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Jet Research Center (JRC) originated and introduced jet perforating to the energy industry—forever changing the way oil and gas are produced. Located on more than 800 acres in Alvarado, Texas, JRC’s Explosive Products Center is a fully integrated research, engineering, testing and manufacturing plant that produces advanced perforating systems and specialty explosive devices for the oilfield, including shaped charge perforators, RF-protected detonators, tubing and casing cutters, severing tools, and platform removal charges.

Research and Engineering
JRC’s premier technical staff includes a balance of engineers, designers, and technicians, who are among the most knowledgeable experts in the perforating industry. Their backgrounds range from doctoral and Master’s level engineers to highly skilled explosive technicians—some with more than 25 years experience. We utilize the latest techniques and equipment in our design work, including:

- sophisticated hydrocodes such as DYNA-2D and CTH that model the high strain rate deformations of materials subjected to explosive loading.

- analytical computer programs that predict the response of structures to explosive impulse loads.

- CHEETAH code for predicting state properties of reacting explosives and the resulting detonation products.

Testing
- **Perforation Flow Laboratory** provides a means to measure the flow or injection characteristics of a perforation tunnel created by a shaped charge, allowing design engineers to tailor shaped-charge performance to optimize well productivity. The flow laboratory is able to handle a wide range of test conditions and materials, including hard rocks and fully unconsolidated formations with permeabilities ranging from 0.001 to 2.0 Darcy.

- **Flash X-Ray Equipment** allows us to study the details of explosive events in nanosecond resolution allowing us to improve the performance of new and existing shaped-charge designs. All information and data gathered with the Flash X-Ray is utilized, building into every JRC charge the reliability and performance expected in the field.

- **API RP43 Testing Facilities** available for conducting tests.

- **Firing Chambers and Shooting Bunkers** are available for testing a wide range of devices—less than 1 gram of explosive to more than 25 lb. In addition, scaled tests can simulate even larger tests.

- **Pressure Vessels and Thermal Ovens** are available to test explosive components and systems to conditions up to 30,000 psi (207 MPa) and 500°F (260°C). High-speed multi-channel oscilloscopes, piezoelectric pins, ballistic pressure transducers, and other specialty instrumentation are routinely used to conduct diagnostic experiments on explosive components and systems.

- **Shooting Pond** is used for conducting underwater test shots and for verifying gun survival in fluid.

- **Air Shot Test Enclosure** is specially designed test pit for conducting full-length gun survivability shots in air.
Manufacturing
In the manufacturing process, the emphasis on quality and consistency has resulted in a continual progression toward automation. This produces a more accurate and consistent charge, while at the same time providing a more cost-effective and safer production process.

- High quality metal powders blended and tested to extend perforator performance and storage life

- Spinning and vibrating sub-presses used with computerized hydraulic pressing systems to fabricate powdered metal liners

- High purity explosive powders tested for melting point, flow characteristics, and moisture content

- Computer controlled electronic powder weigh stations integrated into the automated charge presses to ensure accurate and consistent measures of explosive powder for each charge

- Automated hydraulic pressing units help maintain high levels of concentricity between the case and liner for optimum charge performance

- Melt/Pour Facility available for melting and casting TNT-based explosives

- State-of-the-art laser tubular cutting technology

- World-class perforating hardware machining center

- First explosive manufacturer in US to gain OSHA VPP Merit plant status

Contact
For more information about Jet Research Center:

Research, Test and Manufacturing Facility:
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8432 South I-35W
Alvarado, Tex 76009-9775
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Broussard, LA 70518
Telephone: 318-837-2681
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Jet Research Center:
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Jet Research Center:
Dee Facility,
Howe Moss Avenue
Kirkhill Industrial Estate
Dyce, Aberdeen, AB21 OGP
Telephone: 01224 795174
Fax: 01224 724862

Jet Research Center:
10200 Bellaire Blvd.
Houston, TX 77047
Telephone: 281-988-2525
Fax: 281-988-2105
GENERAL TERMS AND CONDITIONS OF SALE

All orders from Buyer are subject to final acceptance by Jet Research Center, a Division of Halliburton Energy Services Inc. (hereinafter “JRC”) and to the terms and conditions set out herein. Terms and conditions set forth in Buyer’s order shall be null and void unless specifically accepted by JRC in writing. Performance by JRC pursuant to an order by Buyer shall not constitute acceptance by JRC of Buyer’s terms and conditions. No modification of these terms and conditions shall be effective unless agreed to by JRC in writing.

1.0  PRICE

1.1 All prices are expressed in United States dollars net Ex-works JRC’s dock and, unless otherwise agreed in writing by JRC, are subject to change without notice and are at the rates in effect at the time of acceptance of an order. Quotations will be given on request for items not shown on JRC’s Price List. Any quotation will remain in effect only for the period of validity specified therein or, if no such period is stated, for thirty (30) days from date the quotation is given. However, JRC may, at its option, extend the period of validity of the quotation with a price escalation of two percent (2%) per month beyond the initial period of validity up to a maximum of ten percent (10%).

1.2 All prices are exclusive of costs transportation and insurance and federal, state and local use, sales, property (ad valorem) and similar taxes and license fees, import duties and the like. Buyer agrees, by purchase of an item, to pay such costs, taxes, fees and duties, and where appropriate, report the same. When applicable, such costs, taxes, fees, and duties will appear as separate items on JRC’s invoice.

1.3 In the event JRC employs an attorney for collection of any account, Buyer agrees to pay JRC’s reasonable and necessary attorney fees, but in no case shall the attorneys fees be less than 20% of the unpaid account, plus all collection and court cost.

2.0  PAYMENT

2.1 Payment for all items in the United States funds by irrevocable letter of credit or net cash. Letters of credit must be opened with or confirmed by Citibank N.A. (ABA #021000089), 399 Park Avenue, New York, New York 10043 USA; credit for Halliburton Energy Services, Inc. Account #00032969, nominated or approved by JRC, or cash paid within thirty (30) days of acceptance of order. All banking charges are payable by Buyer. Letters of credit must be valid for at least three (3) months after the specified delivery date of the last of the items purchased, must not contain deferred payment provisions, and must allow transshipment and partial deliveries.

2.2 No action will be taken to fulfill any order until letter of credit or payment has been received by JRC.

3.0  DELIVERY AND EXCUSABLE DELAYS

3.1 All shipment and/or delivery dates quoted are estimates and are subject to JRC’s availability schedule. JRC will make every reasonable effort to meet any delivery date(s) quoted; however, JRC will not be liable for its failure to meet any quoted delivery date(s) or for any delay in performance due to any unforeseen circumstances or any causes beyond JRC’s reasonable control including, without limitation, strike, lockout, riot, war, fire, acts of God, accident, failure or breakdown of parts necessary for completion, delays in transportation, delays caused by subcontractors or suppliers or Buyer, shortage of cars, shortage of fuel, inability to obtain labor, materials or manufacturing facilities, or compliance with any law, regulation or order, whether valid or invalid, or any governmental body or instrumentality thereof. Performance shall be deemed suspended during and extended for such time as any such circumstances or causes delay its execution. Whenever such circumstances or causes have been remedied, JRC will make and Buyer shall accept performance hereunder. No penalty clause of any kind shall be effective. As used herein, performance shall include, without limitation, fabrication, assembly, shipment, delivery, and warranty repair or replacement as applicable.
4.0 PACKING
All items shall be packed, if appropriate, for shipping and storage in accordance with standard commercial practices.

5.0 SHIPMENT
5.1 All prices are net Ex-works JRC’s dock unless otherwise specified in the quote. Buyer will pay all rigging, draying and transportation charges.

5.1 Normally, JRC will ship in accordance with Buyer’s shipping instructions. In the absence of shipping instructions or if JRC considers Buyer’s shipping instructions unsuitable, JRC reserves the right to ship by the most appropriate method. JRC reserves the right to ship to engage the services of a forwarder of its choice in the United States.

6.0 TITLE AND RISK
Title to items sold and risk loss and damage shall pass to Buyer upon delivery by JRC to common carrier or Buyer as the case may be, except that title to (but not risk of loss) shall in the case of items supplied upon credit terms not pass until payment in full has been received by JRC.

7.0 CHANGES, CANCELLATIONS, AND RETURNS
7.1 In furtherance of its policy of continuous product improvement, JRC reserves the right to change designs, materials and specifications, and to discontinue items without any notice or liability to Buyer and without any obligation to furnish or install such changes on products previously or subsequently sold.

7.2 If Buyer issues a change order or cancels an order, Buyer shall be liable to pay to JRC for the whole cost and loss incurred by JRC resulting from such change or cancellation, as such is determined by JRC, which shall include all costs, direct and indirect, plus a pro rata proportion or normal profit.

7.3 No credit shall be given for any item returned unless returned with the prior approval of an authorized representative of JRC. All items must be returned with a written declaration by Buyer stating the reason for the return and the name of the authorized representative of JRC authorizing the return. Only sales managers or officers of JRC are authorized to approve return of items. Risk of loss or damage in respect of any item returned with JRC’s authorization will remain with Buyer until redelivery to JRC. A charge of not less than fifteen percent (15%) or such larger amount as JRC may consider reasonable in circumstances, with a minimum of $10.00 per item, will be charged by JRC on all items returned to pay for cost of inspection, repacking, handling, credit arrangements, etc. JRC shall not be responsible for holding or accounting for any item returned without prior authorization by JRC and/or unaccompanied by the required written declaration.

7.4 If freight and other transportation costs are not prepaid on any returned item, the cost thereof will be deducted from the credit issued. No credit will be given on any non-standard item manufactured at the request or to the individual specifications of Buyer.

8.0 OTHER MANUFACTURER’S EQUIPMENT
Where any item supplied by JRC contains any part or parts obtained by JRC from or supplied by another manufacturer, JRC has no responsibility or liability whatever therefor other than to transfer to Buyer any rights capable of transfer that JRC may have in respect thereof.
9.0 USE AND ACCEPTANCE OF ITEM

9.1 Buyer warrants, by purchase of an item, that Buyer is familiar with the item and its proper use, handling, shipping and storage and JRC gives no warranty of fitness or merchantability of any item for any specific purpose or use. Before using any item, Buyer shall give such item reasonable and prudent examination and/or tests to determine the suitability of item for Buyer’s intended use. Any item delivered to Buyer shall be deemed accepted by Buyer unless written notice of defect or nonconformity is received by JRC within thirty (30) days of date of receipt by Buyer. Buyer assumes all risk and liability in connection with an item from time of delivery to Buyer.

9.2 Inspection of any item(s) by Buyer is made at JRC’s designated plant in the United States and at Buyer’s expense and such inspection and acceptance shall be final. Reasonable facilities will be afforded to inspectors representing Buyer. If Buyer requires expediters, inspectors, and/or agents, JRC will make available personnel to assist Buyer’s expediters, inspectors, and/or agents during normal working hours at JRC’s designated plant in the United States and charges for JRC’s personnel in the amount of $25.00 per employee, per hour or any part thereof if less than one hour, will be added to the price quoted for the item(s).

10.0 ASSISTANCE TO BUYER

At Buyer’s request, JRC may at, its discretion, make available to Buyer employee(s) of JRC for the purpose of training Buyer or Buyer’s employees in the operation of an item supplied by JRC or such other duties as JRC may agree upon the basis only that Buyer, by such request, agrees and accepts that JRC’s employee(s) shall be under the direction and control of Buyer and be the full responsibility of Buyer and that Buyer shall supply all necessary equipment and supplies for proper provision of the service(s) to be performed by JRC’s employee(s). All costs associated with the provision of JRC employees hereunder shall be borne by Buyer. JRC shall have no liability whatever to Buyer for such employee(s) while under the direction and control of Buyer as aforesaid.

11.0 WARRANTY

11.1 Buyer, by purchase of an item, agrees and accepts that THERE ARE NO WARRANTIES, EXPRESS OR, IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE, made or given by JRC in respect of any item supplied by JRC. JRC warrants each new item (excluding any part or parts thereof to which Condition 8 hereof applies) to be free from defects in materials and workmanship if, and only if, all of the following conditions are met:

11.1.1 The item claimed to be defective has been exposed only to normal use and service, has been reasonably maintained and kept lubricated, has been otherwise used in accordance with JRC’s instructions and has not been subject to misuse, negligence or accident, nor repaired or altered, except by an authorized representative of JRC, in a manner which in JRC’s judgment may affect its stability or reliability;

11.1.2 The item claimed to be defective has been returned at Buyer’s expense to JRC’s plant in the United States (or such other location as JRC may designate) within ten (10) days after Buyer first discovers the alleged defect;

11.1.3 Examination of the item by JRC, upon return, satisfies JRC that the circumstances referred to in Condition 11.1.1 apply and the defect claimed is due or traceable to defect in original materials or workmanship;

11.1.4 The item is not one expendable in normal use which has been expended in normal use.
11.2 JRC’s liability under the foregoing warranty shall be restricted to the repair or replacement of the item covered at no cost to Buyer other than as set forth in Condition 11.1.2, but subject, if appropriate, to Buyer paying or reimbursing JRC for fair wear and tear to such item arising in normal use and service as aforesaid or, at JRC’s option, refund or an equitable proportion of the purchase price. Repairs or replacement items are only warranted for the remaining unexpired portion of the original warranty period.

11.3 The foregoing warranty shall remain in effect only for the period of six (6) months immediately following date of receipt of item by Buyer, provided that (i) in the case of surface and subsurface electronic equipment such period will be ninety (90) days, and (ii) in the case of scintillation detectors, the only warranty given is that they shall be in working order upon delivery to Buyer.

11.4 No attempt to repair or undertaking or promise to repair, replace or improve an item by any representative of JRC shall have the effect of waiving, changing or extending the foregoing warranty in any way whatever unless agreed to by JRC in writing.

11.5 All claims under the foregoing warranty must be made promptly after occurrence of the circumstances giving rise thereto and must be received by JRC within the applicable warranty period. Such claim should include the item’s description, part number, serial number (if any), date of shipment or delivery and a full description of the circumstances giving rise to the claim. Any item returned for claim purposes shall be sent prepaid by appropriate transportation. JRC reserves the right to reject any claim not promptly reported. Buyer is responsible for all damage or loss resulting from improper packing or handling, and loss in transit until redelivery to JRC. If any item is returned without cause and found out to be serviceable, Buyer will be notified and the item returned to Buyer at Buyer’s expense. In addition, JRC may charge Buyer for testing and examination thereof.

11.6 THE FOREGOING WARRANTY IS THE ONLY WARRANTY, EXPRESS, IMPLIED OR STATUTORY, UPON WHICH ANY ITEM IS SOLD BY JRC, AND BUYER’S SOLE REMEDY IN ANY CAUSE OF ACTION (WHETHER IN TORT, CONTRACT BREACH OF WARRANTY, OR OTHERWISE) ARISING HOWSOEVER ON THE SALE AND PURCHASE OR USE OF ANY ITEM SUPPLIED BY JRC IS EXPRESSLY LIMITED TO THE REPAIR OR REPLACEMENT OF THE ITEM CONCERNED ON THE TERMS AND SUBJECT TO THE CONDITIONS AS HEREINBEFORE PROVIDED AND ALL OTHER DAMAGES AND WARRANTIES, STATUTORY OR OTHERWISE, ARE EXPRESSLY AGREED TO BE WAIVED BY BUYER BY PURCHASE OF THE ITEM CONCERNED. IN NO EVENT SHALL JRC BE LIABLE FOR ANY INJURY, LOSS OR DAMAGE, DIRECT, CONSEQUENTIAL, SPECIAL, INCIDENTAL, INDIRECT, OR PUNITIVE, ARISING OUT OF THE SUPPLY OR USE OF ANY ITEM.

12.0 HOLD HARMLESS TERMS

12.1 To the maximum extent allowed by applicable law, Buyer agrees to release JRC, its parent, subsidiary, affiliated companies, subcontractors and vendors and insurers and its/their officers, directors, employees and agents herein referred to as “JRC Group”, from liability for any and all damages whatsoever to property of any kind owned by, in the possession of or leased by Buyer. Buyer also agrees to defend, indemnify and hold JRC Group harmless from and against any and all liability, claims, cost, expenses, attorney fees, and damages whatsoever for personal injury, illness, death, property damage and loss resulting from:

Loss of well control; services to control a wild well whether underground or above the surface; reservoir or underground damage, including loss of oil, gas, other mineral substances or water; surface damage arising from underground damage; damage to or loss of the wellbore; subsurface trespass or any action in the nature thereof; fire; explosion; subsurface pressure; radioactivity; contamination and pollution of any kind and its cleanup and control.
12.2 Buyer’s release, defense, indemnity and hold harmless obligations will apply even if the liability and claims are caused by the sole, concurrent, active or passive negligence, fault or strict liability of one or more members of the JRC Group, the unseaworthiness on any vessel or any defect in data, products, supplies, materials or equipment furnished by JRC Group whether in the design, manufacture, maintenance or marketing thereof or from a failure to warn of such defect.

13.0 COMPLIANCE WITH EXPORT LAWS

13.1 The parties acknowledge that the laws of the United States regulate the movement between countries of such goods and services, whether it be the initial export from the US or any subsequent movement across an international border. JRC cautions that any change in use, change in country of use or use by a party other than Buyer may alter the status of the goods and services under applicable laws of the United States and the country of use and may restrict or prohibit such change. Buyer agrees that it shall in no case be party to a transaction which would allow such goods or services to be used in connection with the design, production, use or storage of chemical, biological or nuclear weapons or missiles of any kind or would result in a violation of or punishable offense under United States law. Additionally, Buyer, without limitation, agrees that absent express license authorization, Buyer shall not (i) re-export any item directly or indirectly, in whole or in part, from the authorized country(ies) of ultimate destination as approved in the appropriate US export license; or (ii) export any such item from the United States with the knowledge that it is to be re-exported directly or indirectly, in whole or in part, from the authorized country(ies) of ultimate destination as approved in the appropriate US export license.

13.2 Any JRC obligation to supply goods and services to Buyer is subject to its ability to do so under applicable law current from time to time hereafter, including its ability to secure a license from the appropriate agency of government. Any failure of JRC to comply with such an obligation or delay in compliance arising out of or in connection with applicable law or inability to obtain a license shall be deemed a force majeure event and not a breach of contract. Further, Buyer agrees to comply with all terms and conditions of such licenses regarding export, re-export, transshipment and/or disclosure of the details of any item supplied by JRC under such licenses. Acceptance of any order for any item an contract or agreement relating thereto shall be subject to and be deemed to include the condition that it is conditional upon such licenses being granted. In the event of any such license being in terms not acceptable to Buyer and Buyer cancels an order or contract or agreement, Condition 7.2 hereof shall apply.

14.0 ARBITRATION

Any claims, disputes, or controversies between the Parties arising out of these General Terms and Conditions, which exceed $10,000.00 in value and which cannot be settled by mutual agreement shall, upon written notice by one Party to the other, be finally settled by arbitration in accordance with and subject to the Rules of Arbitration of the American Arbitration Association. All arbitration hearings or proceedings shall be held in Houston, Harris County, Texas. The Party desiring arbitration shall notify the other party in writing of the matter to be arbitrated and the name of the arbitrator selected by it. Within ten (10) days after receipt of such notice, the other Party shall appoint an arbitrator and shall forthwith notify the first Party of such appointment. The two arbitrators named shall within ten (10) days appoint, in writing, a third arbitrator. Pending a decision by the majority of the arbitration panel, both parties agree to take no action, which might upset the status quo or prejudice the respective positions of the Parties with respect to the matter in controversy. A decision by the majority of the arbitration panel with respect to the matter in controversy shall be final and binding on the parties, and judgment on any award so rendered may be entered in any court having jurisdiction.
15.0 MISCELLANEOUS

15.1 All of these Terms and Conditions including Buyer’s warranties and undertaking to hold JRC harmless and indemnifying JRC shall also apply in favor of all subsidiaries and affiliates of JRC and in favor of any manufacturer or supplier of any part or parts of any item supplied by JRC, and their respective agents, servants, officers, and employees.

15.2 Failure by JRC to enforce any or all of these General Terms and Conditions in any case or cases shall not constitute a waiver of or preclude subsequent enforcement of any or all such General Terms and Conditions.

15.3 Any attempted or purported assignment or transfer of any of the rights, duties or obligations herein contained shall render such attempted or purported assignment or transfer null and void, provided that JRC may perform and fulfill all or any of its obligations hereunder by or through one or more of its said subsidiaries and affiliates.

15.4 Certain items contain or embody confidential and proprietary information and to protect such information from unauthorized disclosure, Buyer undertakes not, without the prior written consent of JRC, (i) to disclose to any third party (other than employees of Buyer) any detail or feature or part of any item or any specification or drawing relating thereto without first containing a similar undertaking of nondisclosure from such third party nor (ii) to sell any item without the purchaser thereof being subject to an obligation similar to this Condition 14.4.

15.5 If any provision of these General Terms and Conditions is capable of more than one construction, one or more of which would render the provision void and one which would render the provision valid, the provision shall be interpreted in the manner which would render it valid. If any provision is determined to be void by court of competent jurisdiction, such determination shall not affect any other provision and such other provision shall remain in full force and effect. These General Terms and Conditions shall be interpreted and receive effect in accordance with the law of the State of Texas, notwithstanding conflicts of law principles that would refer to the law of another jurisdiction.

The headings used in these General Terms and Conditions are for convenience and ease of reference only and shall not be used in the interpretation hereof.

The clauses contained in these General Terms and Conditions of Sale shall be construed as one document in its entirety.