



ARRAY



# OPERATION & MAINTENANCE MANUAL

## API 6A SLAB GATE VALVE



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## INTRODUCTION

Array's forged slab gate valves are available in 10,000 and 15,000 PSI configurations. The valves come standard with forged steel valve bodies and bonnets. Fittings are provided for valve body lubrication located on the bonnet. This valve has a bi-directional sealing direct acting slab gate design with metal to metal seat to gate sealing surfaces. The non-rising stem includes an integrated backseat that is seated when the bearing cap is backed off. This allows removal and replacement of the packing with the valve in service and in the open or closed position. The stem pin protects the stem and internal parts from damage by shearing if the hand wheel is over torqued. The valve is available in a wide variety of trim configurations to suit all service conditions.



Valves are also available prepared for an actuator of the customer's choice or equipped with an Array Products Pneumatic Diaphragm, Pneumatic Piston, or Hydraulic Actuator. The standard configuration for an actuated valve includes a slab gate and floating seats. Actuator / bonnet assemblies and actuated valve assemblies also include an optional manual override device.



# INSTALLATION AND OPERATING INSTRUCTIONS

## INSTALLATION INSTRUCTIONS

Once an Array gate valve has been assembled and tested it is fully lubricated.

Protective coatings are applied to flange seal surfaces and threads which are exposed to the environment. Gates, seats, stems and other internal parts are also coated with a lubricant such as Molybdenum Disulfide, Xylan, etc., prior to assembly. Every effort should be made to preserve the protective coatings and lubricants prior to installation.

To prevent damage to gate and seat sealing surfaces, all valves are shipped in the open position. The valve should be left in the open position until installation is complete. Should it be necessary to transport the valve, it should always be placed in the open position.

If a hydrostatic test is performed prior to installation, the valve cavity should be drained of test fluids and refilled with a suitable lubricant. **CAUTION:** If hydrostatic tests that exceed the working pressure are required, they must be performed with the valve in the open or partially open position.

## OPERATING INSTRUCTIONS

Array slab gate valves must be backed off a quarter of a turn from the fully closed or fully open position to allow the gate to float and seal off properly.

The appropriate number of turns to operate each Array valve is shown in Table 1 and Table 2.

10,000 WP	
Nominal Size (Inches)	No. of Turns
1 <sup>13</sup> / <sub>16</sub> "	12
2 <sup>1</sup> / <sub>16</sub> "	12
2 <sup>9</sup> / <sub>16</sub> "	15
3 <sup>1</sup> / <sub>16</sub> "	18
4 <sup>1</sup> / <sub>16</sub> "	23

Table 1

15,000 WP	
Nominal Size (Inches)	No. of Turns
1 <sup>13</sup> / <sub>16</sub> "	12
2 <sup>1</sup> / <sub>16</sub> "	12
2 <sup>9</sup> / <sub>16</sub> "	15
3 <sup>1</sup> / <sub>16</sub> "	19
4 <sup>1</sup> / <sub>16</sub> "	24

Table 2



## MAINTENANCE

When shipped, all Array valves are fully lubricated and serviced. Once installed, well clean up, cementing operations, hydrofrac, acidizing, etc., can displace lubricants from the body cavity. This may leave particles and fluid which can be damaging to the gate and seat sealing surfaces. It is recommended to drain, vent and lubricate valves following such operations.

A routine program of draining the valve body is the best approach to increasing the effective life of the valve. A minimum of lubrication maintenance will enhance the life and trouble free operation of the valve. Array Field Service Personnel are available to assist you with Valve Maintenance Programs.

The maintenance tools and accessories, as well as, the procedures to be followed for each model of Array valve will follow.

### 1. Maintenance Equipment

- 1.1. To facilitate the necessary valve maintenance we recommend the following equipment: Pressure releasing tool for Alemite grease fittings, Alemite grease gun, Alemite P/N 6713, with needle valve and adapter or equivalent., 24" Pipe wrench.

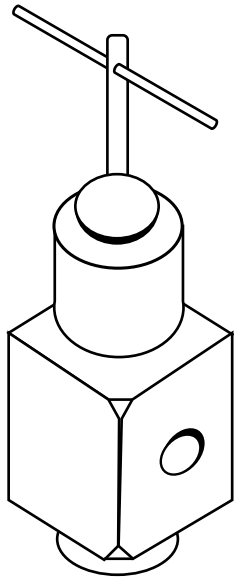


Figure 3

Safety Pressure Releasing Tool

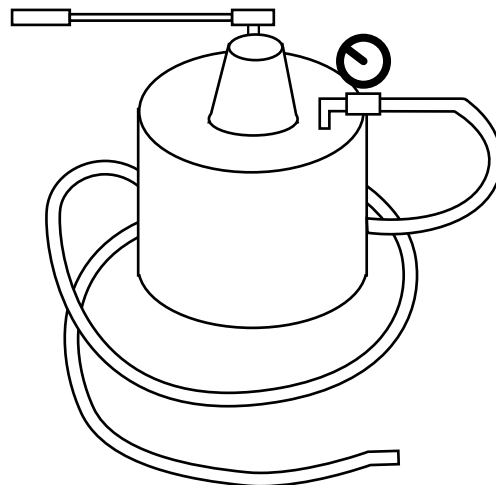


Figure 4

Alemite Grease Gun



## 2. LUBRICATION

- 2.1. Valves are equipped with a standard 1/8" Alemite grease fitting for bearing lubrication. A good grade of #3 grease is recommended for this lubrication. Only a small amount of grease is required. Over lubrication will result in leakage around the stem. **CAUTION:** Array gate valves must be removed from service to perform any work on bearings.

## 3. BODY CAVITY LUBRICATION

- 3.1. Regular body lubrication will help keep valves operating freely and prolong their service life.

Generally, Desco 111 (HS) is recommended for body lubrication. Any good grade #3, #4 or #5 grade lubricant that is not soluble in the media being handled may be substituted as a body lubricant.

Approximately one pound of grease per inch of valve bore size will sufficiently lubricate the valve body. It is not necessary to completely fill the valve body. **CAUTION:** Lubricating pressure must not exceed the rated working pressure of the valve being lubricated. A pressure gauge should be used to monitor lubricating pressure.

- 3.1.1. Operate the valve to either its fully open or fully closed position.
- 3.1.2 Remove safety caps from body grease fittings and install the pressure releasing tool to one and the grease pump to the other.
- 3.1.3. Operate the pressure release tool to bleed body pressure and leave the stinger in this position.
- 3.1.4. Inject lubricant through the other body grease fitting.
- 3.1.5. Once lubrication is complete, remove the pressure release tool and grease pump.
- 3.1.6. Reinstall the safety caps securely on both lubrication fittings.

## 4. THRUST BEARING LUBRICATION

Lubricate the thrust bearings as often as required to ensure smooth valve operation.

- 4.1. Using the Alemite grease gun, connect the grease gun fitting to the hydraulic grease fittings with a hydraulic coupler.
- 4.2. Pump lubricant into the fittings until clean grease appears at the bleed port on the opposite side of the bearing cap.

## 5. BONNET GREASE FITTING REPLACEMENT

- 5.1. NOTE: These valves have a "buried" check valve beneath the bonnet grease fitting.
- 5.2. Remove the grease fitting cap
- 5.3. Trip the ball in the grease fitting check valve by inserting a 1/8" diameter by 3/4" long pin into the run of the fitting.
- 5.4. Replace the cap slowly until the ball in the fitting is unseated.



- 5.5. If the trapped pressure escapes quickly, then stops, the “buried” check valve is holding pressure.
  - 5.5.1. Remove the grease fitting.
  - 5.5.2. Install a new grease fitting.
- 5.6. If pressure continues to escape, the “buried” check valve is leaking.
  - 5.6.1. Backseat the valve.
    - 5.6.1.1. Close the valve fully.
    - 5.6.1.2. Loosen the bearing cap four complete turns using a 24" pipe wrench.
    - 5.6.1.3. Turn the handwheel clockwise (closing direction) until the gate firmly contacts the bottom of the cavity, and the stem moves outward contacting the internal backseat shoulder.
    - 5.6.1.4. Bump the handwheel in the closing direction.
  - 5.6.2. Tighten the grease fitting cap to unseat the ball in the grease fitting check valve and release the trapped pressure.
  - 5.6.3. Remove the grease fitting.
  - 5.6.4. Replace the “buried” check valve.
    - 5.6.4.1. Remove the defective check valve using an Allen wrench.
    - 5.6.4.2. Install a new check valve.
  - 5.6.5. Install a new grease fitting.

## 6. STEM SHEAR PIN AND THRUST BEARING REPLACEMENT

The stem thrust bearings can be replaced while the valve is under pressure in the line.

- 6.1. Remove the thrust bearings.
  - 6.1.1. Loosen the bearing cap using a 24" pipe wrench. After two or three turns, the cap will rotate freely by hand. **CAUTION:** If the bearing cap does not rotate freely after three turns, the packing gland may be moving outward with the bearing cap. Do not remove the cap. Tighten the cap and contact an Array Products representative.
  - 6.1.2. If the bearing cap rotates freely, remove the cap from the bonnet.
  - 6.1.3. Using a punch, drive the stem shear pin from the stem adapter, ensuring that the adapter is not damaged.
  - 6.1.4. Remove the adapter from the stem.
  - 6.1.5. Remove both sets of bearings and bearing races from the stem adapter.
  - 6.1.6. Discard any pitted, cracked, or damaged bearings or races.
  - 6.1.7. Discard the stem adapter if either bearing surface on the adapter shoulder is damaged.



## 6.2. Install the new thrust bearings

- 6.2.1. Remove the new bearings from the protective packaging.
- 6.2.2. Pack the bearings with grease.
- 6.2.3. Place each bearing between a pair of carefully cleaned races.
- 6.2.4. Carefully clean the stem adapter.
- 6.2.5. Install one set of bearings and races over the bottom of the adapter, and one set over the top of the adapter. **NOTE:** The adapter O-ring may be removed temporarily to allow the installation of the top bearing and race assembly.
- 6.2.6. Insert the stem adapter over the end of the stem, and align the pin hole in the adapter with the hole in the stem.
- 6.2.7. Using a punch, drive in the stem pin and ensure that the pin does not protrude over the OD of the adapter shoulder. **CAUTION:** Do not strike the bearings, races or the stem adapter with the punch or hammer.
- 6.2.8. Replace the stem adapter O-ring if necessary.
- 6.2.9. Inspect the bearing cap to ensure that an extra race, held by greased tension, is not retained inside.
- 6.2.10. Clean the bearing cap and lubricate the threads.
- 6.2.11. Install the cap using a 24" Pipe wrench.
- 6.2.12. Rotate the stem adapter counter clockwise to ensure that the gate is off the bottom of the body. This will confirm that the stem backseating shoulder is not contacting the bonnet shoulder.
- 6.2.13. Inject grease through the bearing cap grease fittings until excess grease passes through the bleed port.

## 7. STEM PACKING REPLACEMENT WITH PRESSURE IN THE VALVE

### STEM PACKING REMOVAL

- 7.1. Backseat the valve.
  - 7.1.1. Close the valve fully.
  - 7.1.2. Loosen the bearing cap four complete turns using a 24" pipe wrench.
  - 7.1.3. Turn the handwheel clockwise (closing direction) until the gate firmly contacts the bottom of the cavity, and the stem moves outward contacting the internal backseat shoulder.
  - 7.1.4. Bump the handwheel in the closing direction.



- 7.2. Test the effectiveness of the backseat. Note: These valves have a “buried” check valve beneath the bonnet grease fitting.
  - 7.2.1. Remove the bonnet grease-fitting cap.
  - 7.2.2. Trip the ball in the grease fitting check valve by inserting a 1/8” diameter by 3/4” long pin into the run of the fitting.
  - 7.2.3. Replace the cap slowly until the ball in the fitting is unseated and trapped pressure is released.
  - 7.2.4. If pressure escapes quickly, then stops, the “buried” check valve is holding pressure. Proceed to step 7.2.6.
  - 7.2.5. If pressure continues to escape, the “buried” check valve is leaking and the backseat is ineffective. Backseat the valve again. Repeat steps 7.2.1 & 7.2.2
  - 7.2.6. Remove the grease fitting.
  - 7.2.7. Remove the protective collar from the check valve unseating tool.
  - 7.2.8. Install the unseating tool in the bonnet grease fitting preparation.
  - 7.2.9. Slowly turn the unseating tool clockwise until the ball in the “buried” check valve is unseated and the pressure trapped by the backseating process is released.
  - 7.2.10. If pressure escapes quickly, then stops, the backseat is effective. Proceed to step 7.2.14
  - 7.2.11. If no pressure escapes, the “buried” check valve is defective. Proceed to step 7.2.14
  - 7.2.12. If pressure continues to escape, the backseat is ineffective. Repeat steps 7.2.1 & 7.2.2
  - 7.2.13. If the backseat continues to be ineffective, contact an Array representative.
  - 7.2.14. Remove the check-valve unseating tool.
  - 7.2.15. If the “buried” check valve is defective, replace it using an Allen wrench.
  - 7.2.16. Reinstall the grease fitting.
- 7.3. Remove the handwheel and bearing cap.
- 7.4. Remove the cap from the bonnet.
- 7.5. Using a punch, drive the stem shear pin from the stem adapter, ensuring that the adapter is not damaged.
- 7.6. Remove the adapter from the stem.
- 7.7. Remove both sets of bearings and bearing races from the stem adapter.
- 7.8. Using a 24” pipe wrench, loosen the packing gland.
- 7.9. Ensure that the threads on the bonnet neck OD are not damaged.



7.10. Remove the packing gland.

7.10.1. Remove the stem packing using the appropriate packing sleeve for stem size.

7.10.1.1. Thread the packing sleeve into the bonnet packing gland preparation until the sleeves bottom out.

7.10.1.2. Using a grease gun attached to the bonnet grease-fitting, pump the packing out into the recessed area of the packing sleeve.

7.10.2. If a packing sleeve is not available, remove the stem packing by one of the following methods:

7.10.2.1. Pump packing out with a grease until grease bypasses or packing refuses to extract further.

7.10.2.2. Pull the packing out with a corkscrew. **CAUTION:** Do not damage the stem or packing bore.

## STEM PACKING INSTALLATION

7.11. Clean the grease from the stuffing box bore so that a hydraulic lock will not prevent the installation of new packing.

7.12. Inspect the stuffing box to ensure that the box is clean and free of pits or scars.

7.13. Inspect the stem to ensure that the surface is free of pits or scars.

7.14. Apply a light coat of grease to the stem, the stuffing box bore, and the ID and OD of the stem packing.

7.15. Install the new packing over the end of stem so that the rounded Teflon nose of the packing faces the pressure.

7.16. Using the packing gland as a pushing tool, push the packing back into the stuffing box.

7.17. Remove the packing gland and lubricate the stem OD.

7.18. Install the packing gland with a 24" pipe wrench. Apply approximately 200 ft-lb. of torque, ensuring that the bonnet threads are not damaged.

7.19. Inspect the bearings and bearing races on the stem adapter for pits, scores, or cracks. Replace if damaged.

7.20. Pack the bearings with grease.

7.21. Place each bearing between a pair of carefully cleaned races.

7.22. Carefully clean the stem adapter.

7.23. Install one set of bearings and races over the bottom of the adapter, and one set over the top of the adapter.

**NOTE:** The adapter o-ring may be removed temporarily to allow the installation of the top bearing and race assembly.

7.24. Insert the stem adapter over the end of the stem, and align the pin hole in the adapter with the hole in the stem.

7.25. Using a punch, drive in the stem pin and ensure that the pin does not protrude over the OD of the adapter shoulder. **CAUTION:** Do not strike the bearings, races, or stem adapter with punch or hammer.



- 7.26. Replace the stem adapter o-ring if necessary.
- 7.27. Inspect the bearing cap to ensure that an extra race, held by grease tension, is not retained inside.
- 7.28. Clean the bearing cap and lubricate the threads.
- 7.29. Install the cap using a 24" pipe wrench.
- 7.30. Rotate the stem adapter counter clockwise to ensure the gate is off the bottom of the body. This will confirm that the stem backseat shoulder.
- 7.31. Inject grease through the bearing cap grease fittings until the excess grease passes through the bleed port.
- 7.32. Lubricate the body cavity according to section 3.

## 8. GATE AND SEAT REPLACEMENT

### GATE AND SEAT DISASSEMBLY

- 8.1. Isolate valve from the line pressure.
- 8.2. Release the cavity pressure.
- 8.3. Fully open the valve to ensure that the stem is completely within the gate neck.
- 8.4. Remove the bonnet nuts.
- 8.5. Turn the handwheel clockwise to raise the bonnet from the body. Continue handwheel rotation until the face of the bonnet clears the body to provide access to holes in the top end of the retainer plates.
- 8.6. Insert a pin approximately 3/8" diameter by 3/4" long in each of the four holes located near the bonnet face end of four holes located near the bonnet face end of the retainer plates.
- 8.7. Place two bonnet nuts as spacers on each side of the body cavity between the bonnet and body faces.
- 8.8. Turn the handwheel counter clockwise until the retainer plates are pulled out against the bonnet.
- 8.9. If the ports of the seat ring are not exposed, repeat step 8.7, stacking additional nuts as spacers.
- 8.10. Support the bonnet and turn the handwheel clockwise until the stem completely backs out of the gate.
- 8.11. Remove the bonnet assembly.
- 8.12. Pull the gate and seat assembly from the body.
- 8.13. Remove the body bushings and guides. Use one of the following methods to remove the body bushings if they stick.
  - 8.13.1. Pry out the bushings with a screwdriver or pry bar.
    - 8.13.1.1. Insert the screwdriver or pry bar between the groove in the OD of the bushing and the wall of the body cavity.
    - 8.13.1.2. Pull on the bar, alternating from side to side of the bushing, until it loosens enough to remove by hand.
    - 8.13.1.3. Remove the bushing and pry tool.
- 8.14. Flush the body cavity thoroughly with a suitable solvent and wipe clean with a rag.



## GATE AND SEAT ASSEMBLY

- 8.15. Inspect all gate and seat assembly parts for damage.
  - 8.15.1. Ensure that the retainer plates are not bent, twisted, or distorted at the seal ring opening. Solid materials should not be built up on the ends.
  - 8.15.2. Ensure that the seal rings, seat rings, gate, body bushing seal rings, body bushings and guides are not damaged or have cuts.
- 8.16. Replace any damaged parts.
- 8.17. Ensure that the body cavity is free of all foreign matter such as solid particles, grit, trash, dirt, etc.
- 8.18. Clean the body cavity with a suitable cleaning solvent.
- 8.19. Lubricate the body cavity and the gate and seat assembly parts on all sides.
- 8.20. Lubricate the body bushings seal rings and body bushings.
- 8.21. Install the body bushings, with seal rings, into the body cavity.
- 8.22. Ensure that the body bushing seal rings are installed against the valve body.
- 8.23. Install the guides into the body cavity.
- 8.24. Assemble the gate and seat assembly parts.
- 8.25. Slide the gate and seat assembly into the body according to the following guide lines:
  - 8.25.1. Do not pinch the seat-to-body seals, or apply heavy impact loads to the parts. Only light impact-ing on the gate or retainer plate can be tolerated.
  - 8.25.2. Most valves require effort, gently applied, to force the gate and seat assembly into the cavity. While pushing the gate and seat assembly into the body cavity, ensure that the top edge of the gate extends slightly farther into the cavity than the top edge of the retainer plates. If a retainer plate leads the gate into the cavity, pounding the retainer plate can break the seat ring.
- 8.26. Push the gate all the way to the bottom and hand pack the remaining space with grease.
- 8.27. Remove the seal ring from the bonnet groove.
- 8.28. Clean the grooves and/or seating area of the body and bonnet.
- 8.29. Apply a very thin film of grease to the seal ring and groove.
- 8.30. Install a new seal ring in the bonnet groove.
- 8.31. Install the bonnet over the bonnet studs.
  - 8.31.1. Rotate the bonnet until the grease fitting is 90° from the gate bore.



- 8.32. Turn the handwheel counter clockwise to thread the stem into the gate and pull the bonnet down over the studs.
- 8.33. Hand tighten the bonnet nuts.
- 8.34. Ensure that the gate is not on the bottom of the cavity.
- 8.35. Evenly tighten the bonnet nuts. **NOTE:** The raised bonnet face will fully contact the body face when the bonnet nuts are tight.

## 9. VENTING AND DRAINING

- 9.1. Routine draining of valve bodies will increase valve life and reduce damage to the valve caused by accumulation of foreign matter. The accumulation of foreign matter may keep the valve from fully closing which could result in damaged seat and gate segment sealing surfaces.
  - 9.1.1. Put the valve in a fully open or fully closed position.
  - 9.1.2. Remove one of the body grease fitting safety caps and install a pressure release tool.
  - 9.1.3. Screw the stinger of the pressure release tool into the fitting to bleed body pressure and allow the valve to vent or drain.
  - 9.1.4. After venting or draining, back the stinger of the pressure release tool out to reseal the ball check.
  - 9.1.5. If the initial draining is not sufficient, it may be necessary to repeat the procedure.
  - 9.1.6. Once draining is completed, the valve should be lubricated (Section 3).

## 10. REGULAR PREVENTIVE MAINTENANCE

- 10.1. A program of routine draining and body lubrication is the most positive way to prevent problems caused by foreign matter in the valve body. If a routine program cannot be followed, it is recommended that valves be drained at the following times:
  - After a well has come in and has been cleaned up.
  - After any cementing or fracturing operation.
  - Anytime the valve becomes hard to operate or will not fully open or close by the required number of handwheel turns. Run the hex head stinger all the way into the stem packing fitting and then back out when you are sure that the ball check has seated. Ball check leakage can be detected through the small hole in the side of the fitting prior to completely.



# PARTS LIST

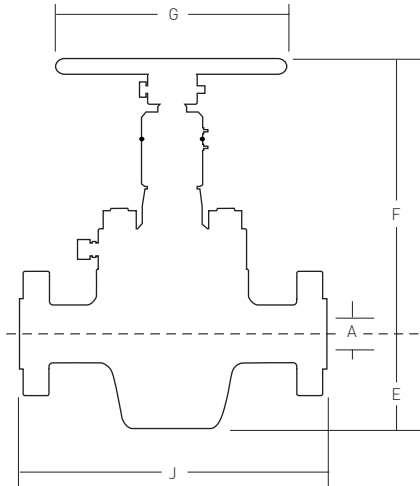
## 3,000–5,000 PSI VALVES

#	DESCRIPTION
1	Handwheel
2	Lubrication Fitting
3	O-Ring
4	Packing Gland
5	Stem Adapter
6	Thrust Bearing
7	Bearing Cap
8	Stud
9	Stem Packing
10	Nut
11	Bonnet
12	Bonnet Seal Ring
13	Grease Fitting
14	Slab Gate
15	Body Bushing
16	Valve Body
17	Retainer Plate
18	Seat Ring
19	Seat Seal / Bushing Seal





# DIMENSIONAL DATA



- A Valve bore
- E Bore centerline to bottom of valve
- F Bore centerline to handwheel top
- G Handwheel diameter
- J Flange face to face
- WT Estimated weight

SIZE	PRESS	A		E		F		G		J		WT	
		in	mm	in	mm	in	mm	in	mm	in	mm	lbs	kgs
1 13/16	10,000	1.81	46	5.69	144	16.47	418	14.00	355	18.25	463	240	108
	15,000	1.81	46	5.90	149	16.73	425	18.00	431	18.00	457	300	136
2 1/16	10,000	2.06	52	5.69	144	16.45	417	14.00	355	20.50	520	265	120
	15,000	2.06	52	5.90	149	16.73	425	18.00	431	19.00	482	330	149
2 9/16	10,000	2.56	65	6.75	171	17.68	448	18.00	431	22.25	565	370	167
	15,000	2.56	65	7.74	196	18.95	481	18.00	431	21.00	533	450	204
3 1/16	10,000	3.06	77	8.12	206	18.58	471	24.00	584	24.38	619	520	235
	15,000	3.06	77	9.65	245	22.79	578	24.00	584	23.56	598	880	399
4 1/16	10,000	4.06	103	10.19	258	21.42	544	24.00	584	26.38	670	850	385
	15,000	4.06	103	11.71	297	24.05	636	24.00	584	29.00	736	1360	616



## TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Fluid leaks past the gate and seat assembly.	Gate and seat assembly is worn.	Replace the gate and seat assembly.
	Handwheel is not backed off.	Back off the handwheel ¼ turn.
Fluid leaks around the valve stem.	Stem packing is worn.	Replace the stem packing.
Fluid leaks at the bonnet flange.	Bonnet seal ring is worn.	Replace the bonnet seal ring.
	Loose bonnet nuts.	Retighten the bonnet nuts.
	Bonnet or body ring groove is damaged.	Back up from hard operating spot before continuing in one direction. Replace at first opportunity.
Fluid leaks from the bonnet grease fitting.	Check valve inside the grease fitting is worn.	Replace the grease fitting.
Handwheel is hard to turn.	Thrust bearings have lost lubricant	Lubricate the thrust bearings.
	Thrust bearings are corroded	Replace the thrust bearings.
	Gate and Stem threads have lost lubricant.	Lubricate the gate and stem through the bonnet grease fitting.
Handwheel turns without opening or closing the valve.	Stem shear pin is sheared.	Replace the stem shear pin.

If ice or hydrates cause the valve not to operate, use the following procedure:

1. Remove the safety cap from the body grease fitting and attach a test pump to the open fitting.
2. Pump methanol or glycol into the valve body to dissolve ice.
3. Work the valve handwheel back and forth to break up the ice block.
4. Continue working the handwheel until the valve can be operated to the fully open and closed position.
5. Remove the test pump and reinstall the safety cap.
6. Drain the test pump and flush the pump hoses clean with hydraulic oil.



# API 6A SLAB GATE VALVE

## ACTUATOR AVAILABILITY

Array slab gate valves can be used with actuators from the any manufacturer, provided that the manufacturer can supply the appropriate bonnet and stem mating assembly. Interface information for Array slab gate valves can be provided upon request.

Array Products also manufactures complete lines of pneumatic diaphragm, pneumatic piston and hydraulic linear actuators that can be used in conjunction with Array slab gate valves prepared for actuator.

## VALVE SPECIFICATIONS

Size Range Available:	API 6A 1 <sup>13</sup> / <sub>16</sub> " through 4 <sup>1</sup> / <sub>16</sub> "
Pressure Ranges Available:	API 10,000 – 15,000 PSI
API Material Classes Available:	AA, BB, CC (Non-Nace) DD-0, 5 / DD-1, 5 / DD-NL EE-0, 5 / EE-1, 5 / EE-NL FF-0, 5 / FF-1, 5 / FF-NL HH-NL
API Product Specification Levels Available:	PSL-1 / PSL-2
API Temperature Ratings Available:	L through U

## LIMITED PRODUCT WARRANTY

The following warranty is exclusive and in lieu of all other warranties. Whether express, implied or statutory, including, but not by way of limitation, any warranty of merchantability or fitness for any particular purpose.

Array Products warrants to each original buyer of products manufactured by Array that such products are free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment provided that no warranty is made with respect to: Any product which has been repaired or altered in such a way in ARRAY's judgment, as to affect the product adversely; Any product which has, in ARRAY's judgment, been subject to negligence, accident or improper storage; Any product which has not been operated or maintained in accordance with normal practice and in conformity with recommendations and public specification of Array.

ARRAY's obligation under this Warranty is limited to use reasonable efforts to repair, replace or, at it's option, refunding the purchase price. The cost of labor for installing a repair or replacement product shall be borne by Purchaser. Replacement parts provided under the terms of this Warranty are warranted for the remainder of the warranty period of the products upon which they are installed to the same extent as if such parts were original components thereof. Warranty services provided there under do not assume any liability for damages caused by any delays involving warranty service. For complete specification information, prices and name, address and telephone number of the ARRAY representative nearest you, call or write to us at the address below.

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### ARRAY HOLDINGS, INC., D.B.A. ARRAY PRODUCTS

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