT / LENGTH

as shown

8 lbs (3.6 kg) / 23.48" (59.64 cm)

TOOL SPACING

as shown

Ctr of Impeller to Top Shoulder: 20.73" (52.65 cm)
Ctr of Impeller to Bottom Shoulder: 2.75" (6.99 cm)

OPERATING VOLTAGE

120 VDC

FEATURES

Combinable with CCL and Temperature Tools

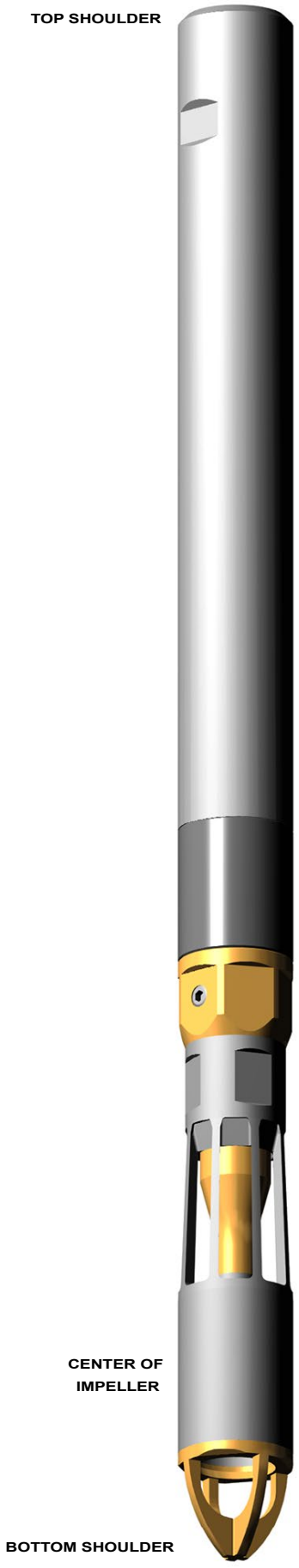
Positive Pulses for Up Flow
Negative Pulses for Down Flow

Several Cage sizes available
1.68" (4.29 cm), 2.125" (5.40 cm) available now

Larger sizes will be available soon

Lower Pitch Impellers available for High Flow Rate

H_2S Resistant Material





690B16A0 Mar-08

1 11/16"
(4.29 cm)

STAND ALONE FLOWMETER

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1 11/16”
(4.29 cm)

ROLLER ASSEMBLY

INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER *as shown (2.25” wheels)* **1200-168-225-1***
TEMPERATURE RATING **400° F (204.4° C)**
PRESSURE RATING **15,000 PSI (103 MPa)**
MAKE UP LENGTH **15.50” (39.37 cm)**
WEIGHT **9 lbs (4.1 kg)**
MAX DIAMETER *Varies with wheel size* **Min: 1.75” (4.45 cm)** **Max: 2.25” (5.72 cm)**
OPTIONS *** Other wheel sizes available**



999B16A0 Nov-06

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ROLLER ASSEMBLY

2”
(5.08 cm)

SPECIFICATIONS

MODEL NUMBER *as shown (3.25” wheels)* **1200-200-325-1 ***
TEMPERATURE RATING **400° F (204.4° C)**
PRESSURE RATING **15,000 PSI (103 MPa)**
MAKE UP LENGTH **22.50” (57.15 cm)**
WEIGHT **20 lbs (9.1 kg)**
MAX DIAMETER *Varies with wheel size* **Min: 2.125” (5.40 cm)** **Max: 3.25” (8.26 cm)**
OPTIONS *** Other wheel sizes available**

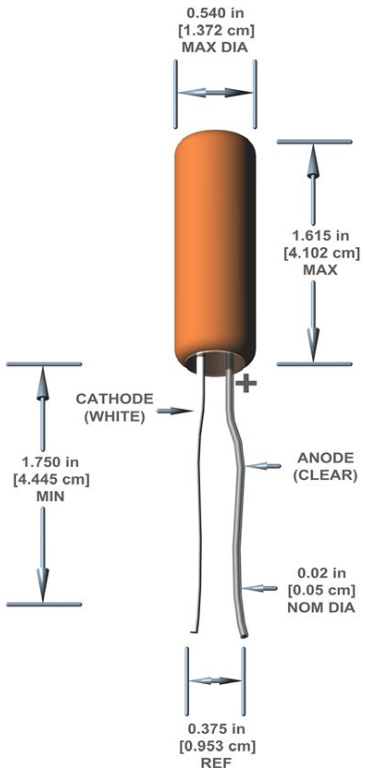


999B20A0 Nov-06

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SPECIFICATIONS



SPECIAL FEATURES

Ideal for Petroleum Well Logging

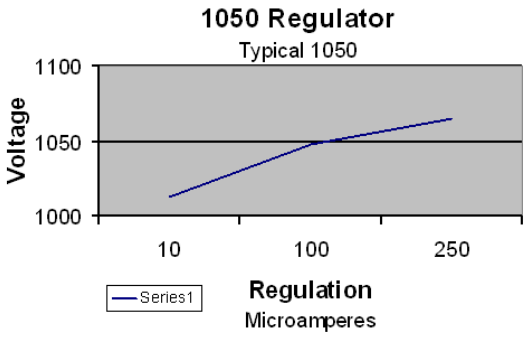
Designed to withstand Shock 2000 G - .4 ms

Vibration: 10 – 2000 CPS – 20 G

Operate to 347° F (175° C)

Replacement for Corona Gas Regulating Tube

Useful for Military, Commercial, Industrial, and other applications



Type	Nom. Voltage @ 100 µA Test Point	Tolerance	Min.	Max.	Peak	Approx. Voltage Change -25° to 175° C @ 100 Z
E1900-HVR-700	700 V	±15 V	50	500	1000	±20
E1900-HVR-900	900 V	±18 V	50	500	1000	±20
E1900-HVR-1000	1000 V	±20 V	50	500	1000	±25
E1900-HVR-1050	1050 V	±20 V	50	500	1000	±25
E1900-HVR-1150	1150 V	±20 V	50	500	1000	±25
E1900-HVR-1200	1200 V	±21 V	50	500	1000	±25
E1900-HVR-1350	1350 V	±25 V	50	500	1000	±25
E1900-HVR-1550	1550 V	±28 V	50	500	1000	±30
E1900-HVR-1650	1650 V	±30 V	50	500	1000	±32
FOR UNITS ABOVE 1650 V		±2%	50	500	1000	±2.2%

This regulation is the change in voltage over useful range of current from Min. to Max.
Date: 05/28/02

3D HVR DIODE Nov-06

3D HVR
DIODE

HV REGULATING DIODE

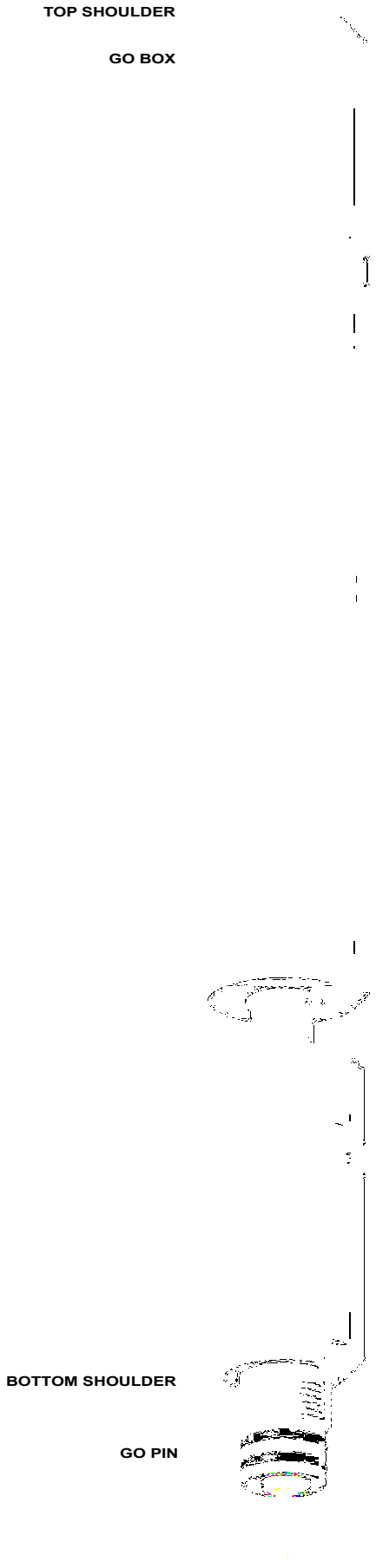
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1 3/4” (4.44 cm) COMPENSATED SWIVEL ASSY.

SPECIFICATIONS

MODEL NUMBER **4100-175-000**
TEMPERATURE RATING **350° F (176.7° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
WEIGHT / LENGTH **10 lbs (4.53 kg) / 18.77” (47.67 cm)**
OPERATING INFORMATION **Retainer wrench P/N 4100-168-012** **Will be needed during assembly**



99SB17A0 May-12

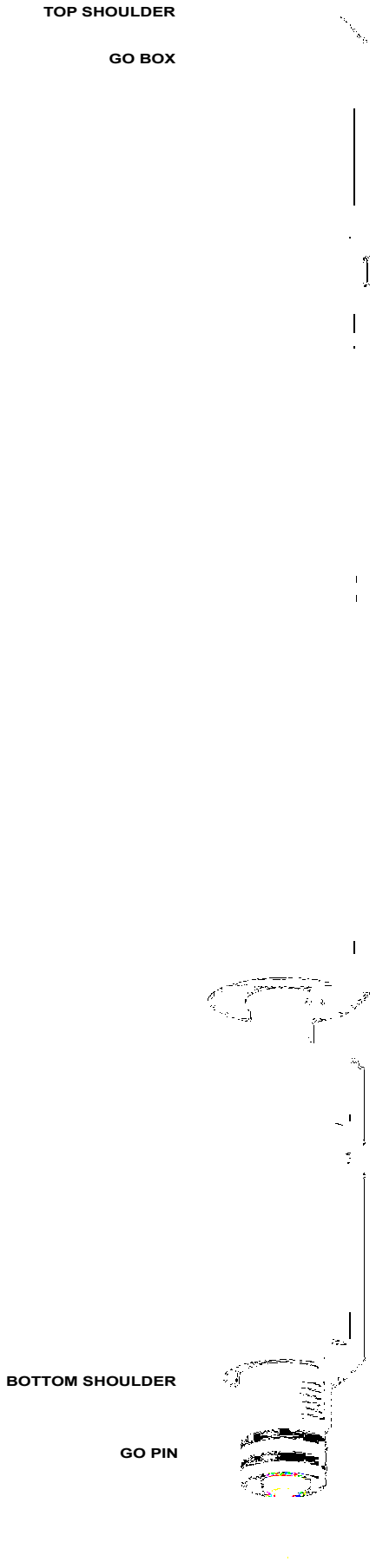
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TITAN® INSTRUMENT DIVISION

SPECIFICATIONS

MODEL NUMBER **4100-212-000**
TEMPERATURE RATING **350° F (176.7° C)**
PRESSURE RATING **20,000 PSI (138 MPa)**
WEIGHT / LENGTH **15 lbs (6.80 kg) / 18.77” (47.67 cm)**
OPERATING INFORMATION **Retainer wrench P/N 4100-168-012** **Will be needed during assembly**

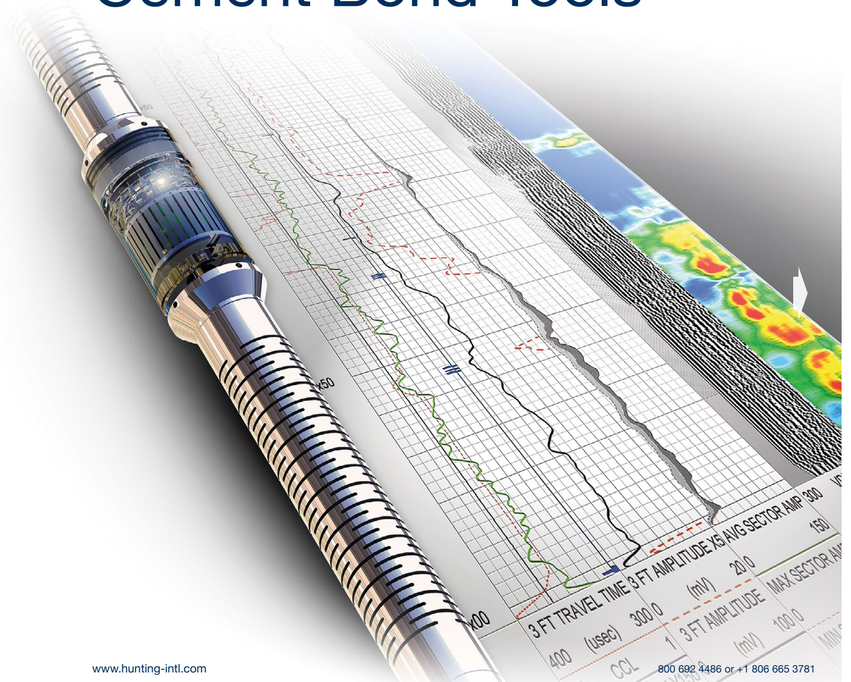


99SB21A0 May-12

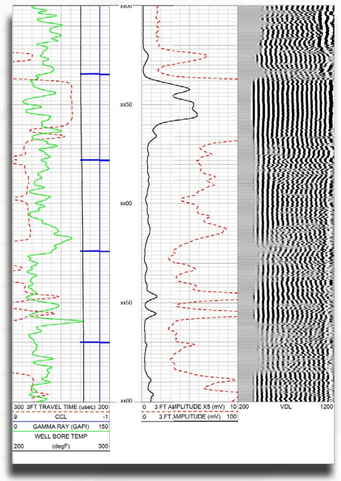
2 1/8”
(5.40 cm)

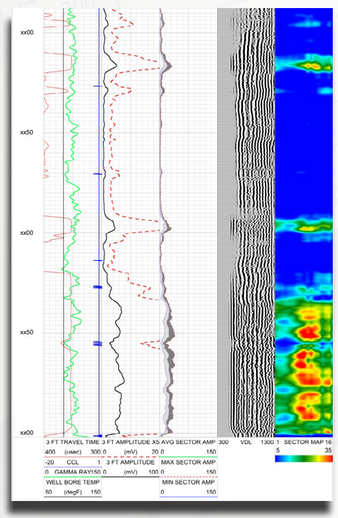
COMPENSATED SWIVEL ASSY.

Cement Bond Tools



Example of a CBL-VDL log showing good and poor cement bond. Good cement bond can be seen where the CBL amplitude is low verified with strong VDL's. High CBL amplitude along with a flat VDL indicates poor bond.





Cement map image showing channeling (red) confirmed by poor VDL signals and high CBL. Good cement bond shown in blue corresponds to good CBL (low amplitude) and strong formation returns on VDL.

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Right Tools. Right Location. Right Time.

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3ft-5ft Cement Bond Tool Family

The accurate evaluation of a wells cement bond to both casing and formation is necessary to confirm the integrity of isolation between zones and avoid production problems. The standard single transmitter Cement Bond Log (CBL) tool accurately determines casing bond by measuring the amplitude of the first arrival at the 3ft receiver. A deeper investigating 5ft receiver confirms the interpretation and also shows formation bond by a full Variable Density Log (VDL) wave display.

Hunting Titan's family of CBL tools come in a range of sizes to suite casings from 2-3/8 inch (60mm) to 14 inch (356mm). They can be configured to several timing schemes for different logging systems.

APPLICATIONS

- Assessment of cement bond quality and hydraulic isolation
- Locating top of cement (TOC)

FEATURES

- Piezoelectric crystals used in transmitters and receivers
- Wellbore and internal temperature sensors
- 450°F (204°C) flasked versions available
- Compatible with Hunting Titan Compensated Neutron, GR-Neutron and CCL

BENEFITS

- 16-20 kHz signal provides optimal casing signal and data transmission
- Canister architecture allows efficient and easy maintenance
- Temperature sensors allow real-time tool quality control

SPECIFICATIONS

Part Number	1-11/16 IN (43 MM)	2-3/4 IN (70 MM)	3-1/4 IN (83 MM)
Standard High Temperature	8010-1687HPE150-1.5-00 8010-1689HPE150-1.5-00	8010-2757HPE237-2.2-00 8010-2759HPE237-2.2-00	8010-3257HPE275-3.5-00 8010-3259HPE275-3.5-00
MEASUREMENTS			
Vertical Resolution	3 ft CBL and 5 ft VDL	3 ft CBL and 5 ft VDL	3 ft CBL and 5 ft VDL
Logging Speed (ft/min)[m/min]	60 [18.3]	60 [18.3]	60 [18.3]
Mud Type • Weight	Must be liquid • No limitations	Must be liquid • No limitations	Must be liquid • No limitations
Offset from bottom shoulder (in)[cm] Temperature • Transmitter 3ft Crystal • 5ft Crystal	78.0 [198.1] • 71.0 [180.3] 53.0 [134.6] • 41.0 [104.1]	77.0 [195.6] • 70.0 [177.8] 52.0 [132.1] • 40.0 [101.6]	77.0 [195.6] • 70.0 [177.8] 52.0 [132.1] • 40.0 [101.6]
ENVIRONMENTAL			
Temperature rating Standard (°F)[°C] High Temperature (°F)[°C]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]
Pressure Rating (psi)[MPa]	20,000 [138]	20,000 [138]	20,000 [138]
Material	H_2S resistant construction	H_2S resistant construction	H_2S resistant construction
MECHANICAL			
Outside Diameter (in)[mm]	1.69 [42.9]	2.75 [69.9]	3.25 [82.6]
Length (ft)[m] (Hi Temp)	9.75 [2.97] [10.29 [3.14])	9.13 [2.78] [10.50 [3.20])	9.13 [2.78] [10.50 [3.20])
Weight (lb)[kg] (Hi Temp)	52 [24] [75 [34])	102 lb [46 kg] [120 lb [54 kg])	122 lb (55 kg) [140 lb [64 kg])
Max. Tension (lbf)[kN]	12,000 [54]	60,000 [267]	60,000 [267]
Min. • Max. Casing Size (in)[mm]	2.38 [60] • 7.00 [178]	4.50 [114] • 9.63 [244]	5.50 [140] • 12.75 [324]
Top/Bottom Connection	1-3/16" GO Box/Pin	1-3/16" GO Box/Pin	1-3/16" GO Box/Pin
ELECTRICAL			
Operating Voltage & Current	120 VDC @ 40±5 mA	120 VDC @ 55±5 mA	120 VDC @ 55±5 mA
Auxiliary Tool Input	Single or bi-level pulse	Single or bi-level pulse	Single or bi-level pulse
Input Pulse Height • Width	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max
Transmitter Frequency	20 kHz	18 kHz	16 kHz
Cable Type Conductor High Capacitance Lines	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)
Crystal Type	Piezoelectric	Piezoelectric	Piezoelectric
Temperature Sensor	Platinum RTD	Platinum RTD	Platinum RTD
Pressure Compensation	Sliding cans	Sliding cans	Sliding cans



6-8 Sector

Radial Incremented Bond Tool Family

Conventional dual spaced 3ft - 5ft CBL is an economical way to evaluate a cement job. However, if it shows less than perfect bonding, additional information is needed to correctly evaluate the cement bond. Hunting Titan's Radial Incremented Bond (RIB) tools provide the conventional CBL-VDL receivers plus additional directional radial receivers that can measure circumferential data necessary to determine if there is channeling in the cement, or to indicate low compressive strength.

Hunting Titan's unique 1.5ft transmitter to radial receiver spacing provides highly directional information without the averaging effect seen in traditional 3ft spacing, and is less susceptible to fast formation interference. The amplitude display of each directional receiver forms a detailed 360° cement map that can be used to identify channeling, voids and other bonding irregularities.

ADDITIONAL APPLICATIONS

- Identification of micro annulus and channeling

ADDITIONAL FEATURES

- 1.5ft spacing cement map sensors
- Slip joint and bi-metallic isolator bar construction

ADDITIONAL BENEFITS

- Less fast formation interference in cement mapping

SPECIFICATIONS

Part Number	1-11/16 IN (43 MM)	2-3/4 IN (70 MM)
Standard High Temperature	8012-1687HPE150-1.5-00 8012-1689HPE150-1.5-00	8012-2757HPE237-2.2-00 8012-2759HPE237-2.2-00
MEASUREMENTS		
Vertical Resolution	1.5 ft RIB 3 ft CBL and 5 ft VDL	1.5 ft RIB 3 ft CBL and 5 ft VDL
Azimuthal Resolution	60° Cement map	45 ° Cement map
Logging Speed (ft/min)[m/min]	60 [18.3]	60 [18.3]
Mud Type • Weight	Must be liquid • No limitations	Must be liquid • No limitations
Offset from bottom shoulder (in)[cm] Temperature • Transmitter 3ft Crystal • 5ft Crystal	78.0 [198.2] • 70.0 [177.8] 61 [154.9] 52.0 [132.1] • 40.0 [101.6]	76.5 [194.3] • 70.0 [177.8] 61 [154.9] 52.0 [132.1] • 40.0 [101.6]
ENVIRONMENTAL		
Temperature rating Standard (°F)[°C] High Temperature (°F)[°C]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]
Pressure Rating (psi)[MPa]	20,000 [138]	20,000 [138]
Material	H_2S resistant construction	H_2S resistant construction
MECHANICAL		
Outside Diameter (in)[mm]	1.69 [42.9]	2.75 [69.9]
Length (ft)[m] (Hi Temp)	9.13 [2.78] [10.34 [3.15])	9.13 [2.78] [10.47 [3.19])
Weight (lb)[kg] (Hi Temp)	63 [29] (73 [33])	120 [54] (148 [67])
Max. Tension (lbf)[kN]	40,000 [178]	60,000 [267]
Min. Casing Size (in)[mm]	2.38 [60]	4.50 [114]
Max. Casing Size (in)[mm]	6.13 [156] (RIB) 7.00 [178] (CBL/VDL)	8.63 [219] (RIB) 9.63 [244] (CBL/VDL)
Top/Bottom Connection	1-3/16" GO Box/Pin	1-3/16" GO Box/Pin
ELECTRICAL		
Operating Voltage & Current	120 VDC @ 40±5 mA	120 VDC @ 55±5 mA
Auxiliary Tool Input	Single or bi-level pulse	Single or bi-level pulse
Input Pulse Height • Width	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max
Transmitter Frequency	20 kHz	20 kHz (Sectors) 18 kHz (CBL/VDL)
Cable Type Conductor High Capacitance Lines	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)
Crystal Type	Piezoelectric	Piezoelectric
Temperature Sensor	Platinum RTD	Platinum RTD
Pressure Compensation	Sliding cans	Sliding cans



12-16 Sector

High Definition Radial Incremented Bond

The industry standard 8 – Sector radial bond provides excellent cement evaluation between the casing and formation in most applications. However, as the casing size increase, the sector resolution of the 8 – Sector RIB tool decreases making it difficult to accurately identify channeling and other bonding irregularities. These unique challenges have been addressed by Hunting Titan's industry leading High Definition Radial Incremented Bond (HD-RIB) tools. The high sector azimuthal resolution, up to 22.5°, provides details necessary for identification of channeling, voids and other bonding irregularities in casing sizes of 7" (178 mm) or larger. A sonic receiver spaced 3ft from the transmitter provides quality information on casing to cement bonding. Amplitude display of the highly directional receivers allows a detailed 360° cement map of the wellbore to be created. A deeper investigating receiver confirms the data obtained from the 3ft receiver and shows formation bonding by a full VDL wave display.

FEATURES

- Wellbore and internal temperature sensors
- 450°F (204°C) flasked versions available
- VDL crystal on 4-1/2 in (114 mm) tool at 6 ft for increased depth of investigation
- Compatible with Hunting Titan Compensated Neutron, GR-Neutron and CCL

BENEFITS

- Up to 22.5° azimuthal resolution on cement maps
- Excellent sonic isolation
- Temperature sensors allow real-time tool quality control
- VDL spacing ideal for large boreholes

SPECIFICATIONS

Part Number	3-1/4 IN (83 MM)	4-1/2 IN (114 MM)
Standard High Temperature	8012-3257HPE300-3.0-00-S 8012-3259HPE300-3.0-00-S	8012-4507HPE400-03-00 8012-4509HPE400-03-00
MEASUREMENTS		
Vertical Resolution	1.5 ft RIB 3 ft CBL and 5 ft VDL	3 ft RIB 3 ft CBL and 6 ft VDL
Azimuthal Resolution	30° Cement map	22.5° Cement map
Logging Speed (ft/min)[m/min]	60 [18.3]	60 [18.3]
Mud Type • Weight	Must be liquid • No limitations	Must be liquid • No limitations
Offset from bottom shoulder (in)[cm] Temperature • Transmitter RIB 3ft Crystal • 5ft or 6ft Crystal	76.5 [194.3] • 70.0 [177.8] 61.0 [154.9] 52.0 [132.1] • 40.0 [101.6]	88.6 [225.0] • 81.2 [206.2] 63.2 [160.5] 63.2 [160.5] • 45.2 [114.8]
ENVIRONMENTAL		
Temperature rating Standard (°F)[°C] High Temperature (°F)[°C]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]	-25 to 400 [-32 to 204] -25 to 450 [-32 to 232]
Pressure Rating (psi)[MPa]	20,000 [138]	20,000 [138]
Material	H_2S resistant construction	H_2S resistant construction
MECHANICAL		
Outside Diameter (in)[mm]	3.25 [82.6]	4.50 [114.3]
Length (ft)[m] (Hi Temp)	9.13 [2.78 [10.75 [3.28])	10.29 [3.14] [11.86 [3.61])
Weight (lb)[kg] (Hi Temp)	135 [61] [160 [73])	202 [92] [234 [106])
Max. Tension (lbf)[kN]	60,000 [267]	60,000 [267]
Min. Casing Size (in)[mm]	5.50 [140]	8.63 [219]
Max. Casing Size (in)[mm]	10.75 [273] (RIB) 12.75 [324] (CBL/VDL)	18.00 [457]
Top • Bottom Connection	1-3/16" GO Box • 1-3/16" GO Pin	1-3/16" GO Box • 1-3/16" GO Pin
ELECTRICAL		
Operating Voltage & Current	120 VDC @ 30±5 mA (at tool head)	120 VDC @ 30±5 mA (at tool head)
Auxiliary Tool Input	Single or bi-level pulse	Single or bi-level pulse
Input Pulse Height • Width	±12V max • 1µs min, 30 µs max	±12V max • 1µs min, 30 µs max
Transmitter Frequency	18 kHz	14 kHz
Cable Type Conductor High Capacitance Lines	Single or multi-conductor 7/32 in 500°F (260°C)	Single or multi-conductor 7/32 in 500°F (260°C)
Crystal Type	Piezoelectric	Piezoelectric
Temperature Sensor	Platinum RTD	Platinum RTD
Pressure Compensation	Sliding cans	Sliding cans

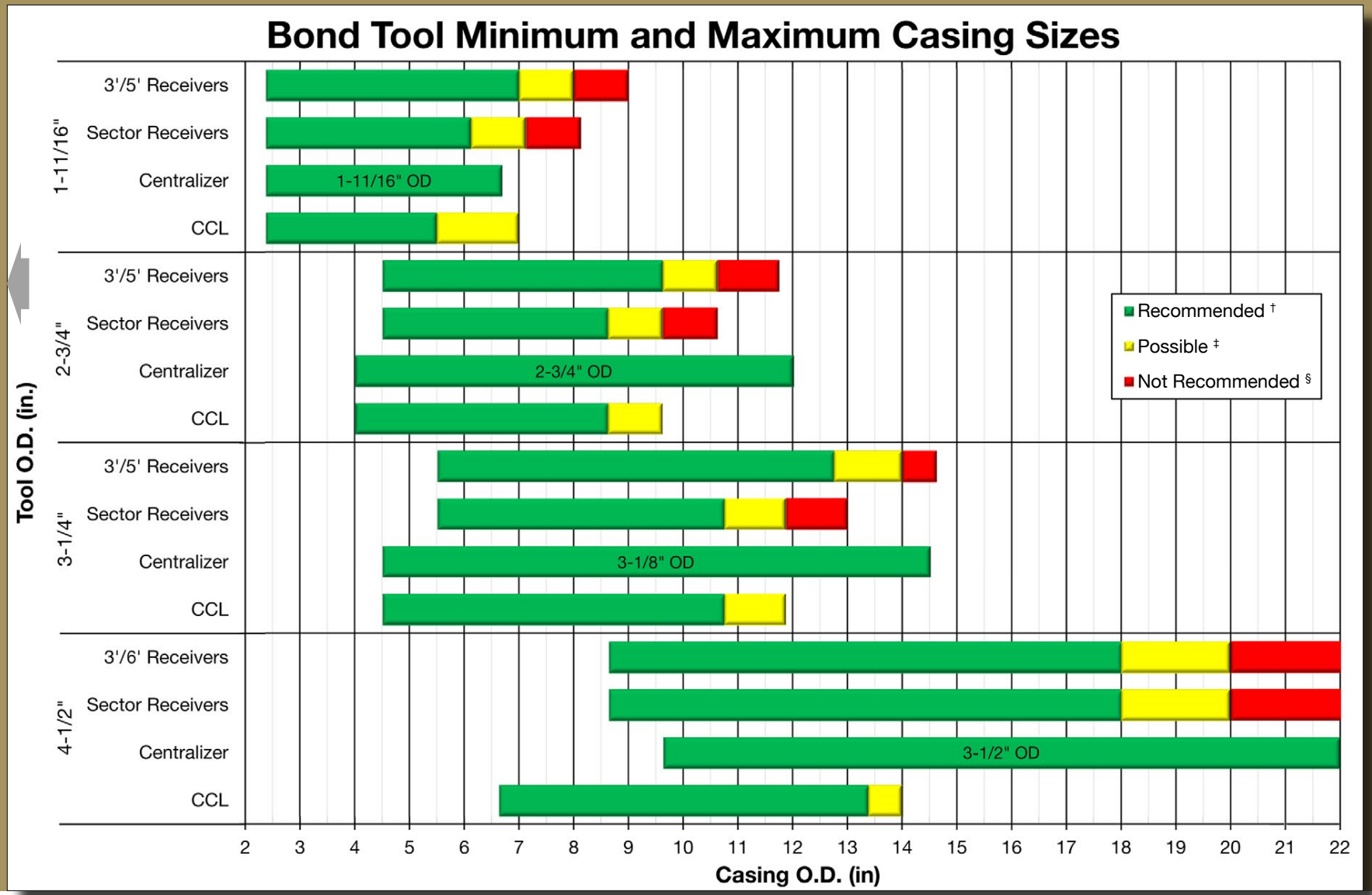


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Due to variables such as well bore fluid density, casing weights and tool condition, the above values are for general tool selection.

† Excellent signal return in ideal conditions
‡ Sufficient signal return in ideal conditions
§ No signal return

"Ideal Conditions" include fresh water, minimum 1000 psi hydrostatic pressure, good free pipe calibrations, proper tool centralization, and a recently serviced tool.

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ControlFire®

Perforating Solutions

ControlFire® Switch Specifications

ENVIRONMENTAL	
Operating Temperature Range	-20 to 347 °F (-29 to 175 °C)
Survival Temperature	-58 to 392 °F (-50 to 200 °C)
Max. Thermal Change	9 °F/min (5 °C/min)
Vibration Compliance	Compliant to all hollow carrier gun systems
Vibration (3 axis)	50G RMS @ Sweep Frequency 50-1,000 Hz
ELECTRICAL	
Operating Voltage Range	-5 to -550 VDC
Operating Current – Standby	>1 mA
Current – Communicating	10 mA at Surface • 30 mA Downhole
Communications	Bi-Directional
COMPATIBILITY	
Detonators – Hot Wire	50 ohms or higher (single or double resistor types)
Igniters – Setting Tools	50 ohms or higher
RF Safe Detonators	PX-1/EBW, RED (all versions)

ControlFire® Shooting Power Supply Specifications

ENVIRONMENTAL	
Operating Temperature Range	14 to 131 °F (-10 to 55 °C)
ELECTRICAL	
AC Power Supply	110-120 VAC
Power Supply Frequency	50-60 Hz, Single Phase, 2-Wire Plus Ground
Voltage Output	0 to ±450 VDC (Filtered & Continuously Adjustable)
Current Output	0 to 2.5 A
Power Output	>800 W (±350 VDC @ 2.33 A with 150 ohm load)
Output Current Limit	3.0 A
Output Ripple (rms)	<2% @ ±300 VDC and 2 A
Output Noise (p-p)	<1% @ ±300 VDC and 2 A
GENERAL SPECIFICATION	
Dimensions	3.5 x 19 x 14 in. (8.9 x 48.3 x 35.6 cm)
Weight	28.8 lb (10.6 kg)
Mount	19 in. Rack with Slide Rails & Grab Handles

Hunting Titan Part Numbers

	Part Number
CONTROLFIRE SWITCH SYSTEM	
Switch (V1.8)	9002-013-120-1.8
Command and Control Panel (portable)	9002-013-510
Command and Control Panel (rack mount)	9002-013-550
VeriFire Panel	9002-013-210
Wireline Switch Simulator Panel	9002-013-610
Panel External Test Block	9002-013-320
Cable Kit	9002-013-017
EBFire® Feed Thru w/ Ground	9400-EBTW-WG
EBFire® Feed Thru	9400-EBTW
Retainer Nut – ¼" ID w/ Ground	9400-EBRN-WG
Retainer Nut – ¼" ID	9400-EBRN-250
RF-SAFE CONTROLFIRE SYSTEM (with Austin Powder detonator selection)	
RF-Safe Switch with A-85 Detonator	DETO-CFA-A85-T
RF-Safe Switch with A-96L Detonator	DETO-CFA-A96L-T
RF-Safe Switch with A-105 Detonator	DETO-CFA-A105-T
RF-Safe Switch with A-105-100 Detonator	DETO-CFA-A105100-T
RF-Safe Switch with A-140 Detonator	DETO-CFA-A140-T
RF-Safe Switch with A-140F & Block Detonator	DETO-CFA-A140F-T
RF-Safe Switch with A-140S Detonator	DETO-CFA-A140S-T
HUNTING TITAN SHOOTING POWER SUPPLY	
ControlFire Shooting Power Supply	9002-013-810-1

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The solutions to all of your perforating needs are right here

ControlFire® Systems

APPLICATIONS

- Selective perforating
- Single trip plug and perf
- Horizontal pump down operations
- Tractor perforating operations

FEATURES

- Shoot up to 40 guns per run
- No downhole control sub or high impedance CCL
- Compatible with perforating gamma ray tools
- Integrates into existing gun carrier systems
- User friendly software
- Complete log event stored on file
- Real time shot verification with voltage/current plot
- Surface switch tester
- Integrated surface system
- RF-Safe options

BENEFITS

- Added level of safety versus conventional mechanical switch systems
- Skip over capabilities provide valuable time savings in the case of a misfire
- Increased reliability and efficiency of electronic switch over conventional mechanical components
- Switch check at anytime in wellbore for improved confidence prior to pumping operations
- Reduced switch maintenance through fully expendable system
- VeriFire® allows safe switch communication to an armed gun on surface
- ControlFire® Shooting Power Supply eliminates the need for an additional surface panel
- RF-Safe ControlFire system eliminates the need for radio silence during arming procedures

ControlFire Switch System

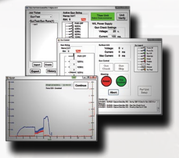
Hunting Titan's ControlFire® switch system is the latest in perforating switch technology that utilizes unique switch identification logic to selectively perforate multiple intervals in a single trip. Each ControlFire switch communicates with a surface Perforating Command and Control Panel (PCCP) allowing for real time confirmation and skip-over capabilities. The switch also adds an extra level of safety by electrically isolating the detonator until the appropriate commands are received from the ControlFire software. These are significant advantages over sequentially activated mechanical switches enabling safe, reliable, and confident perforating operations. Gun Systems implementing ControlFire switches can be conveyed on wireline and E-coil, and are compatible with tractor systems.





The PCCP adapts to your surface power supply for ControlFire and is available in a rack mount or portable panel.





The ControlFire software is the user friendly interface between the PCCP and the ControlFire switches. It features real time communication, stored job data, and shot verification via a voltage/current plot.

The software does not require a designated computer, and is compatible with Windows XP/7. It can also be accessed through SDS Warrior® acquisition systems.

VeriFire Switch Tester

The VeriFire® ControlFire Switch Tester has been designed with voltage and current limiting features to safely check electrical continuity and operational functionality of ControlFire switches contained in armed or unarmed perforating guns while at surface. It has been reviewed and confirmed by an independent third party to be compliant with API RP-67 Guidelines. VeriFire can greatly enhance confidence by allowing switch checks after gun loading and prior to descent in the well.



RF-Safe ControlFire System

Despite safety procedures and training, accidents involving perforating operations still occur in the oilfield industry. One possible cause of such incidents is the unintentional initiation of explosives by extraneous electricity, the main types being stray voltage, radio frequency (RF) and electrostatic discharge (ESD).

Although preventive measures are set in place to mitigate these risks, Hunting Titan's RF-Safe ControlFire System takes a significant step in eliminating these hazards altogether. Unlike existing safe systems, the RF-Safe ControlFire System utilizes conventional detonators integrated with ControlFire switch technology, providing an affordable option without compromising safety. An independently recognized testing agency confirmed that *"users of the RF-Safe ControlFire System are safe from stray voltage up to 500V, from personnel-borne ESD, and from nearby radio transmitters of types commonly found at inland or offshore oil-well sites." -Franklin Applied Physics*

Integrated Surface Systems

Hunting Titan can simplify and economize your surface perforating equipment by combining multiple systems into one compact and convenient package. The ControlFire Shooting Power Supply (SPS) is a 3.5" rack mount panel that features a built in ControlFire board. This integrated system eliminates the need for a separate PCCP, reducing the complexity of your perforating operations.

The front panel includes a function switch to easily transition from ControlFire operations to CCL, auxiliary, log or conventional firing mode. The SPS can be configured for one or two logging cable drums and fits into existing rack mounted systems. The ControlFire SPS is compatible with the SDS Warrior acquisition system, satisfies API RP-67 Guidelines and is currently undergoing CE certification.



ControlFire SPS combines your shooting supply with a ControlFire board for an all-in-one rack mounted panel.

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ControlFire® Shooting Power Supply

One panel for all of your perforating needs

The ControlFire® Shooting Power Supply (SPS) from Hunting Titan conveniently integrates multiple surface systems into a single, compact package to reduce the complexity of your cased hole perforating operations. The 3.5" rack mount panel features a built in ControlFire board, allowing users to perforate using conventional or ControlFire switch systems. This eliminates the need for separate surface equipment when implementing an addressable switch system. The front panel includes a function dial to easily switch from ControlFire operations to CCL, auxiliary, log or conventional firing modes. The ControlFire SPS is compatible with the SDS Warrior® acquisition system, satisfies the recommendations set forth in API RP-67 and is currently undergoing CE certification. Safe, reliable and versatile, the ControlFire Shooting Power Supply provides a cost effective solution to your cased hole perforating needs.



APPLICATIONS

- Wireline and E-Coil perforating

SPECIFICATIONS

Part Number	9002-013-810-1
ENVIRONMENTAL	
Operating Temperature Range	14 to 131 °F (-10 to 55 °C)
ELECTRICAL	
AC Power Supply	110-120 VAC
Power Supply Frequency	50-60 Hz, Single Phase, 2-Wire Plus Ground
Voltage Output	0 to ±450 VDC (Filtered & Continuously Adjustable)
Current Output	0 to 2.5 A
Power Output	>800 W (±350 VDC @ 2.33 A with 150 ohm load)
Output Current Limit	3.0 A
Output Ripple (rms)	<2% @ ±300 VDC and 2 A
Output Noise (p-p)	<1% @ ±300 VDC and 2 A
GENERAL SPECIFICATION	
Dimensions	3.5 x 19 x 14 in. (8.9 x 48.3 x 35.6 cm)
Weight	28.8 lb (10.6 kg)
Mount	19 in. Rack with Slide Rails & Grab Handles

FEATURES

- Rack mount panel
- Log, Auxiliary, CCL, Conventional switch and ControlFire switch modes
- Resistorized bridge wire and high energy detonator compatible
- Dual drum configuration
- Clean shooting power
- Onboard safety switch
- Front and back Aux In jack

BENEFITS

- Fits into existing rack mounted systems
- One panel for all perforating switch and detonator systems
- Roll up and dump-fire capabilities
- Two line input allows easy switching from one drum to another
- Conveniently run external auxiliary services
- Clear shot indication

P_CONTOLFIRE_PWR.indd 1/31/12 10:44 AM

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Highly Integrated Detector

Log data obtained from nuclear logging tools provide some of the fundamental information required to characterize and assess a reservoirs performance. These include formation identification and correlation, porosity measurements, gas detection, fluid contact migration, clay typing and seismic processing.



It is therefore vital to obtain the most accurate data possible. Hunting Titan's Highly Integrated Detectors (HID) provide the high accuracy plus outstanding reliability required to perform these tasks.

They're designed to take advantage of our proprietary mounting technology†. By combining the photomultiplier tube (PMT) and crystal in a hermetically sealed package, the shock energy is substantially dampened. This unique mounting technology is unaffected by changes in temperature. The compound coupler used as an interface with the PMT to the crystal is the most optically clear product available on the market and remains constantly in contact making it less prone to alignment mismatch.

APPLICATIONS

- Wireline openhole
  - Natural and spectral GR (KUT)
  - Formation litho density
  - Pulsed neutron
- MWD/LWD
  - Focused and Standard GR
  - Natural and spectral GR (KUT)
  - Formation litho density
  - Pulsed neutron
- Wireline cased hole
  - Production logging and perforating GR
  - Fluid density

FEATURES

- Proprietary shock and vibration mounting technology†
- PMT coupled directly to crystal with exclusive coupler†
- Qualified up to 200 °C (392 °F)
- Customized packaging and interface to customer specifications
- Optimized for Hamamatsu PMT's

BENEFITS

- Extreme shock and vibration resistance
- Innovative packaging allows for larger crystal volume
- HID packaging improves pulse height resolution by 25%
- Compound coupler reduces light loss and is less prone to alignment mismatch
- High temperature applications

CRYSTAL SPECIFICATIONS

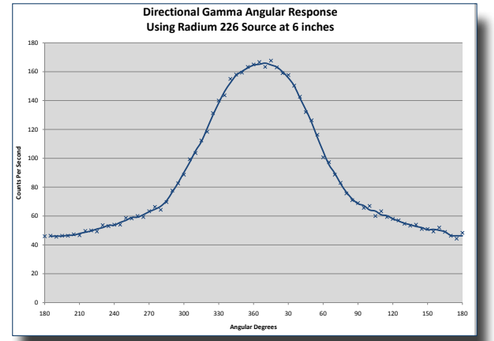
Part Number Series	E2920
MEASUREMENTS	
Pulse Height Resolution	Less than 9% with typical PMT
ENVIRONMENTAL	
Operating Temperature Rating	-40 to 200 °C (-40 to 392 °F)
Survival Temperature	-55 to 205 °C (-67 to 401 °F)
Max. Heat/Cool Range	3 °C/min (5.4 °F/min)
Vibration (3 Axis)	30 G RMS (15 – 300 Hz random)
Shock (3 Axis)	1,000 G, 0.5 ms
MECHANICAL	
Crystal Diameter	0.70 to 2.00 in (17.8 to 50.8 mm)
Crystal Length	1.00 to 12.00 in (25.4 to 304.8 mm)
ELECTRICAL (WITH HAMAMATSU PMT)	
Voltage	1000 to 1750 VDC
Signal	Analog Gamma counts
PMT Amplification	10^5 to 10^6

† *US patents: 7,115,873 7,381,957 7,485,865 7,485,851*

MWD Gamma Detector Module

With the increasing complexity of directional drilling operations, timely and accurate downhole measurements are vital to achieve a wells objective.

Hunting Titan's ruggedized MWD Gamma Detector Module (MWD-GDM) has been field proven in both conventional MWD drilling applications and in the harsh multiphase drilling environments associated with electromagnetic (EM-MWD) systems. Scintillation crystals and integral PMT assemblies are manufactured in-house using proprietary assembly and shock-mounting technology. This technology provides outstanding protection at higher shock and vibration loads, and minimizes detector failures associated with severe downhole drilling conditions.



The MWD-GDM can be fully customized upon request. Some of the options available include choice of negative or positive pulse outputs, standard or directional (focused) GR and floating or ungrounded chassis for EM applications

Solid, reliable and backed by a company with a history of durable products, Hunting Titan's MWD-GDM provides the best detectors for downhole MWD systems.

MWD SPECIFICATIONS

Part Number Series Standard Ruggedized MWD Focused MWD	8100-17558SH 8100-17558DG
MEASUREMENTS	
Thin Bed Resolution 8 in. hole diameter @ 50% points	6.8 in (173 mm)
Measurement Range	0 to 5000 API
Accuracy	±5% to 150 °C (302 °F) ±10% to 175 °C (347 °F)
Sensitivity (beryllium copper housing)	0.82 counts per API
Effective Angular Window	±45°
ENVIRONMENTAL	
Operating Temperature Rating	-40 to 175 °C (-40 to 347 °F)
Survival Temperature	200 °C (392 °F)
Max. Heat/Cool Range	3 °C/min (5.4 °F/min)
Vibration (3 Axis)	30 G RMS (50 – 1000 Hz sweep)
Shock (Z Axis)	500 G (0.5 ms)
Shock (X-Y Axis)	1000 G (0.5 ms)
MECHANICAL	
O.D. with Shock Rings	1.49 in (37.8 mm)
Length	15.38 in (39.1 mm)
Electrical Connections	MDM 15-pin male/female
ELECTRICAL (WITH HAMAMATSU PMT)	
Operating Voltage Range	18-38 VDC
Max. Voltage Input	40 VDC
Operating Current (constant power)	10±5 mA
Output Pulse TTL or CMOS	Negative (+5 to 0 V)
Output Pulse Width	2 to 5 µs
Active NaI Crystal Size	0.84 x 4.18 in (21.3 x 106.2 mm)
Front/Back Count Ratio	3.5

APPLICATIONS

- Conventional MWD/LWD systems
- Electromagnetic MWD systems
- Retrievable and collar mounted tools

FEATURES

- Industry exclusive shock and vibration technology†
- Continuous operation at 175 °C (347 °F)
- High sensitivity and repeatability
- Low power operations
- Industry standard MDM 15 pin connectors

BENEFITS

- Compact and rugged
- High survivability in underbalanced and air drilling environments
- Not affected by pulser electrical noise
- Detector design minimizes vibration induced noise
- Maximizes battery life
- Standard connectors allow drop-in replacement capabilities



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Motorized Free Point Tool



Many factors can contribute to a drilling or workover string getting stuck in the well. Some examples are borehole conditions, wellbore fluid properties, formation characteristics and assembly problems.

Hunting Titan's Motorized Free Point Tool accurately determines the stuck point in pipe, tubing or a casing string. The real-time data allows the operator to make rapid and informed decisions in determining the next steps to recover the stuck downhole assembly.

The sensor picks up movements in the assembly associated with tension, compression or torque measurements and converts that to an AC signal. This signal is then processed at the surface by the Free Point Panel for display and recording for permanent records.

APPLICATIONS

- Stuck pipe determination

FEATURES

- Tension, compression and torque measurements
- Built in Casing Collar Locator (CCL)
- Solid-state electronic motor control
- Full open/close sensors
- Seven anchor sizes available for most applications

BENEFITS

- Real-time data assists in optimizing pipe recovery methods
- Accurate depth determination of stuck assembly
- Controlled electronics protect damage to gear and drive assemblies
- Interchangeable anchors for different assemblies

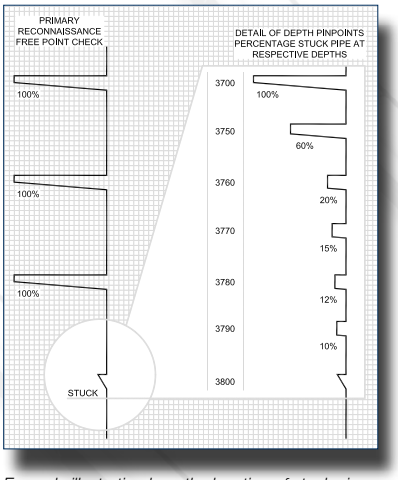
ANCHOR SELECTION CHART

LEG PART NUMBER	Closed Diameter (in)[mm]	Open Diameter (in)[mm]
8140-143-016-1	1.43 [37]†	2.74 [70] @ 45°
8140-143-016-2	1.43 [37]†	4.17 [106] @ 45°
8140-143-016-3	1.43 [40]†	5.56 [141] @ 45°
8140-143-016-4	4.10 [104]	5.28 [134] @ 30°
8140-143-016-5	4.10 [104]	6.43 [163] @ 30°
8140-143-016-6	5.86 [149]	8.40 [213] @ 30° 9.17 [233] @ 45°
8140-143-016-7	7.38 [187]	10.52 [267] @ 30° 11.27 [286] @ 45°

† 1.56 in (40 mm) for 18,000 psi (124 MPa) version

SPECIFICATIONS

Part Number	1-7/16 in (37 mm)	1-9/16 in(40 mm)
With Panel Without Panel	8140-14342-600-00 8140-14342-630-00	8140-15642-600-00 8140-15642-630-00
MEASUREMENTS		
Vertical Resolution	4.03 [1.23]	4.03 [1.23]
Logging Speed CCL (ft/min)[m/min]	60 [18.3]	60 [18.3]
Mud Type • Weight	No limitations	No limitations
ENVIRONMENTAL		
Temperature rating (°F)[°C]	325 [163]	325 [163]
Pressure Rating (psi)[MPa]	15,000 [103]	18,000 [124]
Material	Nedox® coated steel	Nedox® coated steel
MECHANICAL		
Outside Diameter (in)[mm]	1.43 [36.5]	1.56 [39.7]
Length (ft)[m]	8.32 [2.54]	8.32 [2.54]
Weight (lb)[kg]	45 [20]	50 [23]
Fishing Strength (lbf)[kN]	22,000 [98]	22,000 [98]
Min. • Max. Pipe I.D. (in)[mm]	1.77 [45] • 11.27 [287]	1.90 [48] • 11.27 [287]
Top Connection	1-3/16" GO Box	1-3/16" GO Box
ELECTRICAL		
Operating Voltage & Current Operating Anchors Operating Sensors	 32 VDC @ 240±20 mA 40 VDC @ 200±10 mA	 32 VDC @ 240±20 mA 40 VDC @ 200±10 mA
Output Signal (Peak to Peak)	1.0 V variable frequency	1.0 V variable frequency
Cable Type	Single conductor	Single conductor
Stretch/Torque Sensor	Magnetic flux gap	Magnetic flux gap



Example illustrating how the location of stuck pipe can be determined by the Motorized Free Point Tool. The ideal depth to perform backoff operations will be somewhere between 3700ft and 3750ft.



The Free Point Panel (8140-000-500) provides control functionality to the tool and processes signals coming from the tool. The panel is available separately.

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PerfECTA®

The PerfECTA® family is Hunting Titan's latest generation of shaped charges that have been engineered to provide superior performance in all types of formations.

The PerfECTA Super Deep Penetrating (SDP) series offers unbeatable penetration when compared to conventional shaped charges while maintaining excellent hole diameter. These large holes assure greater tunnel volume beyond the damaged zone allowing for enhanced flow and productivity.

PerfECTA Good Hole (GH) charges are unique in that they offer a perfect balance between larger hole diameter while retaining very good penetration. This kind of perforation is ideally suited for fracturing operations where hole size needs to be large enough for proppant flow, yet deep enough to go beyond the damaged zone to allow for lower break down pressures.

PerfECTA Big Hole (BH) charges produce the maximum hole diameter and area of flow while keeping an effective penetration, perfect for gravel pack or frac pack operations.

APPLICATIONS

- Natural flowing and stimulated wells
- Sand control and gravel-pack completions
- Production and injection wells
- Damaged formations
- All reservoir types
- All fluid types (oil, water, gas)

BENEFITS

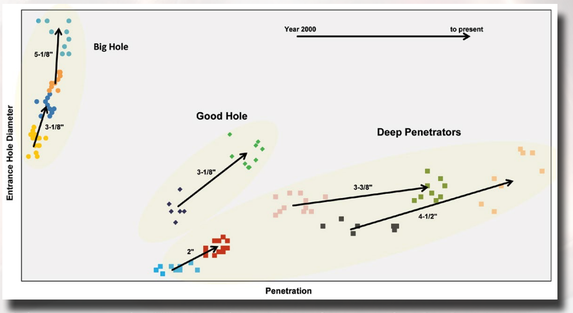
- Improves well performance
- Capable of lowering skin factors allowing improved production or injection
- Helps reduce fracture break down pressure
- Potential reduction in weak sand production
- No incremental cost required to upgrade existing hardware

FEATURES

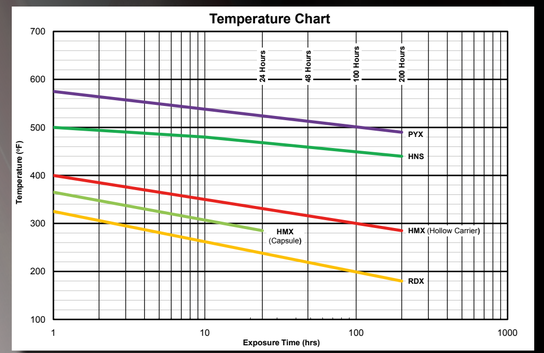
- Wide variety of charges to meet specific needs
- Super deep penetrating charges perforate beyond the damaged zone
- Greater formation contact created by bigger holes
- Big hole charges optimized for gravel packs
- Compatible and best used with all existing Hunting Titan wireline and TCP perforating systems
- Can be deployed using all conveyance methods
- Available with RDX, HMX and HNS

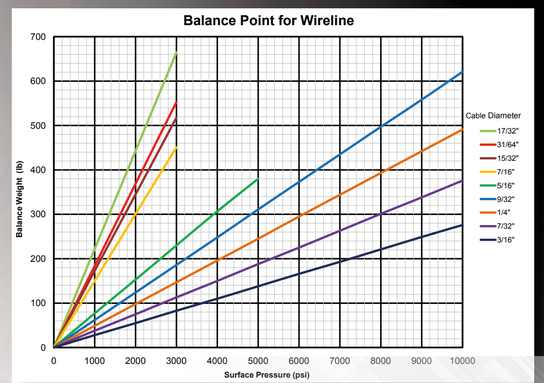
INNOVATION

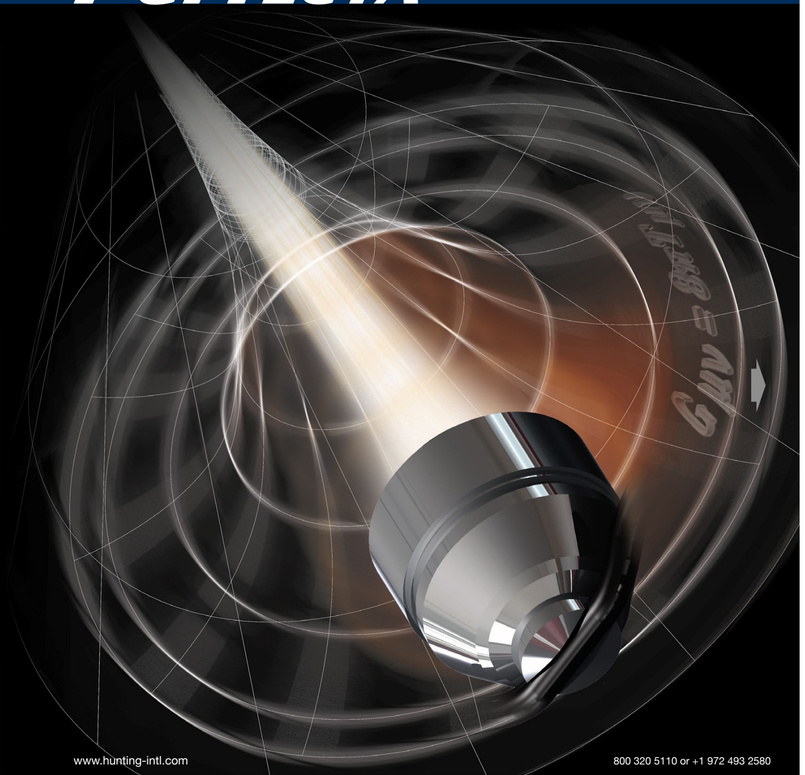
Through years of research, development and experience, Hunting Titan has proven itself to be the industry leader in shaped charge design and manufacturing. Utilizing the latest technology and innovative design, the PerfECTA family of charges have increased in penetration performance up to 43% and entrance hole diameters by 39% compared to shaped charges designed a decade ago.



Performance comparison from 2000 to present for select Big Hole, Good Hole and Super Deep Penetrator gun systems







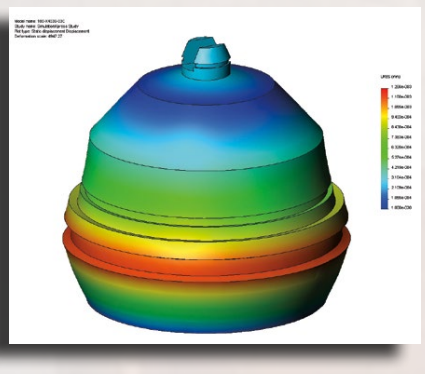
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PerfECTA®

DESIGN



Utilizing knowledge and experience, PerfECTA's innovative charge designs translate to a new level of deeper penetration and larger hole size. All Hunting Titan gun systems are designed to minimize debris and lower gun swell.



PerfECTA liner designs focus energy to portions of the jet that increase penetration, while minimizing wasted energy that is not helpful downhole. This results in cleaner, more effective perforations.

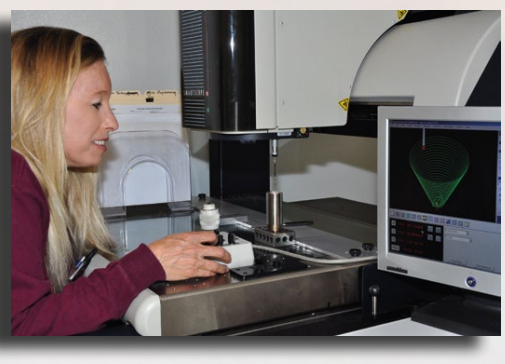
PerfECTA charges are designed and optimized in a combination of materials that correlate to soft, medium and hard rock. Tests are also performed under stressed conditions. All this equates to shaped charges designed to perform well in rock under downhole conditions.



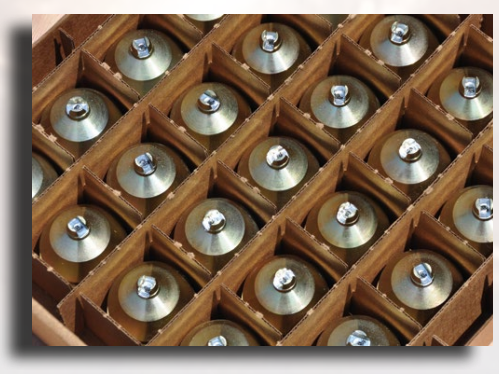
As part of a stringent design process, all Hunting Titan gun systems are tested to ensure superior charge performance while retaining gun survivability. Check with your local Hunting Titan distributor or GunFacts® data sheets for test results.



MANUFACTURING



Hunting Titan prides itself on strict and unique quality control applied to manufacturing of PerfECTA charges by utilizing the latest technology in equipment and processes. Hunting Titan fully complies with all ISO9001:2008 standards for quality management.



Packaging is designed to withstand the tough oilfield handling, transportation and storage. This guarantees the outstanding performance expected by PerfECTA.

API RP-19B Performance

	Gun OD (in)[mm]	Charge Part Number†	Explosive Weight (g)	Shot Density (spf)[spm], Phasing	Entrance Hole (in)[mm]	Penetration (in)[cm]	Burr Height (in)[cm]	Casing Size (in)[mm]	Casing Weight (lb/ft)[kg/m]	Target Strength (psi)[MPa]	Recommended Min. I.D. (in)[mm]
CAPSULE STRIP GUNS											
	1-11/16 [43]	CAP-1708-421T	8.0	4 [13], 0°	0.24 [6]	20.41 [51.84]	0.05 [0.13]	4-1/2 [114]	11.6 [17.3]	7,170 [49.4]	1.78 [45]
	2-1/8 [54]	CAP-2115-420T	15.0	4 [13], 0°	0.28 [7]	34.84 [88.49]	0.05 [0.13]	5-1/2 [140]	17 [25.3]	7,125 [49.1]	2.25 [57]
SCALLOPED HOLLOW CARRIER GUNS											
SUPER DEEP PENETRATOR	1-9/16 [40]	RTG-1604-421T	3.5	6 [20], 0°	0.23 [6]	12.14 [30.84]	0.04 [0.10]	2-3/8 [60]	4.6 [6.9]	6,980 [48.1]	1.78 [45]
	1-9/16 [40]	RTG-1604-421T	3.5	6 [20], 60°	0.20 [5]	12.68 [32.21]	0.04 [0.10]	2-3/8 [60]	4.6 [6.9]	6,800 [46.9]	1.78 [45]
	2 [51]	RTG-2104-421T‡	4.0	6 [20], 0°	0.21 [5]	19.05 [48.39]	0.05 [0.13]	2-7/8 [73]	6.4 [9.5]	8,360 [57.6]	2.18 [55]
	2 [51]	RTG-2107-421T	7.0	6 [20], 60°	0.29 [7]	26.07 [66.22]	0.05 [0.13]	2-7/8 [73]	6.4 [9.5]	7,760 [53.5]	2.25 [57]
	2-1/2 [64]	RTG-2512-421T	12.0	6 [20], 60°	0.33 [8]	31.26 [79.40]	0.05 [0.13]	3-1/2 [89]	9.2 [13.7]	5,970 [41.2]	2.71 [69]
	2-3/4 [70]	RTG-2512-421T	12.0	6 [20], 60°	0.36 [9]	31.90 [81.03]	0.05 [0.13]	4-1/2 [114]	11.6 [17.3]	8,050 [55.5]	3.00 [76]
	2-3/4 [70]	EXP-2716-421T	16.0	6 [20], 60°	0.38 [10]	35.94 [91.29]	0.04 [0.10]	4-1/2 [114]	11.6 [17.3]	7,470 [51.5]	3.00 [76]
	2-3/4 [70]	EXP-2818-421T	18.0	6 [20], 60°	0.41 [10]	36.22 [92.00]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	7,920 [54.6]	3.13 [80]
	2-7/8 [73]	EXP-2818-421T	18.0	6 [20], 60°	0.39 [10]	37.50 [95.25]	0.05 [0.13]	4-1/2 [114]	11.6 [17.3]	6,850 [47.2]	3.25 [83]
	3-1/8 [79]	EXP-3319-423T	19.0	6 [20], 60°	0.38 [10]	45.89 [116.56]	0.05 [0.13]	4-1/2 [114]	11.6 [17.3]	5,900 [40.7]	3.58 [91]
	3-1/8 [79]	EXP-3321-421T§	21.0	4 [13], 60°	0.43 [11]	42.13 [107.01]	0.05 [0.13]	4-1/2 [114]	11.6 [17.3]	6,320 [43.6]	3.58 [91]
	3-1/8 [79]	EXP-3321-421T	21.0	6 [20], 60°	0.42 [11]	44.19 [112.24]	0.05 [0.13]	4-1/2 [114]	11.6 [17.3]	5,900 [40.7]	3.58 [91]
	3-1/8 [79]	EXP-3323-423T	22.7	6 [20], 60°	0.46 [12]	41.17 [104.57]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	6,770 [46.7]	3.58 [91]
	3-3/8 [86]	EXP-3323-423T	22.7	6 [20], 60°	0.45 [11]	42.21 [107.21]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	7,270 [50.1]	3.80 [97]
	3-3/8 [86]	EXP-3326-421T	26.0	6 [20], 60°	0.41 [10]	50.05 [127.13]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	7,835 [54.0]	3.80 [97]
	4 [102]	EXP-4039-423T	38.5	4 [13], 90°	0.44 [11]	62.81 [159.54]	0.07 [0.18]	5-1/2 [140]	17 [25.3]	6,460 [44.5]	4.60 [117]
	4-1/2 [114]	EXP-4521-423T	21.0	12 [39], 135/45°	0.37 [9]	35.97 [91.36]	0.05 [0.13]	7 [178]	32 [47.6]	8,470 [53.4]	4.92 [125]
	4-1/2 [114]	EXP-4539-425T	38.5	5 [16], 60°	0.46 [12]	55.70 [141.48]	0.08 [0.20]	7 [178]	32 [47.6]	6,320 [43.6]	4.92 [125]
	7 [178]	EXP-4039-423T	38.5	12 [39], 135/45°	0.40 [10]	49.60 [125.98]	0.09 [0.23]	9-5/8 [245]	47 [69.9]	6,175 [42.6]	7.50 [191]
GOOD HOLE	2-1/2 [64]	RTG-2512-431	12.0	6 [20], 60°	0.45 [11]	20.31 [51.59]	0.05 [0.13]	3-1/2 [89]	9.2 [13.7]	6,710 [46.3]	2.71 [69]
	3-1/8 [79]	EXP-3319-431	19.0	6 [20], 60°	0.55 [14]	29.18 [74.12]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	6,375 [44.0]	3.58 [91]
	3-1/8 [79]	EXP-3321-431	21.0	6 [20], 60°	0.56 [14]	29.23 [74.24]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	6,375 [44.0]	3.58 [91]
	3-3/8 [86]	EXP-3323-431	22.7	6 [20], 60°	0.59 [15]	29.42 [74.73]	0.06 [0.15]	4-1/2 [114]	11.6 [17.3]	5,350 [36.9]	3.80 [97]
	4-1/2 [114]	EXP-4521-431	21.0	12 [39], 135/45°	0.46 [12]	22.02 [55.93]	0.07 [0.18]	7 [178]	32 [47.6]	5,350 [36.9]	4.92 [125]
BIG HOLE	3-1/8 [79]	FLO-3112-411CFZ	12.0	12 [39], 140/20°	0.55 [14]	4.68 [11.89]	0.06 [0.15]	5 [127]	15 [22.3]	5,860 [40.4]	3.58 [91]
	3-1/8 [79]	FLO-3323-311CF	22.7	6 [20], 60°	0.68 [17]	7.10 [18.03]	0.07 [0.18]	4-1/2 [114]	11.6 [17.3]	6,710 [46.3]	3.58 [91]
	3-3/8 [86]	FLO-3112-411CFZ	12.0	12 [39], 140/20°	0.59 [15]	5.31 [13.49]	0.05 [0.13]	5 [127]	15 [22.3]	5,115 [35.3]	3.80 [97]
	4-1/2 [114]	FLO-4623-411CFZ	22.7	16 [52], 140/20°	0.79 [20]	7.06 [17.93]	0.05 [0.13]	7 [178]	32 [47.6]	6,125 [42.2]	4.92 [125]
	4-5/8 [117]	FLO-4623-411CFZ	22.7	16 [52], 140/20°	0.75 [19]	6.11 [15.52]	0.05 [0.13]	7 [178]	32 [47.6]	6,070 [41.9]	5.00 [127]
	5-1/8 [130]	FLO-5128-311CFZ	28.0	12 [39], 135/45°	0.79 [20]	9.11 [23.14]	0.04 [0.10]	7 [178]	32 [47.6]	5,210 [35.9]	5.68 [144]
	5-1/8 [130]	FLO-5130-311CF	30.0	12 [39], 135/45°	0.86 [22]	8.25 [20.96]	0.05 [0.13]	7 [178]	32 [47.6]	5,210 [35.9]	5.68 [144]
	7 [178]	FLO-7039-312CF	38.8	12 [39], 135/45°	1.10 [28]	10.37 [26.34]	0.15 [0.38]	9-5/8 [244]	47 [69.9]	8,633 [59.5]	7.50 [191]
	7 [178]	FLO-7039-312CF	38.8	18 [59], 140/20°	1.08 [27]	9.88 [25.10]	0.09 [0.23]	9-5/8 [244]	47 [69.9]	5,310 [36.6]	7.50 [191]
	7 [178]	FLO-7039-312CFZ	38.8	18 [59], 140/20°	1.06 [27]	9.73 [24.71]	0.10 [0.25]	9-5/8 [244]	47 [69.9]	5,310 [36.6]	7.50 [191]

04/13

Note: All charges available with RDX, HMX and HNS. Table displays charges that have been API RP-19B certified

† xxx-xxxx-3xxxx for RDX, xxx-xxxx-4xxx for HMX, xxx-xxxx-5xxx for HNS

‡ Low swell (LS) charge

§ Slick gun. No scallops

See *www.hunting-intl.com* for complete details and copies of API RP-19B registration and certification sheets. Or call your Hunting Titan sales representative or Hunting Titan Energetics at (800) 320-5110 or +1 972 493-2580 for outside USA.

Best Practice on deciding which detonating cord to use

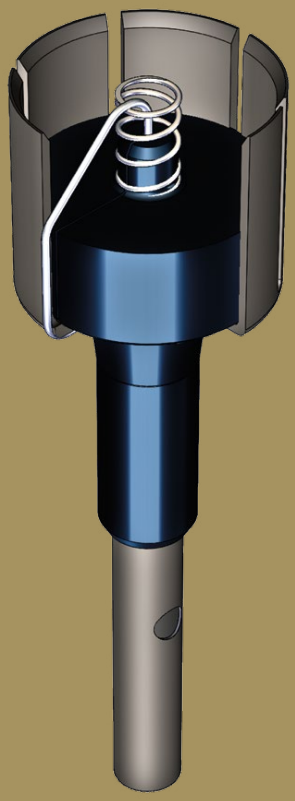
For optimal performance of any shaped charge, the same explosive type must be used in detonating cords and shaped charges. Mixing different explosive types can cause a detrimental reduction in shaped charge performance, charge interference, low order detonation and in some cases a complete misfire. For example, PETN detonating cord cannot provide the necessary energy to high order detonate RDX and HMX shaped charges. The only exception to this rule is RDX and HMX can be interchanged without taking temperature limits in account.

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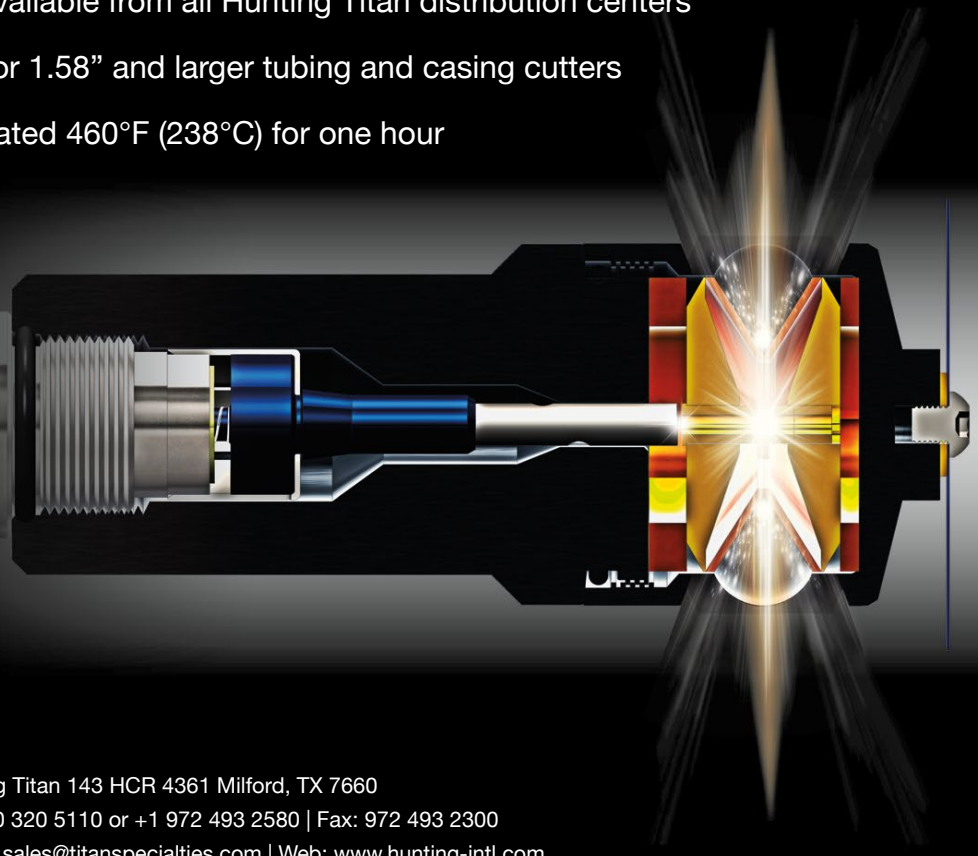
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SPECTRA®
TUBING CUTTER DETONATOR



DETO-D1208-T

- Easy, user friendly installation
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- Available from all Hunting Titan distribution centers
- For 1.58” and larger tubing and casing cutters
- Rated 460°F (238°C) for one hour



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Right Tools. Right Location. Right Time.

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Spectra® Cutter Summary Chart

Cutters (excluding coiled tubing) are available to utilize the JRC RED top fire detonator (version III or IV). Specify "RED" after the part number.

Pipe O.D. (in)[mm]	Type	Cutter O.D. (in)[mm]	Recommended Pipe Parameters		Assembly Part Number	Max. Pressure (psi)[MPa]	Explosive Weight (g)	Explosive Type	Hazard Class
			I.D. (in)[mm]	Weight (lb/ft)[kg/m]					
Coiled Tubing Cutters									
1 [25]	Coiled Tubing	0.69 [17]	0.84-0.78 [21-20]	0.79-1.04 [1.18-1.55]	SCP-0687T001	18,000 [124]	2	HMX	1.4D
1.25 [32]	Coiled Tubing	0.80 [20]	0.94 [24]	1.83 [2.72]	SCP-0800T001	18,000 [124]	3	HMX	1.4D
1.25 [32]	Coiled Tubing	0.82 [21]	0.94 [24]	1.83 [2.72]	SCP-0820T001	18,000 [124]	3	HMX	1.4D
1.25 [32]	Coiled Tubing	0.88 [22]	1.09-1.00 [28-25]	1.00-1.51 [1.49-2.25]	SCP-0875T001	18,000 [124]	3	HMX	1.4D
1.50 [38]	Coiled Tubing	1.00 [25]	1.31-1.12 [33-28]	1.43-2.67 [2.13-3.97]	SCP-1000T001	18,000 [124]	3	HMX	1.4D
1.75 [44]	Coiled Tubing	1.19 [30]	1.53-1.34 [39-34]	1.92-3.38 [2.86-5.03]	SCP-1188T001	18,000 [124]	6.25	HMX	1.4D
1.75 [44]	Coiled Tubing	1.25 [32]	1.53-1.34 [39-34]	1.92-3.38 [2.86-5.03]	SCP-1250T001	18,000 [124]	7	HMX	1.4D
2.00 [51]	Coiled Tubing	1.38 [35]	1.78-1.59 [45-40]	2.21-3.92 [3.29-5.83]	SCP-1375T001	18,000 [124]	7	HMX	1.4D
Tubing and Casing Cutters									
2-3/8 [60]	Tubing	1.58 [40]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1580T001	18,000 [124]	12	HMX	1.4D
	Tubing	1.58 [40]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1580T101	18,000 [124]	38	HMX	1.4D
	Tubing	1.68 [43]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1680T001	18,000 [124]	12	HMX	1.4D
	Tubing	1.68 [43]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1680T001 HNS	18,000 [124]	12	HNS	1.4D
	Tubing	1.81 [46]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1813T001	18,000 [124]	12	HMX	1.4D
2-7/8 [68]	Tubing	2.06 [52]	2.32 [59]	7.90 [11.8]	SCP-2063T001	18,000 [124]	17	HMX	1.4D
	Tubing	2.13 [54]	2.32 [59]	7.90 [11.8]	SCP-2125T001	18,000 [124]	17	HMX	1.4D
	Tubing	2.13 [54]	2.32 [59]	7.90 [11.8]	SCP-2125T101	18,000 [124]	38	HMX	1.4D
	Tubing	2.25 [57]	2.32 [59]	7.90 [11.8]	SCP-2250T001	18,000 [124]	22.7	HMX	1.4D
	Tubing	2.25 [57]	2.32 [59]	7.90 [11.8]	SCP-2250T101	18,000 [124]	38	HMX	1.4D
3-1/2 [89]	Tubing	2.50 [64]	2.92 [74]	10.2 [15.2]	SCP-2500T001	18,000 [124]	22.7	HMX	1.4D
	Tubing	2.50 [64]	2.92 [74]	10.2 [15.2]	SCP-2500T101 HNS	18,000 [124]	38	HNS	1.4D
	Tubing	2.50 [64]	2.75 [70]	12.95 [19.27]	SCP-2500T101	18,000 [124]	28.33	HMX	1.4D
	Tubing	2.63 [67]	2.75 [70]	12.95 [19.27]	SCP-2625T101 HNS	18,000 [124]	38	HNS	1.4D
	Tubing	2.65 [67]	2.99 [76]	9.30 [13.8]	SCP-2650T101	18,000 [124]	34	HMX	1.4D
	Tubing	2.68 [68]	2.99 [76]	9.30 [13.8]	SCP-2680T101	18,000 [124]	34	HMX	1.4D
	Tubing	2.75 [70]	2.92 [74]	10.20 [15.18]	SCP-2750T001	18,000 [124]	22.7	HMX	1.4D
	Tubing	2.75 [70]	2.92 [74]	10.20 [15.18]	SCP-2750T101	18,000 [124]	38	HMX	1.4D
4-1/2 [114]	Casing	3.50 [89]	4.09-3.83 [104-97]	9.50-15.1 [14.1-22.5]	SCP-C3500T301	7,500 [52]	59	HMX	1.4D
5 [127]	Casing	3.75 [95]	4.56-4.28 [116-109]	11.5-18.0 [17.1-26.8]	SCP-C3750T301	7,500 [52]	59	HMX	1.4D
5-1/2 [140]	Casing	4.25 [108]	4.89-4.67 [124-119]	17.0-23.0 [25.3-34.2]	SCP-C4250T301	7,500 [52]	76	HMX	1.4D
7 [178]	Casing	5.80 [147]	6.37-6.18 [162-157]	23.0-29.0 [34.2-43.2]	SCP-C5800T301	7,500 [52]	75.13	HMX	1.4D
7.625 [194]	Casing	6.25 [159]	6.88-6.63 [175-168]	29.7-39.0 [44.2-58.0]	SCP-C6250T301	7,500 [52]	75.13	HMX	1.4D

continued...

Pipe O.D. (in)[mm]	Type	Cutter O.D. (in)[mm]	Recommended Pipe Parameters		Assembly Part Number	Max. Pressure (psi)[MPa]	Explosive Weight (g)	Explosive Type	Hazard Class
			I.D. (in)[mm]	Weight (lb/ft)[kg/m]					
Low Hydrostatic Pressure Tubing Cutters									
2-3/8 [60]	Tubing	1.68 [43]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1680T001GW	7,000 [48]	5.9	HMX	1.4D
	Tubing	1.81 [46]	2.00-1.87 [51-47]	4.70-5.80 [6.99-8.63]	SCP-1813T001GW	7,000 [48]	6.6	HMX	1.4D
2-7/8 [68]	Tubing	2.13 [54]	2.32 [59]	7.90 [11.8]	SCP-2125T001GW	7,000 [48]	10.3	HMX	1.4D
	Tubing	2.25 [57]	2.32 [59]	7.90 [11.8]	SCP-2250T001GW	7,000 [48]	12	HMX	1.4D
Premium Specialty Cutters									
2-7/8 [68]	Tubing	1.90 [48]	2.20 [56]	9.45 [14.1]	SCP-1900S001	18,000 [124]	20	HMX	1.4D
3-1/8 [79]	Tubing	2.19 [56]	2.26 [57]	12.5 [18.6]	SCP-2188T101	22,000 [152]	36	HMX	1.4D
3-1/2 [89]	Drill Pipe	2.19 [56]	2.76-2.60 [70-66]	13.3-15.5 [19.8-23.1]	SCP-2188T101	22,000 [152]	36	HMX	1.4D
	Tubing	2.25 [57]	2.55 [65]	15.5 [23.1]	SCP-2251T101	20,000 [138]	36	HMX	1.4D
	Tubing	2.25 [57]	2.64-2.55 [67-65]	14.3-15.5 [21.3-23.1]	SCP-2252T101	20,000 [138]	35	HMX	1.4D
	Tubing	2.38 [60]	2.75-2.64 [70-67]	12.95-14.3 [19.27-21.3]	SCP-2375T201	18,000 [124]	38	HMX	1.4D
4 [102]	Packer Mandrel	3.00 [76]	3.28 [83]	14.00 [20.83]	SCP-3000T101	22,000 [152]	38	HMX	1.4D
	Packer Mandrel	3.19 [81]	3.28 [83]	14.00 [20.83]	SCP-3190T301	22,000 [152]	59	HMX	1.4D
4-1/2 [114]	Tubing	2.69 [68]	3.83-3.74 [97-95]	15.2-17.0 [22.6-25.3]	SCP-2690T301	18,000 [124]	52	HMX	1.4D
	Tubing	3.38 [86]	3.74-3.64 [95-93]	17.0-18.9 [25.3-28.1]	SCP-3375T301	22,000 [152]	59	HMX	1.4D
	Tubing	3.48 [88]	3.74-3.64 [95-93]	17.0-18.9 [25.3-28.1]	SCP-3475T301	22,000 [152]	59	HMX	1.4D
5 [127]	Tubing	3.25 [83]	4.28 [109]	18.0 [26.8]	SCP-3250T301	22,000 [152]	59	HMX	1.4D
	Tubing	3.31 [84]	4.28 [109]	18.0 [26.8]	SCP-3310T301	18,500 [128]	59	HMX	1.4D
	Tubing	3.68 [93]	4.04 [103]	23.2 [34.5]	SCP-3680T201	18,000 [124]	59	HMX	1.1D
	Drill Pipe	3.68 [93]	4.28 [109]	19.50 [29.02]	SCP-3680T301	18,000 [124]	59	HMX	1.4D
	Drill Pipe	3.80 [97]	4.28-4.00 [109-102]	19.5-25.6 [29.0-38.1]	SCP-3800T201	18,000 [124]	109.33	HMX	1.1D
	Drill Pipe	3.80 [97]	4.28-4.00 [109-102]	19.5-25.6 [29.0-38.1]	SCP-3800T301	18,000 [124]	76	HMX	1.4D
5-1/2 [140]	Tubing	3.38 [86]	4.67 [119]	23.0 [34.2]	SCP-3375T301	22,000 [152]	59	HMX	1.4D
	Tubing	3.48 [88]	4.67 [119]	23.0 [34.2]	SCP-3475T301	22,000 [152]	59	HMX	1.4D
	Tubing	4.07 [103]	4.67 [119]	23.0 [34.2]	SCP-4070T301	18,000 [124]	76	HMX	1.4D
	Tubing	4.15 [105]	4.67 [119]	23.0 [34.2]	SCP-4150T301	18,000 [124]	76	HMX	1.4D
	Tubing	4.20 [107]	4.67 [119]	23.0 [34.2]	SCP-4200T201	18,000 [124]	109.33	HMX	1.1D
	Tubing	4.20 [107]	4.67 [119]	23.0 [34.2]	SCP-4200T301	18,000 [124]	76	HMX	1.4D
7 [178]	Casing	5.25 [133]	6.00 [153]	35.0 [52.1]	SCP-5250T201	18,000 [124]	139	HMX	1.1D
	Casing	5.25 [133]	6.18 [157]	29.0 [43.2]	SCP-5250T301	18,000 [124]	75.13	HMX	1.4D
	Casing	5.38 [137]	6.00 [153]	35.0 [52.1]	SCP-5375T201	18,000 [124]	139	HMX	1.1D
	Casing	5.38 [137]	6.18 [157]	29.0 [43.2]	SCP-5375T301	18,000 [124]	75.13	HMX	1.4D
	Casing	5.70 [145]	6.00 [153]	35.0 [52.1]	SCP-5700T201	18,000 [124]	139	HMX	1.1D
	Casing	5.70 [145]	6.18 [157]	29.0 [43.2]	SCP-5700T301	18,000 [124]	75.13	HMX	1.4D

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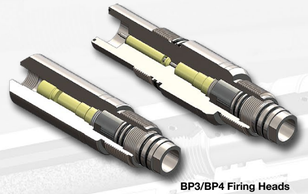
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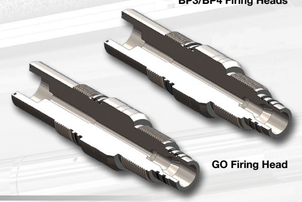
T-SET® FIRING HEADS

T-Set Size (in)[mm]	Assembly Part Number†	Contact Kit Part Number	Igniter Type	Upper Head Connection
No. 5	2005-000-000	2005-000-002	BP3/BP4	1-3/16"-12 GO Box
No. 10	2010-000-000	2010-000-002	BP3/BP4	1-3/16"-12 GO Box
	2010-000-020	2010-000-022	BP3/BP4	3-1/8" O.D. GO Quick-Change Assembly
	2010-000-040	2010-000-022	BP3/BP4	2-3/4" O.D. GO Quick-Change Assembly
	2010-000-070	2010-000-072	BP3/BP4	3-1/8" O.D. SIE Quick-Change Assembly
	2010-000-100	-	GO	3-1/8" O.D. GO Quick-Change Assembly
	2010-000-105	-	RED	3-1/8" O.D. GO Quick-Change Assembly
	2010-000-111	-	GO	3-1/8" O.D. SIE Quick-Change Assembly
	2010-000-115	-	RED	3-1/8" O.D. SIE Quick-Change Assembly
No. 20	2020-000-000	2020-000-002	BP3/BP4	1-3/16"-12 GO Box
	2020-000-020	2020-000-022	BP3/BP4	3-1/8" O.D. GO Quick-Change Assembly
	2020-000-070	2020-000-072	BP3/BP4	3-1/8" O.D. SIE Quick-Change Assembly
	2020-000-100	-	GO	3-1/8" O.D. GO Quick-Change Assembly
	2020-000-105	-	RED	3-1/8" O.D. GO Quick-Change Assembly
	2020-000-111	-	GO	3-1/8" O.D. SIE Quick-Change Assembly
	2020-000-115	-	RED	3-1/8" O.D. SIE Quick-Change Assembly
1.50 [38] 1.72 [43] 2.13 [54] 2.50 [64]	6110-000-000	6110-000-002	GO	1-3/16"-12 GO Box
3.50 [89]	6035-000-111	-	GO	3-1/8" O.D. SIE Quick-Change Assembly
	6035-000-115	-	RED	3-1/8" O.D. SIE Quick-Change Assembly
3.63[92]	WST-3625-115	-	RED	3-1/8" O.D. SIE Quick-Change Assembly

† All firing heads rated to 400°F (204°C), 20,000psi (138MPa), 600VDC and 2,000mA. Viton O-rings need to be used above 325°F (163°C)



BP3/BP4 Firing Heads



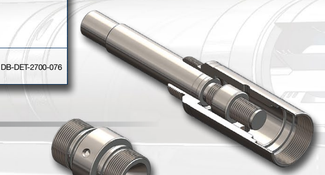
GO Firing Head



RED Firing Head

T-SET IGNITERS AND POWER CHARGES

T-Set Size (in)[mm]	1 Hour Temp. Rating (°F)[°C]	Power Charge	Slow Set Charge	Standard Charge	Primary Igniter	Secondary Igniter
1.50 [38] Compact	400 [204]	HDO-1500-100	-	-	DB-DET-2700-0741	-
1.72 [43] Compact		HDO-1500-100	-	-		
2.50 [64] Compact		HDO-2500-200	-	-		
3.50 [89] Compact		HDO-3500-100	-	-		
3.63 [92] Compact		HDO-3625-100	-	-		
1.72 [43] Multi-Stage		HDO-1687-100	-	-		
2.13 [54] Multi-Stage		HDO-3625-100	-	-		
3.25 [83] Multi-Stage		JEC-5336-099	-	-		
4.50 [114] Multi-Stage	250 [121]	JEC-0450-140	-	-		
Size 05	400 [204]	-	DO NOT USE	DB-BPC-0800-005S	DB-DET-2700-075 or DB-DET-2700-075(4)	DB-DET-2700-076
Size 10		-	DB-BPC-1300-010	DB-BPC-1300-010S		
Size 20		-	DB-BPC-1500-020	DB-BPC-1500-020S		



Adapter Kits

T-SET ADAPTER KITS

T-Set Size (in)[mm]	Assembly Part Number	Adapter Type
1.72 [43]	WST-1500-040	Adapter kit to 1-11/16" O.D. setting tool setting adapter
2.50 [64]	WST-2500-040	Adapter kit to #10 setting equipment
3.50 [89]	WST-5321-023M	Top sub adapter to TCP firing head
	WST-5303-117	Adapter kit to #10 setting equipment
	WST-5303-120	Adapter kit to #20 setting equipment
3.63 [92]	WST-3625-120M	Top sub adapter to TCP firing head
	WST-5303-117	Adapter kit to #10 setting equipment
	WST-5303-120	Adapter kit to #20 setting equipment
Size 10	2010-000-101M	Top sub adapter to TCP firing head
Size 20	2020-000-101-MOD	Top sub adapter to TCP firing head

T-SET BLEEDER VALVE & WRENCH ASSEMBLIES

T-Set Size (in)[mm]	Stem Type		Rupture Disc Type		
	Bleeder Wrench Part Number	Bleeder Valve Assembly	Bleeder Wrench Part Number	Bleeder Valve Assembly	Torque Socket Assembly
1.50 [38] 1.72 [43] 2.13 [54] Size 05	WST-2125-146	WST-2125-142	WST-2125-150	WST-2125-135 (WST-2125-138 redress kit)	-
3.25 [83] 3.63 [92] 4.50 [114] Size 10 Size 20	WST-5125-146	WST-5125-142	WST-3625-244	WST-3625-135 (WST-3625-138 redress kit)	WST-3625-240A



Torque Set



Stem Type Bleeder Valve

Rupture Disc Type Bleeder Valve

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T-Set®



Family of Setting Tools

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SIZE 05 – 10 – 20 T-SET

FEATURES

- Case hardened pressure cylinders
- Black oxide coated components
- Options for bleeder valves

BENEFITS

- Greater surface hardness and increased abrasive wear from case hardening
- Black oxide coating improves corrosion and chemical resistance
- Bleeder valves provide a safer option to bleed off pressure inside the tool at surface

The Size 05 – 10 – 20 T-Set series features a classic design that the oilfield has been familiar with for decades. Hunting Titan has made many improvements to the original design, making it the most rugged and reliable setting tool in the oilfield today.

The ignition of a power charge creates high gas pressure inside the setting tool. The generated high pressure gas pushes a piston, which in turn drives hydraulic oil through a small orifice, initiating the setting sequence. Once the required setting force is achieved, a shear stud breaks releasing the T-Set from the plug/packer.



O.D. (in)[mm]	Assembly Part Number	Redress Kit Part Number	Max. Temp (°F)[°C]†	Max. Pressure (psi)[MPa]	Length (ft)[m]	Empty Weight (lbm)[kg]	Stroke (in)[cm]	Max. Setting Force (lbf)[kN]	Fishing Strength (lbf)[kN]	Upper Head Connection
No. 05 1.72 [43]	WST-BK05-001	WST-BK05-010**	400 [204]	23,500 [162]	6.02 [1.83]	34 [15]	6.0 [15.2]	7,000 [31]	43,900 [195]	No. 05 Firing Head Pin
No. 10 2-3/4 [70]	WST-BK10-001	WST-BK10-010**	400 [204]	18,500 [128]	5.32 [1.62]	64 [29]	5.8 [14.7]	33,000 [147]	139,500 [621]	No. 10 Firing Head Box
No. 10 Non-Ported 2-3/4 [70]	WST-BK10-201	WST-BK10-010-ND**	400 [204]	18,500 [128]	5.32 [1.62]	64 [29]	5.8 [14.7]	33,000 [147]	139,500 [621]	No. 10 Firing Head Box
No. 10 Non-Ported High Pressure 3.20 [81]	WST-BK10-###	WST-BK10-010-ND**	400 [204]	25,000 [172]	5.32 [1.62]	92 [42]	5.8 [14.7]	33,000 [147]	139,500 [621]	No. 10 Firing Head Box
No. 20 3.81 [97]	WST-BK20-001	WST-BK20-010**	400 [204]	17,500 [121]	6.24 [1.90]	146 [66]	11.1 [29.2]	55,000 [245]	184,500 [821]	No. 20 Firing Head Box
No. 20 Non-Ported 3.81 [97]	WST-BK20-201	WST-BK20-010-ND**	400 [204]	17,500 [121]	6.24 [1.90]	146 [66]	11.1 [29.2]	55,000 [245]	184,500 [821]	No. 20 Firing Head Box
No. 20 Non-Ported High Pressure 4.12 [105]	WST-BK20-###	WST-BK20-010**	400 [204]	21,500 [148]	6.24 [1.90]	170 [77]	11.1 [29.2]	55,000 [245]	184,500 [821]	No. 20 Firing Head Box

† Hardware only. Viton O-rings need to be used above 325°F (163°C)
** Use “HT” for high temperature operations (above 325°F (163°C))
Use “002” for high pressure assembly; use “101” for high pressure, high temperature assembly

COMPACT SINGLE STAGE T-SET

FEATURES

- Short compact design
- Self-bleeding compensating system
- Options for bleeder valves
- Black oxide coated components



BENEFITS

- Ideal for horizontal pump down operations
- Compensation oil level adjustments are not necessary
- Bleeder valves provide a safer option to bleed off pressure inside the tool at surface
- Black oxide coating improves corrosion and chemical resistance

The compact, single stage T-Set is the shortest setting tool in in the T-Set family. Its low weight and short length make it ideal for stage frac jobs requiring pump down operations.

The top cylinder is filled with oil and self-bleeds with increased temperature. The trouble-free design makes it quick and easy to redress at the wellsite providing fast turnaround times.

The ignition of a slow set power charge creates gas pressure inside the setting tool. The gas migrates through the piston initiating the setting sequence. The hydraulic oil slowly bleeds out of the tool providing a cushioning effect while setting. Once the required setting force is achieved, a shear stud breaks releasing the T-Set from the plug/packer.

O.D. (in)[mm]	Assembly Part Number	Redress Kit Part Number	Max. Temp (°F)[°C]†	Max. Pressure (psi)[MPa]	Length (ft)[m]	Empty Weight (lbm)[kg]	Stroke (in)[cm]	Max. Setting Force (lbf)[kN]	Fishing Strength (lbf)[kN]	Upper Head Connection
1.50 [38]	WST-1500-001	WST-1500-010**	400 [204]	20,000 [138]‡	4.66 [1.42]	17 [8]	6.4 [16.3]	10,000 [44]	19,500 [87]	1-3/16” - 12 GO Box
1.72 [43]	WST-1718-001	WST-1718-001**	400 [204]	20,000 [138]‡	4.24 [1.29]	21 [10]	6.4 [16.3]	13,000 [59]	30,750 [137]	1-3/16” - 12 GO Box
2.50 [64] Self Bleeding	WST-2500-001	WST-2500-010**	400 [204]	20,000 [138]	4.98 [1.52]	51 [23]	10.5 [26.7]	30,000 [133]	64,500 [287]	1-3/16” - 12 GO Box
2.50 [64] Manual Bleeding	WST-2500-002	WST-2500-010**	400 [204]	20,000 [138]	4.98 [1.52]	51 [23]	10.5 [26.7]	30,000 [133]	64,500 [287]	1-3/16” - 12 GO Box
3.50 [89] Self Bleeding	WST-5321-501	WST-5321-110**	400 [204]	15,000 [103]	4.45 [1.36]	94 [43]	9.6 [24.4]	55,000 [245]	172,400 [767]	3-1/8” O.D. GO Quick-Change Assembly
3.63 [92]	WST-3625-101	WST-3625-110**	400 [204]	10,000 [69]	3.29 [1.00]	70 [32]	10.0 [25.4]	55,000 [245]	164,300 [731]	3-1/8” O.D. GO Quick-Change Assembly
3.63 [92]	WST-3625-102	WST-3625-102**	400 [204]	10,000 [69]	3.66 [1.12]	70 [32]	10.0 [25.4]	55,000 [245]	164,300 [731]	No. 10 Firing Head Box
3.63 [92] High Pressure	WST-3625-105	WST-3625-110**	400 [204]	15,000 [103]	3.52 [1.07]	76 [34]	10.0 [25.4]	55,000 [245]	164,300 [731]	3-1/8” O.D. GO Quick-Change Assembly
3.63 [92] High Pressure	WST-3625-106	WST-3625-112**	400 [204]	15,000 [103]	3.89 [1.19]	76 [34]	10.0 [25.4]	55,000 [245]	164,300 [731]	No. 10 Firing Head Box

† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ No bleeder valve. Assembly with bleeder valve rated to 15,000 psi (103 MPa)
** Use “HT” for high temperature operations (above 325°F (163°C))

MULTI-STAGE T-SET

FEATURES

- Long stroke
- Higher forces necessary for tubing patches
- Self-bleeding compensating system
- Options for bleeder valves
- Black oxide coated components

BENEFITS

- Ideal for plugs and packers requiring a long stroke
- Compensation oil level adjustments are not necessary
- Bleeder valves provide a safe option to bleed off pressure inside the tool at surface
- Black oxide coating improves corrosion and chemical resistance

The Multi-Stage T-Set offers the capability to set plugs and packers requiring long setting strokes and higher forces necessary for tubing patches.

The design concept of the Multi-Stage T-Set is the same as the Compact Single Stage T-Set. A self-bleeding compensation system allows for quick oil filling without the need for oil level gauges.

A larger slow set power charge is used to compensate for the extra piston movement required for longer strokes. Once ignited, the generated high pressure gas migrates through the upper and lower pistons initiating the setting sequence. Like the Compact Single Stage T-Set, the hydraulic oil slowly bleeds out of the tool providing a cushioning effect. Once the required setting force is achieved, a shear stud breaks releasing the T-Set from the plug/packer.



O.D. (in)[mm]	Assembly Part Number	Redress Kit Part Number	Max. Temp (°F)[°C]†	Max. Pressure (psi)[MPa]	Length (ft)[m]	Empty Weight (lbm)[kg]	Stroke (in)[cm]	Max. Setting Force (lbf)[kN]	Fishing Strength (lbf)[kN]	Upper Head Connection
1.72 [43]	WST-1718-101	WST-1718-110**	400 [204]	20,000 [138]‡	7.70 [2.35]	36 [16]	10.5 [26.7]	20,000 [89]	25,000 [111]	1-3/16” - 12 GO Box
2.13 [54]	WST-2125-101	WST-2125-110**	400 [204]	15,000 [103]‡	7.27 [2.22]	53 [24]	10.4 [26.4]	32,000 [142]	52,000 [231]	1-3/16” - 12 GO Box
3.25 [83]	WST-3250-001	WST-3250-010**	400 [204]	15,000 [103]	10.23 [3.12]	178 [801]	14.9 [37.8]	72,000 [320]	120,000 [534]	3-1/8” O.D. GO Quick-Change Assembly
4.50 [114]	WST-4500-001	WST-4500-010**	250 [121]	15,000 [103]	12.88 [3.93]	433 [196]	20.0 [50.8]	95,000 [423]	194,000 [863]	3-1/8” O.D. GO Quick-Change Assembly

† Hardware only. Viton O-rings need to be used above 325°F (163°C)
‡ No bleeder valve. Assembly with bleeder valve rated to 15,000 psi (103 MPa)
** Use “HT” for high temperature operations (above 325°F (163°C))

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