

V20, VA/VG20, VA/VG35 Open-Center Control Valves

Mobile Hydraulic Valves
Bulletin HY14-2409/US

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



ENGINEERING YOUR SUCCESS.

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 **WARNING – USER RESPONSIBILITY**

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

- This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.
- The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.
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SAFETY GUIDE

For safety information, see Safety Guide SG HY14-1000 at www.parker.com/safety or call 1-800-CParker.



General Valve Assembly Information

The Basics

Every valve has the following elements:

- Inlet
- Main relief
- Work sections
- Outlet
- Section seals
- Stud kit to hold the assembly in place

The valve inlet is connected directly to the outlet coming from the hydraulic pump, and the valve outlet is connected directly to the tank.

The main relief valve is generally installed in the inlet and controls maximum system pressure.

The valve work sections connect the cylinders, motors, spreader valves or other auxiliary valves.



Work Section Types

Sections can be the following types:

- Single Acting (one work port)
- Double Acting (two work ports)

Actuators

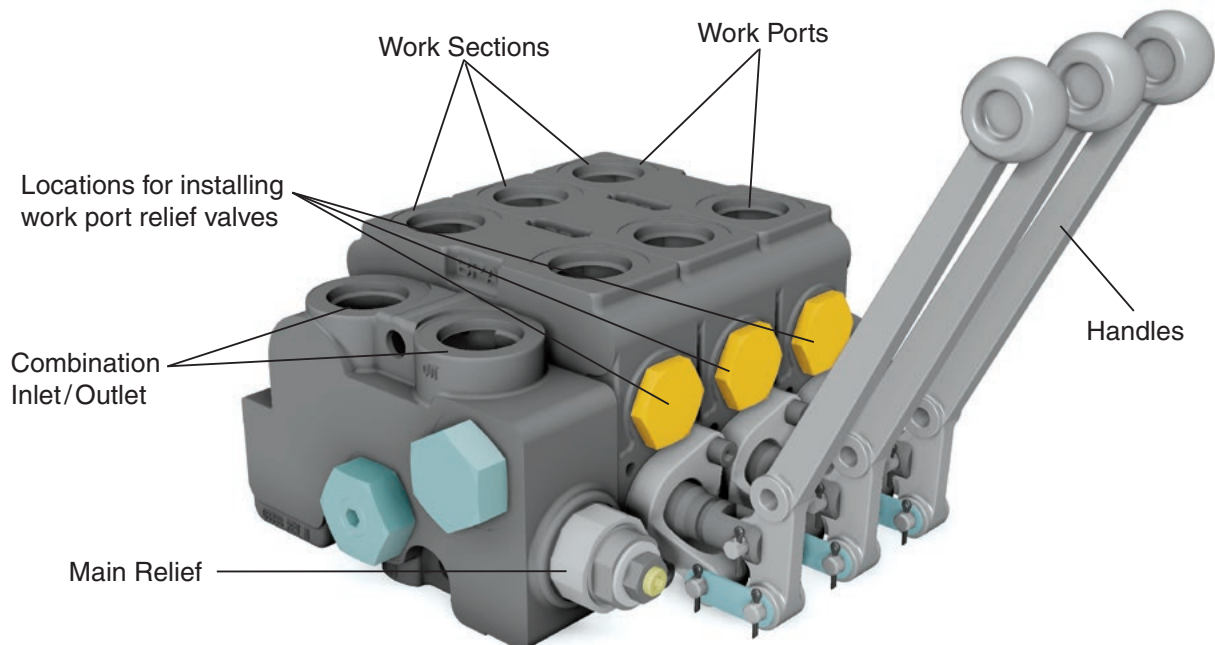
Work sections can be actuated by four means:

- Manual Handles
- Electric Solenoids
- Air Actuators
- Hydraulic Pilot

Work Port Relief Valves

Individual work section can have work port relief valves screwed into the sides of the work sections and can control:

- Control pressure
- Reduce cavitation
- Work port relief valves can be adjustable or fixed depending to the style.



V20 Inlets



Standard



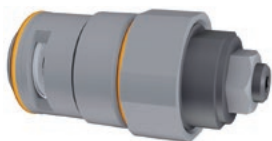
Mid Inlets

Specifications

Nominal Flow	Up to 95 LPM (25 GPM)
Operating Pressure	Up to 240 Bar (3500 PSI)

Part Number	Model Number	Description	Porting
08650029	20-LC-12	Standard Inlet	SAE 12
08650004	20-12-SF	Split Flow Mid Inlet	SAE 12
08650003	20-12-CF	Combined Flow Mid Inlet	SAE 12

V20 Main Relief Valves

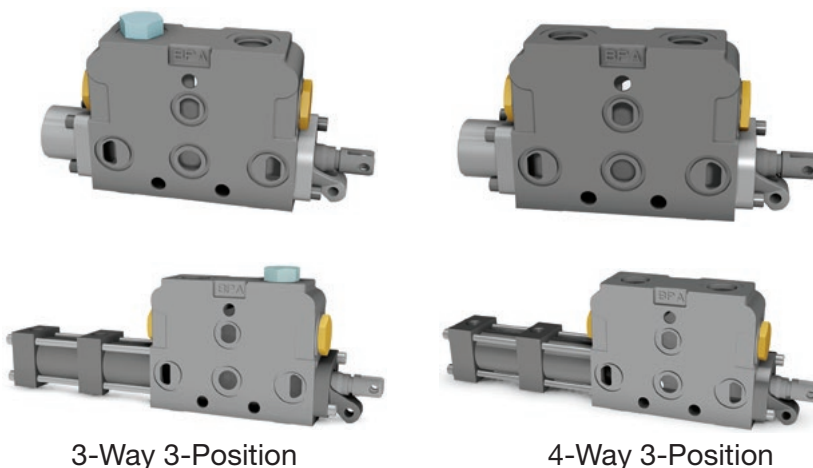


Part Number	Model Number	Description
RP51A-3000	RP51A-3000	Main Relief Valve
08650419	WH-1950	Fixed Main Relief Valve 134 Bar (1950 PSI)
08650420	WH-2550	Fixed Main Relief Valve 176 Bar (2550 PSI)



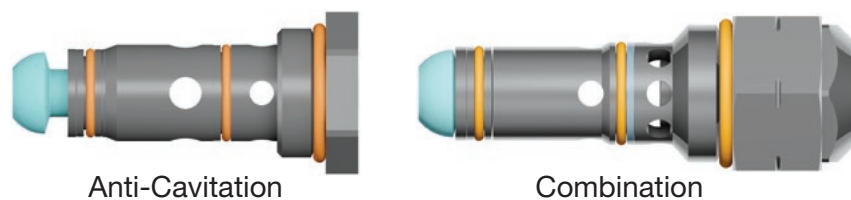
V20 Work Sections

Model V20 double-acting cylinder sections versus V20 motor spools cannot be visually determined simply by looking at the valves. It is important to keep the valves properly marked during the assembly process. It is recommended that a permanent M be marked on the motor spool so the installer will know the difference.



Part Number	Model Number	Description	Porting
08650016	20-10-03	Single-Acting Cylinder Spool	SAE 10
08650020	20-10-04	Double-Acting Cylinder Spool	SAE 10
08650018	20-10-F4	Double-Acting Motor Spool	SAE 10
13650963	20-10-03-PA1	Single-Acting Cylinder Spool Pneumatic	SAE 10
13650964	20-10-04-PA1	Double-Acting Cylinder Spool Pneumatic	SAE 10

V20 Work Port Reliefs

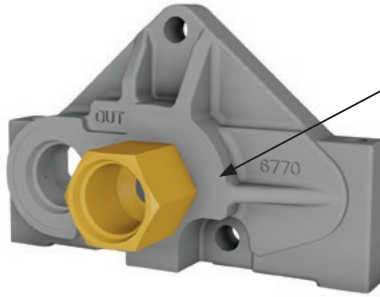


Part Number	Model Number	Description
08650380	K-20-AC	Anti-Cavitation Check
08650387	CRA-1200	Combination PR/AC 83 Bar (1200 PSI)
08650388	CRA-1700	Combination PR/AC 117 Bar (1700 PSI)
08650389	CRA-1950	Combination PR/AC 134 Bar (1950 PSI)
08650390	CRA-2500	Combination PR/AC 176 Bar (2550 PSI)

V20 Outlets



Standard Outlet



Power Beyond Outlet

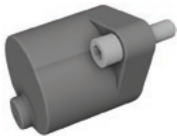
The Power Beyond Sleeve must be ordered separately and does not come installed.



Power Beyond Sleeve

Part Number	Model Number	Description	Porting
13650146	20-RC-12-E	Standard Outlet	SAE 12
08650024	20-RC-12-E-MY	Power Beyond Outlet	SAE 12
08650103	K-20-10-Y	Power Beyond Sleeve	SAE 10
08650100	K-20-X	Conversion Plug	SAE 12

Action Kits



Part Number	Model Number	Description
08650105	K-20-D	3-Position Detent
08650630	K-20-PA1	Pneumatic Positioner

Handles and Accessories

Part Number	Model Number	Description
08650151	K-20-VH-B	Vertical Handle Black
08650156	K-20-HH-B	Horizontal Handle Black
08650107	K-20-RET	Standard Seal Retainer Plate
08650097	Wiper	Spool Wiper
08650113	K-20-HBO-C1	Complete Bracket
08650112	K-20-Boot	Spool Boot Assembly



Stud Kits

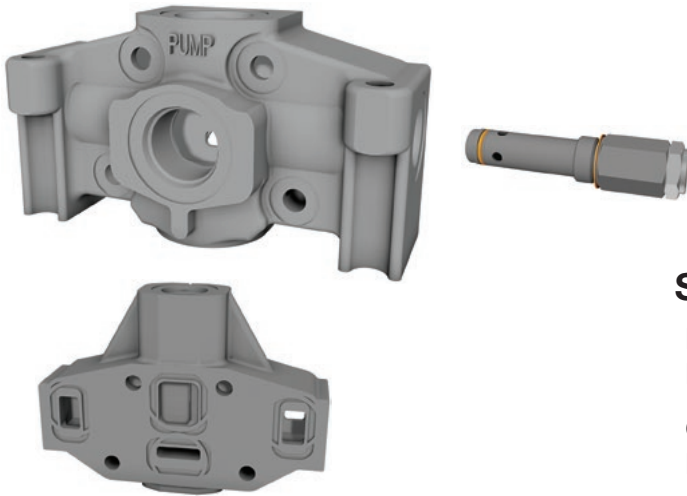
Mid Inlets and Utility Sections count as a work section when selecting stud kits.



Part Number	Model Number	Description
08650087	K-20-1	1 Work Section
08650088	K-20-2	2 Work Sections
08650089	K-20-3	3 Work Sections
08650090	K-20-4	4 Work Sections
08650091	K-20-5	5 Work Sections
08650092	K-20-6	6 Work Sections
08650093	K-20-7	7 Work Sections
08650094	K-20-8	8 Work Sections
08650095	K-20-9	9 Work Sections
08650096	K-20-10	10 Work Sections



VA20 and VG20 Inlets / Main Relief Valves



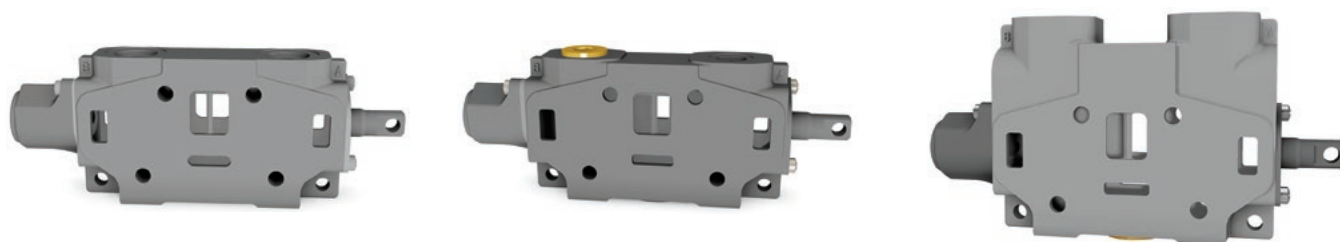
Specifications

Nominal Flow	Up to 170 LPM (45 GPM)
Operating Pressure	VA20 Up to 172 Bar (2500 PSI) VG20 Up to 241 Bar (3500 PSI)

Part Number	Model Number	Description	Porting
347-9175-002	DVA20-A880	Inlet	SAE 16 Porting
347-9174-004	DVA20-CFA70	Combined Flow Mid Inlet	SAE 12 Porting
347-9174-002	DVA20-SFA70	Split Flow Mid Inlet	SAE 12 Porting
391-1873-001	DVA20-MRV	Adjustable Main Relief	N/A
391-1873-002	DV20-MRVP	Main Relief Plug	N/A
347-9175-010	DVG20-A880	Inlet	SAE 16 Porting
347-9174-006	DVG20-CFA70	Combined Flow Mid Inlet	SAE 12 Porting
347-9174-005	DVG20-SFA70	Split Flow Mid Inlet	SAE 12 Porting
391-1873-128	DVG20-HMRV	Adjustable Main Relief	N/A



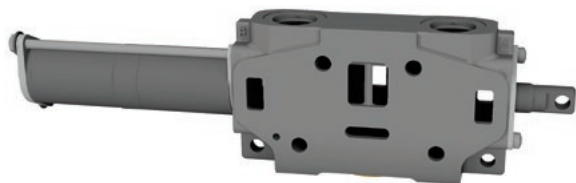
VA20 and VG20 Work Sections



Spring Return

Part Number	Model Number	Description	Porting
347-9172-003	DVA20-DA7	Low Boy Double-Acting Cylinder Spool	SAE 12
347-9172-006	DVA20-MA7	Low Boy Double-Acting Motor Spool	SAE 12
347-9171-003	DVA20-SA7	Low Boy Single-Acting Cylinder Spool	SAE 12
347-9172-009	DVA20-HA755	High Boy Double-Acting Cylinder Spool	SAE 12
347-9172-012	DVA20-LA755	High Boy Double-Acting Motor Spool	SAE 12
347-9171-006	DVA20-JA705	High Boy Single-Acting Cylinder Spool	SAE 12
347-9172-052	DVG20-DA7	Low Boy Double-Acting Cylinder Spool	SAE 12
347-9172-053	DVG20-MA7	Low Boy Double-Acting Motor Spool	SAE 12
347-9172-056	DVG20-HA755	High Boy Double-Acting Cylinder Spool	SAE 12
347-9172-057	DVG20-LA755	High Boy Double-Acting Motor Spool	SAE 12
347-9171-007	DVG20-JA705	High Boy Single-Acting Cylinder Spool	SAE 12

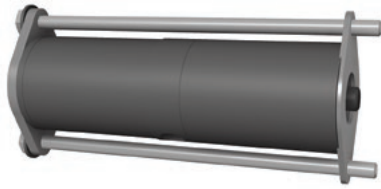
* Hi boy port accessories come standard unplugged and must use either a port option or port plug for operation.



Pneumatic

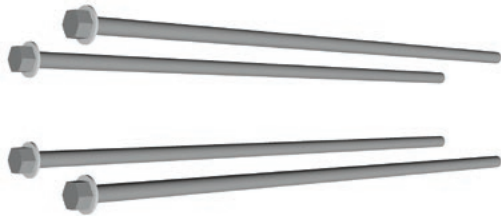
Part Number	Model Number	Description	Porting
347-9172-034	DVA20-DV7	Low Boy Double-Acting Cylinder Spool	SAE 12
347-9171-018	DVA20-SV7	Low Boy Single-Acting Cylinder Spool	SAE 12

VA20 and VG20 Positioner Kits



Part Number	Model Number	Description
391-1873-206	DV20-K-113	Pneumatic Shifter
391-1873-020	DV20-K-101	3-Position Detent
391-1873-019	DV20-K-100	Spring Center

VA20 and VG20 Stud Kits



Part Number	Model Number	Description
391-1873-045	DVA20-SK1	1 Work Section
391-1873-046	DVA20-SK2	2 Work Sections
391-1873-047	DVA20-SK3	3 Work Sections
391-1873-048	DVA20-SK4	4 Work Sections
391-1873-049	DVA20-SK5	5 Work Sections
391-1873-050	DVA20-SK6	6 Work Sections
391-1873-051	DVA20-SK7	7 Work Sections
391-1873-052	DVA20-SK8	8 Work Sections
391-1873-129	DVG20-TSK1	1 Work Section
391-1873-130	DVG20-TSK2	2 Work Sections
391-1873-131	DVG20-TSK3	3 Work Sections
391-1873-132	DVG20-TSK4	4 Work Sections
391-1873-133	DVG20-TSK5	5 Work Sections
391-1873-134	DVG20-TSK6	6 Work Sections
391-1873-135	DVG20-TSK7	7 Work Sections
391-1873-136	DVG20-TSK8	8 Work Sections

TSK have studs and nuts



VA and VG Work Port Relief



Part Number	Model Number	Description
391-1873-006	DV-PRVAC	Screw Adjustable Work Port Relief
391-1873-010	DV-AC	Anti-Cavitation Check Valve
391-1873-007	DV-PRV-1	Work Port Relief 34 - 69 Bar (500 - 1000 PSI)
391-1873-008	DV-PRV-2	Work Port Relief 69 - 172 Bar (1000 - 2500 PSI)
391-1873-009	DV-PRV-3	Work Port Relief 172 - 241 Bar (2500 - 3500 PSI)
391-1873-011	DV-PRVP	Work Port Relief Plug

*PRV Accesories are shim adjustable.

VA and VG20 Handle Assemblies

Part Number	Model Number	Description
391-1873-094	DV20-H4	Standard 6" Handle
391-1873-062	DV20-H8	Standard 8" Handle

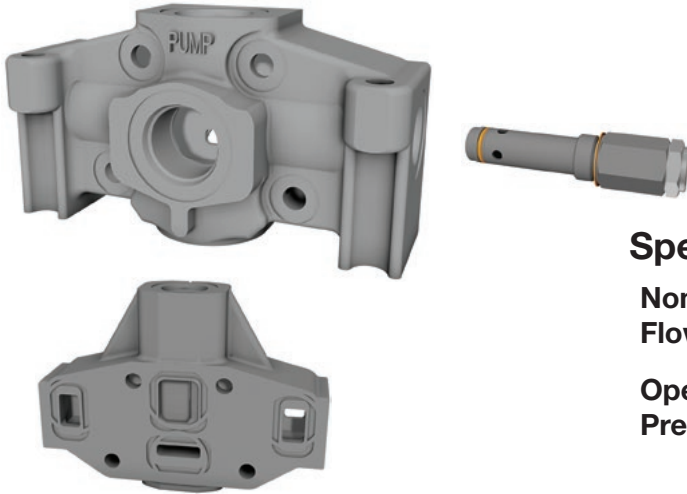


VA20 and VG20 Outlets



Part Number	Model Number	Description	Porting
347-9176-002	DVA20-TR88	Tank Return	SAE 16
347-9176-004	DVA20-PB80	Power Beyond End Porting	SAE 16
347-9176-005	DVA20-PB08	Power Beyond Top Porting	SAE 16
347-9176-007	DVG20-TTR88	Tank Return	SAE 16
347-9176-008	DVG20-TTB80	Power Beyond Porting	SAE 16

VA35 and VG35 Inlets and Main Relief Valve



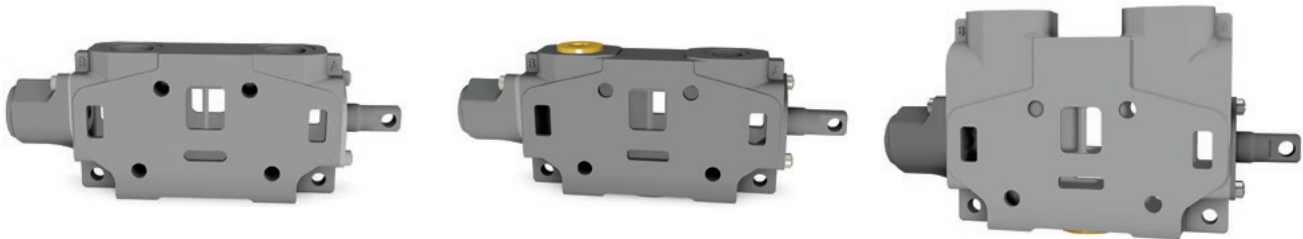
Specifications

Nominal Flow Up to 246 LPM (65 GPM)

Operating Pressure VA35 Up to 172 Bar (2500 PSI)
 VG35 Up to 241 Bar (3500 PSI)

Part Number	Model Number	Description	Porting
348-9175-005	DVA35-A880	Inlet	SAE 16 Porting
348-9174-004	DVA35-CFA80	Combined Flow Mid Inlet	SAE 16 Porting
348-9174-002	DVA35-SFA80	Split Flow Mid Inlet	SAE 16 Porting
391-1873-003	DVA35-MRV-1	Main Relief 55 - 138 Bar (800 - 2000 PSI)	N/A
391-1873-004	DVA35-MRV-2	Main Relief 138 - 172 Bar (2000 - 2500 PSI)	N/A
348-9175-008	DVG35-A880	Inlet	SAE 16 Porting
348-9174-006	DVG35-CFA80	Combined Flow Mid Inlet	SAE 16 Porting
348-9174-005	DVG35-SFA80	Split Flow Mid Inlet	SAE 16 Porting
391-1873-137	DVG35-HMRV	Main Relief 193 - 241 Bar (2800 - 3500 PSI)	N/A

VA35 and VG35 Work Sections



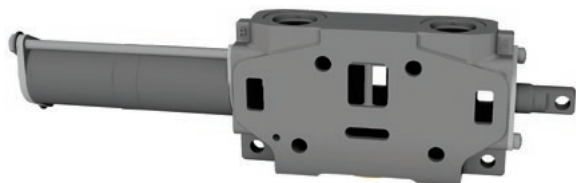
Spring Return

Part Number	Model Number	Description	Porting
348-9172-003	DVA35-DA8	Low Boy Double-Acting Cylinder Spool	SAE 16
348-9172-006	DVA35-MA8	Low Boy Double-Acting Motor Spool	SAE 16
348-9171-003	DVA35-SA8	Low Boy Single-Acting Cylinder Spool	SAE 16
348-9172-009	DVA35-HA855	High Boy Double-Acting Cylinder Spool	SAE 16
348-9172-012	DVA35-LA855	High Boy Double-Acting Motor Spool	SAE 16
348-9171-006	DVA35-JA805	High Boy Single-Acting Cylinder Spool	SAE 16

VA35 and VG35 Work Sections Continued

Spring Return

Part Number	Model Number	Description	Porting
348-9172-048	DVG35-DA8	Low Boy Double-Acting Cylinder Spool	SAE 16
348-9172-049	DVG35-MA8	Low Boy Double-Acting Motor Spool	SAE 16
348-9172-052	DVG35-HA855	High Boy Double-Acting Cylinder Spool	SAE 16
348-9172-053	DVG35-LA855	High Boy Double-Acting Motor Spool	SAE 16
348-9171-011	DVG35-JA805	High Boy Single-Acting Cylinder Spool	SAE 16



Pneumatic

Part Number	Model Number	Description	Porting
348-9172-030	DVA35-DV8	Low Boy Double-Acting Cylinder Spool	SAE 16
348-9171-016	DVA35-SV8	Low Boy Single-Acting Cylinder Spool	SAE 16
348-9172-021	DVA35-HV855	High Boy Double-Acting Cylinder Spool	SAE 16
348-9172-066	DVA35-LV855	High Boy Double-Acting Motor Spool	SAE 16

Part Number	Model Number	Description	Porting
348-9172-075	DVG35-HV855	High Boy Double-Acting Cylinder Spool	SAE 16

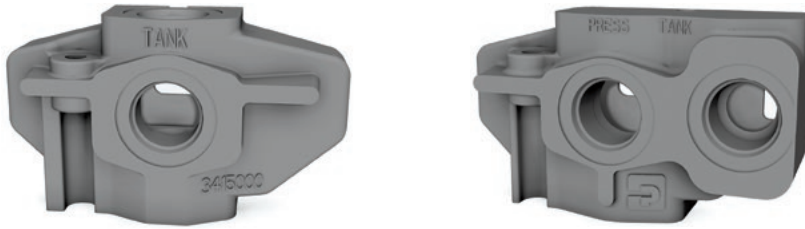
* Hi boy port accessories come standard unplugged and must use either a port option or port plug for operation.

VA35 and VG35 Handle Assemblies

Part Number	Model Number	Description
391-1873-097	DV35-H4	Low Boy 6" Handle
391-1873-065	DV35-H8	High Boy 8" Handle

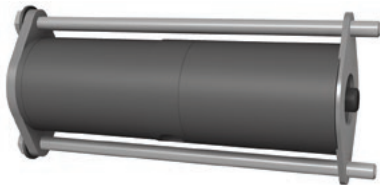


VA35 and VG35 Outlets



Part Number	Model Number	Description	Porting
348-9176-002	DVA35-TR99	Tank Return	SAE 20
348-9176-004	DVA35-PB90	Power Beyond	SAE 20
348-9176-007	DVG35-TTR99	Tank Return	SAE 20
348-9176-008	DVG35-TTB90	Power Beyond Porting	SAE 20

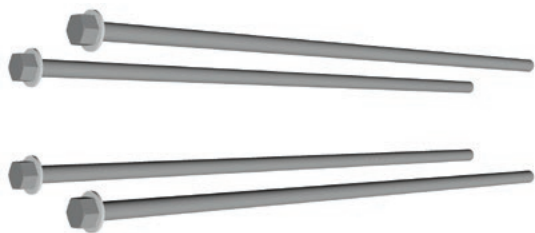
VA35 and VG35 Positioner Kits



Part Number	Model Number	Description
391-1873-203	DV35-K-213	Pneumatic Shifter
391-1873-027	DV35-K-201	3-Position Detent
391-1873-026	DV35-K-200	Spring Center Detent



VA35 and VG35 Stud Kits



Part Number	Model Number	Description
391-1873-053	DVA35-SK1	1 Work Section
391-1873-054	DVA35-SK2	2 Work Sections
391-1873-055	DVA35-SK3	3 Work Sections
391-1873-056	DVA35-SK4	4 Work Sections
391-1873-057	DVA35-SK5	5 Work Sections
391-1873-058	DVA35-SK6	6 Work Sections
391-1873-059	DVA35-SK7	7 Work Sections
391-1873-060	DVA35-SK8	8 Work Sections
391-1873-138	DVG35-TSK1	1 Work Section
391-1873-139	DVG35-TSK2	2 Work Sections
391-1873-140	DVG35-TSK3	3 Work Sections
391-1873-141	DVG35-TSK4	4 Work Sections
391-1873-142	DVG35-TSK5	5 Work Sections
391-1873-143	DVG35-TSK6	6 Work Sections
391-1873-144	DVG35-TSK7	7 Work Sections
391-1873-145	DVG35-TSK8	8 Work Sections



TSK have studs and nuts

Plugs



Part Number	Model Number	Description
08650298	K-SAE-10	Plug 5/8" O-Ring
08650299	K-SAE-12	Plug 3/4" O-Ring
08650301	K-SAE-16	Plug 1" O-Ring
391-1873-016	DV-DPL-12	Plug 3/4" O-Ring
391-1873-017	DV-DPL-16	Plug 1" O-Ring
391-1873-018	DV-DPL-20	Plug 1 1/4" O-Ring

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3. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate. Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyer's request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of eighteen (18) months from the date of delivery. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to the Seller within ten (10) days of delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the defect is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

6. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

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8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller retains a security interest in all Products delivered to Buyer and this agreement is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper Use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought

by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, application, design, specification or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Products; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Buyer may not cancel or modify or cancel any order for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change Product features, specifications, designs and availability.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and is not liable for delay or failure to perform any of Seller's obligations by reason of events or circumstances beyond its reasonable control (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not invalidate that provision; nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate this agreement, in writing, if Buyer: (a) breaches any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or one if filed by a third party (d) makes an assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and refund the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller is not liable for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged. The terms contained herein may not be modified unless in writing and signed by an authorized representative of Seller.

20. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards of care, including those of the United Kingdom, the United States of America, and the country or countries in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act") and the U.S. Food Drug and Cosmetic Act ("FDCA"), each as currently amended, and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that it is familiar with the provisions of the U. K. Bribery Act, the FCPA, the FDA, and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.

5/14



Parker Safety Guide for Selecting and Using Hydraulic Valves and Related Accessories

WARNING: Failure or improper selection or improper use of Parker Hydraulic Valve Division (HVD) Valves or related accessories (“Products”) can cause death, personal injury and property damage. Possible consequences of failure or improper use of these Products include but are not limited to:

- Valves or parts thereof thrown off at high speed
- High velocity fluid discharge
- Explosion or burning of the conveyed fluid
- Contact with suddenly moving or falling objects controlled by the Valve
- Injections by high-pressure fluid discharge
- Contact with fluid that may be hot, cold, toxic or otherwise injurious
- Injuries resulting from injection, inhalation or exposure to fluids
- Injury from handling a heavy item (dropped, awkward lift)
- Electric shock from improper handling of solenoid connections
- Injury from slip or fall on spilled or leaked fluid

Before selecting or using any of these Products, it is important that you read and follow the instructions below. In general, the Products are not approved for in-flight aerospace applications. Consult the factory for the few that are FAA approved.

1.0 GENERAL INSTRUCTIONS

- 1.1 **Scope:** This safety guide provides instructions for selecting and using (including assembling, installing and maintaining) these Products. For convenience all items in this guide are called “Valves”. This safety guide is a supplement to and is to be used in conjunction with the specific Parker catalogs for the specific Valves and/or accessories being considered for use. See item 1.6 below for obtaining those catalogs.
- 1.2 **Fail-Safe:** Valves can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Valve or Valve Assembly will not endanger persons or property.
- 1.3 **Safety Devices:** Never disconnect, override, circumvent or otherwise disable any safety lockout on any system whether powered by HVD Valves or any motion control system of any manufacturer. (e.g. Automatic shut-off on a riding lawn mower should the operator get out of the seat).
- 1.4 **Distribution:** Provide a copy of this safety guide to each person that is responsible for selecting or using HVD Valve Products. Do not select HVD Valves without thoroughly reading and understanding this safety guide as well as the specific Parker catalogs for the Products considered or selected.
- 1.5 **User Responsibility:** Due the wide variety of operating conditions and applications for Valves, HVD and its distributors do not represent or warrant that any particular Valve is suitable for any specific system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing is solely responsible for:
 - Making the final selection of the Valve
 - Assuring that the user’s requirements are met and that the application presents no health or safety hazards.
 - Providing all appropriate health and safety warnings on the equipment on which the Valves are used.
 - Assuring compliance with all applicable government and industry standards.
- 1.6 **Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for the telephone numbers of the appropriate technical service department. For additional copies of this or any other Parker Safety Guide go to www.parker.com and click on the safety button on the opening page. Catalogs and/or catalog numbers for the various HVD Valve Products can be obtained by calling HVD at 440-366-5100. Phone numbers and catalog information is also available on the Parker website, www.parker.com.

2.0 VALVE SELECTION INSTRUCTIONS

- 2.1 **Pressure:** Valve selection must be made so that the maximum working pressure of the Valve is equal to or greater than the maximum system pressure. Surge, impulse or peak transient pressures in the system must be below the maximum working pressure of the Valve. Surge, impulse and peak pressures can usually be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressure and cannot be used to determine surge, impulse or peak transient pressures. Burst pressure ratings if given or known are for manufacturing purposes only and are not an indication that the Product can be used in applications at the burst pressure or otherwise above the maximum working pressure.
- 2.2 **Temperature:** The fluid temperature must be regulated or controlled so that the operating viscosity of the fluid is maintained at a level specified for the particular Valve product. Such ranges are given in the product catalogs or can be obtained from the appropriate customer service department for the particular Valve product.
- 2.3 **Fluid Compatibility:** The fluid conveyed in Valves has direct implications on the Valve selection. The fluid must be chemically compatible with the Valve component materials. Elastomer seals, brass, cast iron, aluminum for example all are potentially affected by certain fluids. Additionally, fluid selection affects the performance of various Valves. Considerations relative to fluid selection are outlined in the specific HVD Valve product catalog. Of particular importance is that the fluid be for hydraulic use, contain the proper additives and wear inhibitors. See 1.6 “Additional Questions” above for information to obtain such HVD catalogs.
- 2.4 **Changing Fluids:** If a system requires a different fluid, it should be done with the guidance in number 2.3 above. Additionally, it may be necessary to flush the system (including the Valves) to remove any of the previous fluid. Consult the Parker Valve Division for guidance.
- 2.5 **Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.
- 2.6 **Placement:** Installation of Valves must take into account the orientation of the Valve and the proximity of the Valve to other parts of the system. This includes but is not limited to closeness to hot and cold areas, access for servicing and operation as well as orientation for proper connectors.
- 2.7 **Ports:** Connection of Valves in systems can be by threaded ports, sub-base surfaces, flanges and manifolds. In all cases, the proper fitting, surface or mounting hardware must be selected to properly seal and contain the system fluid so as to avoid the adverse conditions listed in the initial warning box above. Specifically, if using threaded ports, the designer must make sure that the mating fitting is of the compatible thread. Also, the instructions provided by the connector hardware supplier must be read and understood so as to properly assemble the connector. The Parker Safety Guide for using Hose, Tubing and Fittings and Related Accessories is but one reference to this end.
- 2.8 **Environment:** Care must be taken to insure that the Valve and Valve Assemblies are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.
- 2.9 **Electric Power:** For Valves requiring electric power for control, it is imperative that the electricity be delivered at the proper voltage, current and wattage requirements. To obtain the proper control requirements please refer to the respective Parker product catalog for the specific Valve that is intended for use. If further guidance is required, call the appropriate technical service department identified in the respective Parker product catalog.
- 2.10 **Specifications and Standards:** When selecting Valves, government, industry and Parker specifications and recommendations must be reviewed and followed as applicable.
- 2.11 **Accessories:** All accessories used in conjunction with any Parker Valve product must be rated to the same requirements of the Valve including but not limited to pressure, flow, material compatibility, power requirements. All of these items must be examined as stated in the “VALVE INSTALLATION INSTRUCTIONS” paragraph 3.0.

(continued on next page)

3.0 VALVE INSTALLATION INSTRUCTIONS

- 3.1 **Component Inspection:** Prior to use, a careful examination of the Valve(s) must be performed. The Valve intended for use must be checked for correct style, size, catalog number and external condition. The Valve must be examined for cleanliness, absence of external defects or gouges, cracked or otherwise deformed parts or missing items. The mounting surface or port connections must be protected and free of burrs, scratches, corrosion or other imperfections. Do NOT use any item that displays any signs of nonconformance. In addition, any accessory including but not limited to fittings, bolt kits, hoses, sub bases, manifolds, and electrical connectors must be subjected to the same examination.
- 3.2 **Handling Valves:** Many Valves whether HVD Valves or of another manufacturer can be large, bulky or otherwise difficult to handle. Care must be taken to use proper lifting techniques, tools, braces, lifting belts or other aids so as not to cause injury to the user, any other person or to property.
- 3.3 **Filtration:** Fluid cleanliness is a necessity in any hydraulic system. Fluid filters must be installed and maintained in the system to provide the required level of fluid cleanliness. Filters can be placed in the inlets, pressure lines and return lines. The level of cleanliness required is specified in the HVD product catalog for the specific Valve(s) selected or intended for use. For additional information on Filter selection contact Parker Filter Division at 800-253-1258 or 419-644-4311.
- 3.4 **Servo Valves:** Application of Servo Valves in general requires knowledge and awareness of “closed loop control theory” and the use of electronic controls for successful and safe operation. Individuals who do not have such experience or knowledge must gain training before use of such Products. Parker offers both classroom training as well as manuals to assist in gaining this knowledge. These aids can be obtained by contacting Hydraulic Valve Division at 440-366-5100, calling the general Parker help line 800-CPARKER or going to the Parker web site at www.parker.com.
- 3.5 **Accessory Ratings:** All accessories used in combination with the selected or intended Valve product must be rated and compatible with the selected Valve. Specifically, the items must be of equal or greater rating including but not limited to pressure, flow, power, size, port style, thread connectors and material.
- 3.6 **Connection Styles:** It is the responsibility of the user of the Parker product to properly select connectors and accessories that match the connections on the sub plate, Valve, flange or threaded connection or manifold. It is also the responsibility of the installer to possess adequate skill and knowledge including but not limited to thread preparation, torque technique, hose assembly and inspection, tube preparation and assembly, and fitting installation. Parker Tube Fitting Division (www.parker.com/ffd) catalog 4300 and Parker Hose Products (www.parkerhose.com) catalog 4400 describe some basic technical information relative to proper fitting assembly.
- 3.7 **Electrical Connections:** All electrical connections must be made to the applicable codes and local safety requirements.
- 3.8 **Gauges and Sensors:** The user must install sufficient gauges and sensors in the system so as to be able to determine the condition of the system. This includes but is not limited to pressure gauges, flow meters, temperature sensors and site gauges. These are of utmost importance should removal or disassembly of a Valve, portion of a Valve or portion of the system become necessary. Refer to “VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS” for details and especially item 4.8.
- 3.9 **System Checkout:** Once installed, the Valve installation must be tested to insure proper operation and that no external leakage exists. All safety equipment must be in place including but not limited to safety glasses, helmets, ear protection, splash guards, gloves, coveralls and any shields on the equipment. All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Valve maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potentially hazardous areas while testing and using.

4.0 VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS

- 4.1 **Maintenance Program:** Even with proper installation, Valves and Valve System life may be significantly reduced without a continuing maintenance program. The severity of the application and risk potential must determine the frequency of the inspection and the replacement of the Products so that Products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at a minimum, must include instructions 4.2 through 4.10. An FMEA (Failure Mode and Effects Analysis) is recommended in determining maintenance requirements.
- 4.2 **Visual Inspection-Valves:** Any of the following conditions require immediate shut down and replacement of the Valve.
- Evidence that the Valve is in partial dis-assembly.
 - Visible crack or suspicion of a crack in the Valve housing or bent, cracked or otherwise damaged solenoid.
 - Missing or partially extending drive pin on a flow control knob.
 - Missing, loose components, obstructions or other condition impeding the motion or function of the manual knob, lever, foot pedal or other mechanical operator of a hydraulic Valve.
 - Any evidence of burning or heat induced discoloration.
 - Blistered, soft, degraded or loose cover of any kind.
 - Loose wire or electrical connector.
- 4.3 **Visual Inspection-Other:** The following conditions must be tightened, repaired, corrected or replaced as required.
1. Fluid on the ground must be cleaned immediately. Also, the source of the fluid must be determined prior to running the equipment again.
 2. Leaking port or excessive external dirt build-up.
 3. System fluid level is too low or air is entrapped or visible in the reservoir.
 4. Equipment controlled by the Valve or Valve assembly has been losing power, speed, efficiency
- 4.4 **Filter Maintenance:** System filters must be maintained and kept in proper working order. The main service requirement is periodic replacement of the filter element or screen. Contact Parker Filter Division at 800-253-1258 or 419-644-4311 for further filter maintenance details.
- 4.5 **Functional Test:** See “System Checkout” number 3.9 above in “VALVE INSTALLATION INSTRUCTIONS”.
- 4.6 **Replacement Intervals:** Valves and Valve Systems will eventually age and require replacement. Seals especially should be inspected and replaced at specific replacement intervals based on previous experience, government or industry recommendations, or when failures could result in unacceptable downtime, damage or injury risk. At a minimum seals must be replaced whenever service is rendered to a Valve product.
- 4.7 **Adjustments, Control Knobs, and Other Manual Controls:** System Pressure and Flow are typically adjusted by knobs and/or handles. A set-screw or lock-nut secures the adjustment device so as to maintain the desired setting. This set-screw or lock-nut must first be loosened prior to making any adjustments and re-tightened after adjustment on the HVD Valve. All adjustments must be made in conjunction with pressure gauges and/or flow meters (or by watching the speed of the actuator in the case of setting flow only). See paragraph “Gauges and Sensors” above in the section “VALVE INSTALLATION INSTRUCTIONS”. Under no circumstances should any control knob, adjustment stem, handle, foot pedal or other actuating device be forced beyond the mechanical stop(s) on the Valve. For example, the Parker Safety Notice Bulletin **HY14-3310-B1/US** for HVD Colorflow Valves specifically restricts the adjustment torque to “hand adjust” or “less than 10 ft/lbs” if it cannot be adjusted by hand. Failure to adhere to this may force the knob beyond the stop point allowing it to be ejected at high speed resulting in death, personal injury and property damage. For complete safety instructions on HVD Colorflow Valves, copies of Safety Notice **Bulletin HY14-3310-B1/US** can be obtained directly from the Hydraulic Valve Division at 440-366-5100 or from the Parker web site at www.parker.com by selecting the “Safety” button. Parker help line 800-CPARKER is on call 24/7 as well should there be any question about the use of a HVD Valve. Additionally, when making adjustments, always adjust the Valve with all parts of your body to the side of the Valve (that is, the knob is not pointing toward you or anyone else).
- 4.8 **High pressure Warning:** Hydraulic power is transmitted by high-pressure fluids through hoses, fittings and valves, pumps and actuators. This condition can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure. From time to time, hoses, Valves, tubes or fittings fail if they are not replaced at proper time intervals. Typically these failures are the result of some form of misapplication, abuse, wear, or failure to perform proper maintenance. When such failure occurs, generally the high pressure fluid inside escapes in a stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by “feeling” with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possible loss of limb or life. Even seemingly minor hydraulic fluid injection injuries must be treated immediately by a physician with knowledge of the tissue damaging properties of hydraulic fluid. If a hose, tube, fitting or Valve failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the system. Simply shutting down the pump may or may not eliminate the pressure in the system. It may take several minutes or even hours for the pressure to be relieved so that the leak area can be examined safely. Once the pressure has been reduced to zero, the suspected leaking item can be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a connector (especially a hose) or Valve that has failed. Consult the nearest Parker distributor or the appropriate Parker division for component replacement information. Never touch or examine a failed hydraulic component unless it is obvious that the item no longer contains fluid under pressure.



Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 1 800 C-Parker (1 800 272 7537)



Aerospace

Key Markets

Aftermarket services
Commercial transports
Engines
General & business aviation
Helicopters
Launch vehicles
Military aircraft
Missiles
Power generation
Regional transports
Unmanned aerial vehicles

Key Products

Control systems & actuation products
Engine systems & components
Fluid conveyance systems & components
Fluid metering, delivery & atomization devices
Fuel systems & components
Fuel tank inerting systems
Hydraulic systems & components
Thermal management
Wheels & brakes



Climate Control

Key Markets

Agriculture
Air conditioning
Construction Machinery
Food & beverage
Industrial machinery
Life sciences
Oil & gas
Precision cooling
Process
Refrigeration
Transportation

Key Products

Accumulators
Advanced actuators
CO₂ controls
Electronic controllers
Filter driers
Hand shut-off valves
Heat exchangers
Hose & fittings
Pressure regulating valves
Refrigerant distributors
Safety relief valves
Smart pumps
Solenoid valves
Thermostatic expansion valves



Electromechanical

Key Markets

Aerospace
Factory automation
Life science & medical
Machine tools
Packaging machinery
Paper machinery
Plastics machinery & converting
Primary metals
Semiconductor & electronics
Textile
Wire & cable

Key Products

AC/DC drives & systems
Electric actuators, gantry robots & slides
Electrohydraulic actuation systems
Electromechanical actuation systems
Human machine interface
Linear motors
Stepper motors, servo motors, drives & controls
Structural extrusions



Filtration

Key Markets

Aerospace
Food & beverage
Industrial plant & equipment
Life sciences
Marine
Mobile equipment
Oil & gas
Power generation & renewable energy
Process
Transportation
Water Purification

Key Products

Analytical gas generators
Compressed air filters & dryers
Engine air, coolant, fuel & oil filtration systems
Fluid condition monitoring systems
Hydraulic & lubrication filters
Hydrogen, nitrogen & zero air generators
Instrumentation filters
Membrane & fiber filters
Microfiltration
Sterile air filtration
Water desalination & purification filters & systems



Fluid & Gas Handling

Key Markets

Aerial lift
Agriculture
Bulk chemical handling
Construction machinery
Food & beverage
Fuel & gas delivery
Industrial machinery
Life sciences
Marine
Mining
Mobile
Oil & gas
Renewable energy
Transportation

Key Products

Check valves
Connectors for low pressure fluid conveyance
Deep sea umbilicals
Diagnostic equipment
Hose couplings
Industrial hose
Mooring systems & power cables
PTFE hose & tubing
Quick couplings
Rubber & thermoplastic hose
Tube fittings & adapters
Tubing & plastic fittings



Hydraulics

Key Markets

Aerial lift
Agriculture
Alternative energy
Construction machinery
Forestry
Industrial machinery
Machine tools
Marine
Material handling
Mining
Oil & gas
Power generation
Refuse vehicles
Renewable energy
Truck hydraulics
Turf equipment

Key Products

Accumulators
Cartridge valves
Electrohydraulic actuators
Human machine interfaces
Hybrid drives
Hydraulic cylinders
Hydraulic motors & pumps
Hydraulic systems
Hydraulic valves & controls
Hydrostatic steering
Integrated hydraulic circuits
Power take-offs
Power units
Rotary actuators
Sensors



Pneumatics

Key Markets

Aerospace
Conveyor & material handling
Factory automation
Life science & medical
Machine tools
Packaging machinery
Transportation & automotive

Key Products

Air preparation
Brass fittings & valves
Manifolds
Pneumatic accessories
Pneumatic actuators & grippers
Pneumatic valves & controls
Quick disconnects
Rotary actuators
Rubber & thermoplastic hose & couplings
Structural extrusions
Thermoplastic tubing & fittings
Vacuum generators, cups & sensors



Process Control

Key Markets

Alternative fuels
Biopharmaceuticals
Chemical & refining
Food & beverage
Marine & shipbuilding
Medical & dental
Microelectronics
Nuclear Power
Offshore oil exploration
Oil & gas
Pharmaceuticals
Power generation
Pulp & paper
Steel
Water/wastewater

Key Products

Analytical Instruments
Analytical sample conditioning products & systems
Chemical injection fittings & valves
Fluoropolymer chemical delivery fittings, valves & pumps
High purity gas delivery fittings, valves, regulators & digital flow controllers
Industrial mass flow meters/controllers
Permanent no-weld tube fittings
Precision industrial regulators & flow controllers
Process control double block & bleeds
Process control fittings, valves, regulators & manifold valves



Sealing & Shielding

Key Markets

Aerospace
Chemical processing
Consumer
Fluid power
General industrial
Information technology
Life sciences
Microelectronics
Military
Oil & gas
Power generation
Renewable energy
Telecommunications
Transportation

Key Products

Dynamic seals
Elastomeric o-rings
Electro-medical instrument design & assembly
EMI shielding
Extruded & precision-cut, fabricated elastomeric seals
High temperature metal seals
Homogeneous & inserted elastomeric shapes
Medical device fabrication & assembly
Metal & plastic retained composite seals
Shielded optical windows
Silicone tubing & extrusions
Thermal management
Vibration dampening

ENGINEERING YOUR SUCCESS.

Parker Hydraulics International Sales Offices

North America

Hydraulics Group Headquarters
6035 Parkland Boulevard
Cleveland, OH 44124-4141 USA
Tel: 216-896-3000
Fax: 216-896-4031

Parker Canada Division
160 Chisholm Drive
Milton, Ontario, L9T 3G9 Canada
Tel: 905-693-3000
Fax: 905-876-1958

Parker Hannifin de México
Industrial Hydraulic Sales
Eje Uno Norte No. 100
Parque Industrial Toluca 2000
Toluca, Edo. de Mexico CP 50100
Tel: 52 722 275 4200
Fax: 52 722 275 0277

Europe

Hydraulics Group Headquarters
La Tuilière 6
CH 1163 Etoy, Switzerland
Tel: 41 21 821 8500
Fax: 41 21 821 8580

AT – Austria, Wiener Neustadt
Tel: +43 2622-23501-0
Fax: +43 2622-23501-88101

DE – Germany, Kaarst
Tel: +49 2131 4016 0
Fax: +49 2131 4016 9199

Europe (Continued)

ES – Spain, Madrid
Tel: +34 902 33 00 01
Fax: +34 91-675 77 11

FI – Finland, Vantaa
Tel: +358 20 753 2500
Fax: +358 20 753 2200

FR – France, Contamine Sur Arve
Tel: +33 4-50 25 80 25
Fax: +33 4-50 25 24 25

IT – Italy, Corsico (MI)
Tel: +39 02-45 19 21
Fax: +39 02-44 79 340

NL – The Netherlands, Oldenzaal
Tel: +31 541 585 000
Fax: +31 541 585 459

RU – Russia, Moscow
Tel: +7 495 645 2156
Fax: +7 495 612 1860

SE – Sweden, Spånga
Tel: +46 8 5979 50 00
Fax: +46 8 5979 51 10

UK – United Kingdom, Warwick
Tel: +44 1926-317 878
Fax: +44 1926-317 855

Africa

ZA – South Africa, Kempton Park
Tel: +27 (0)11 961 0700
Fax: +27 (0)11 392 7213

Asia Pacific

AU – Australia, Castle Hill
Tel: +61 2 9634 7777
Fax: +61 2 9899 6184

CN – China, Shanghai
Tel: +86 21 2899 5000
Fax: +86 21 5834 8975

HK – Hong Kong, Kowloon
Tel: +852 2428 8008
Fax: +852 2480 4256

IN – India, Mumbai
Tel: +91 22 6513 7081/82/83/84/85
Fax: +91 22 2768 6841

JP – Japan, Fujisawa
Tel: +81 466 35 3050
Fax: +81 466 35 2019

KR – South Korea, Seoul
Tel: +82 2 559 0400
Fax: +82 2 556 8187

SG – Singapore
Tel: +65 6887 6300
Fax: +65 6265 5125

South America

AR – Argentina, Buenos Aires
Tel: +54 3327 44 4129
Fax: +54 3327 44 4199

BR – Brazil, Cachoeirinha RS
Tel: +55 51 3470 9144
Fax: +55 51 3470 9215

Industrial Sales, N.A.

Central Region
1042 Maple Avenue, Unit 331
Lisle, IL 60532 USA
Tel: 440-516-3216
Fax: 440-943-1424

Great Lakes Region
30240 Lakeland Blvd
Wickliffe, OH 44092 USA
Tel: 440-516-3216
Fax: 440-943-1424

Gulf Region
11151 Cash Rd
Stafford, TX 77477 USA
Tel: 817-473-4431
Fax: 888-227-9454

Mid-Atlantic Region
125 E. Meadowview Road
Greensboro, NC 27406 USA
Tel: (336) 202-6068
Fax: (866) 608-1837

**Midwest and
Mississippi Valley Regions**
8145 Lewis Road
Minneapolis, MN 55427 USA
Tel: 763-513-3535
Fax: 763-544-3418

Northeast Region
Parker Hannifin Corporation
P.O. Box 778
Pine Brook, NJ 07058 USA
Tel: 973-227-2565
Fax: 973-461-7509

Northwest Region
6458 North Basin Avenue
Portland, OR 97217 USA
Tel: 503-283-1020
Fax: 866-611-7308

Pacific and Mountain Regions
8460 Kass Drive
Buena Park, CA 90621 USA
Tel: 714-228-2510
Fax: 714-228-2511

Southwest Region
700 S. 4th Avenue
Mansfield, TX 76063 USA
Tel: 817-473-4431
Fax: 888-227-9454

Southeast Region
12600 Deerfield Parkway
Suite 100
Alpharetta, GA 30004 USA
Tel: (614) 202-9968
Fax: (866) 608-1837

Mobile Sales, N.A.

**Mobile Sales Organization
and Global Sales**
850 Arthur Avenue
Elk Grove Village, IL 60007 USA
Tel: 847-258-6200
Fax: 847-258-6299

