Davis Cementing Enhancement Devices

Davis Non-Welded Centralizer*

Davis offers a full line of patented, non-weld centralizers. The centralizers feature a unique interlocking adjoinment between the end collar and bow spring, which makes for a strong singular unit. Davis Type "NW" centralizers are designed to exceed the performance requirements of API Specification 10D for both starting and restoring forces. (See data below) Other design features of the Type "NW" centralizer include:

- Bow springs made of an alloy steel which are heat treated and tempered to a hardness to ensure proper and consistent spring characteristics.
- End collar hinges that are folded to the inside. This acts to minimize the collar stretch that tends to occur when centralizers encounter tapers common to some pipe connections.
- A reinforcing rib stamped into the end collar. This acts to strengthen it and ensure maintenance of its round configuration during transport.
- Several different spring bow heights that are available to accommodate most any casing-to-hole configuration.
- Centralizers with built-in stop devices as well as those for unusual sizes available on request.

Davis "NW" Type Centralizer Dimension and Performance Data

Casing Size(In.)	Hole Size(In.)	Product number	BowO.D (In.)	Starting force (Lbs)		Restoring Force (Lbs)	
				API	Davis	API	Davis
4 -1/2	6	0450-NW2C	7 -1/8	464	361	464	3000+
4 -1/2	6- 1/4	0450-NW2C	7 -1/8	464	332	464	790
4 -1/2	6 -1/2	0450-NW3C	7 -5/8	464	355	464	2070
4 -1/2	7- 7/8	0450-NW4C	9 -1/8	464	264	464	1040
5	6 -1/4	0500-NW1C	7 -1/8	520	175	520	650
5	6- 1/2	0500-NW2C	7 -5/8	520	273	520	3000+
5	7- 7/8	0500-NW4C	8 -1/8	520	190	520	1020
5	8 -1/2	0500-NW4C	9 -5/8	520	360	520	1650
5 -1/2	7- 7/8	0550-NW3C	8 -5/8	620	240	620	650
5 -1/2	8 -1/2	0550-NW4C	10 -1/8	620	520	620	1210
5 -1/2	8 -3/4	0550-NW4C	10 -1/8	620	227	620	1310
5 -1/2	9- 7/8	0550-NW5C	11 -1/8	620	280	620	1180
5 -1/2	12- 1/4	0550-NW6C	13 -5/8	620	240	620	680
7	8- 1/2	0700-NW2C	9 -5/8	1040	720	1040	3000+
7	8 -3/4	0700-NW3C	10 -1/8	1040	795	1040	3000+
7	9 -7/8	0700-NW4C	11- 5/8	1040	720	1040	1910
7- 5/8	9 -7/8	0758-NW3C	10 -3/4	1056	550	1056	1467
8 - 5/8	11	0858-NW3C	11 -3/4	1440	400	1440	1470
8 - 5/8	12 -1/4	0858-NW5C	14 -1/4	1440	1120	1440	1850
9 - 5/8	12- 1/4	0958-NW4C	14 -1/4	1600	1290	1600	1970
10 -3/4	12- 1/4	1034-NW2C	13 -3/8	2040	511	1020	2185
10 -3/4	13 -1/2	1034-NW4C	15 -3/8	2040	645	1020	1385
10 -3/4	14 -3/4	1034-NW5C	16 -3/8	2040	660	1020	1290
11 -3/4	14 -3/4	1134-NW4C	16 -3/8	2160	624	1080	1411
11 -3/4	15- 1/2	1134-NW5C	17 -3/8	2160	940	1080	1530
13- 3/8	17 -1/2	1338-NW5C	19	2400	830	1220	2330
16	20	1600-NW5C	21 -5/8	2600	844	1300	1570
16	22	1600-NW6C	24 -1/8	2600	1161	1300	2530
18 -5/8	22	1858-NW4C	23- 1/4	3500	2010	1750	3000+
18 -5/8	24	1858-NW6C	26 -3/4	3500	740	1750	1850
20	24	2000-NW5C	25 -5/8	3760	1360	1880	1930
20	26	2000-NW6C	28 -1/8	3760	1220	1880	2200

Davis Close-Tolerance Bow Spring Centralizer

In applications for running casing in close tolerances or slim holes, Davis offers a special type bow spring centralizer for these requirements. To provide optimum performance in close-tolerance holes, these centralizers feature low starting forces and high restoring forces. Centralizers consist of a solid type end collar for slipping over the pin end of casing joint. Some features/benefits include:

- Designed to meet or exceed API Specification 10D for starting and restoring forces.
- Available with set screws incorporated for integral stop, or can be run between stop devices for applications when casing is to be rotated.
- Typical applications include: 5-inch casing inside 6-inch hole, 7 5/8-inch casing inside 8 1/2-inch hole, and 9 5/8 inch casing inside 10 5/8-inch hole. Other sizes are available upon request.

Davis Non-Welded Semi-Rigid Centralizer (SRC)

This Davis product features uniquely profiled bows that simultaneously provide the operator with those features found desirable in both spring bow and rigid centralizers. The result is a centralizer that far exceeds the performance standards set forth in API Specification 10D.

As with the standard Davis Non-Welded Centralizer, the bows of the SRC are manufactured from alloy steel which is heat treated and tempered. During assembly they are adjoined to the end collars by the Davis patented interlocking method. The design of the SRC's bows produces centralizers that have starting forces far below API maximums along with very low drag forces. The spring characteristic of the bows allows the SRC to compress in order to get through tight spots and severe doglegs that may be present down-hole. While the manufacture of the bows produces characteristics normally associated with standard spring bow centralizers, the double-crested profile of the SRC bow provides restoring forces that far exceed those standards set forth in API Specification 10D and which are normally associated with rigid centralizers. The SRC is ideally suited for running in horizontal and highly deviated wells where low running forces are a must. It

can be run over casing connections or stop collars and, if requested, can be manufactured with a built-in stop device.

Davis "SR" Semi Rigid Centralizer Dimension and Performance Data

Casing Size(In.)	Hole Size(In.)	Product number	Bow O.D (In.)	Starting force (Lbs)		Restoring Force (Lbs)	
				API	Davis	API	Davis
4 -1/2	6	0450-SR1C	6.06	464	171	464	4000+
4 -1/2	6 -1/4	0450-SR2C	6.38	464	<150	464	4000+
4 -1/2	6 -1/2	0450-SR3C	6.63	464	<150	464	3180
4 -1/2	7- 7/8	0450-SR7C	7.88	464	<150	464	3000
*5	6 -1/2	0500-SR1C	6.56	520	<150	520	4000+
5	7 -7/8	0500-SR6C	8.00	520	<150	520	3585
5	8 -1/2	0500-SR8C	8.68	520	<150	520	4000+
5 -1/2	7 -7/8	0550-SR4C	7.88	620	<150	620	1720
5 -1/2	8 -1/2	0550-SR6C	8.50	620	<150	620	2910
5 -1/2	8 -3/4	0550-SR7C	8.88	620	<150	620	2540
5 -1/2	9 -7/8	0550-SR9C	9.68	620	<150	620	4000+
*7	8 -1/2	0700-SR1C	8.63	1040	<150	1040	4000+
7	8 -3/4	0700-SR2C	8.88	1040	783	1040	4000+
7	9 -7/8	0700-SR6C	10.00	1040	<150	1040	4000+
7 -5/8	9 -7/8	0758-SR4C	10.00	1056	<150	1056	4000+
*8 -5/8	11	0858-SR5C	11.00	1440	276	1440	4000+
8 -5/8	12 -1/4	0858-SR8C	12.31	1440	<150	1440	4000+
9 -5/8	12 -1/4	0958-SR5C	12.38	1600	683	1600	4000+
**10 -3/4	12- 1/4	1034-SR1C	12.38	2040	<150	1020	4000+
10 -3/4	13 -1/2	1034-SR5C	13.5	2040	<150	1020	4000+
10 -3/4	14 -3/4	1034-SR9C	15.00	2040	777	1020	4000+
11 -3/4	14 -3/4	1134-SR6C	14.81	2160	180	1080	4000+
11 -3/4	15 -1/2	1134-SR8C	15.50	2160	180	1080	4000+
13 -3/8	17 -1/2	1338-SR9C	17.63	2400	410	1220	4000+
16	20	1600-SR9C	20.25	2600	745	1300	4000+
18- 5/8	22	1858-SR7C	22.06	3500	<150	1750	4000+
20	24	2000-SR9C	24.25	3760	605	1880	4000+
20	26	2000-SR10C	26.13	3760	757	1880	4000+

* Starting force derived from testing over stop collars

** Starting force derived from testing over stop collars, running only over a stop device.

Davis Non-Welded Turbolizer

This is a centralizer with metal fins installed on the bows to help induce turbulence in the cement slurry during pumping operations. Like the spring bows, the fins are made of heat-treated alloy steel. This makes them flexible, which minimizes damage while moving downhole. The Davis Turbolizer incorporates the same non- welded end collar-to-spring- bow interlocking adjoinment as the Davis centralizer. Turbolizers are available in the same sizes and bow heights as centralizers. As with the Davis centralizer, turbolizers can be manufactured with a built-in stop device. These items are available on special order.

Davis Cement Basket

A simple, economical type of annular packoff, the Davis Cement Basket is commonly used in situations where porous or weak formations require help in supporting a cement column. It is constructed of thin steel petals arranged in an overlapping pattern and rein-forced by spring steel ribs. Its design allows cement to flow in an upward direction, yet helps to prevent it from falling downward. The basket is easily installed by sliding it over the pin end of a casing joint, prior to make-up of the joint. Travel range can be limited by a stop ring or by couplings. Available in sizes 4 1/2” and larger, the Davis Cement Basket is most effective when centralized and placed into a gauged section of the hole.

Davis Non-Welded Rigid Centralizer

This Davis product features the patented adjoinment between end collar and spring bow first introduced in the Davis non-welded bow centralizer, along with all the features that operators demand in a rigid centralizer. These include the reduction in drag associated with running pipe in deviated and horizontal wells, the ability to provide optimum concentricity during casing cementing operations, and the ability to function equally well in either open or cased hole. These centralizers are offered in a wide assortment of bow sizes to accommodate most casing-to-hole configurations.

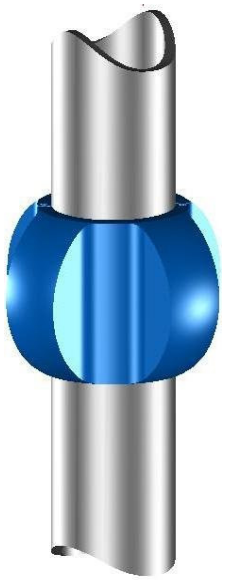
Davis Stop Collars

Stop Collar

Davis also offers a premium one-piece stop-collar, with set screws for superior holding capability.

Davis offers two designs of stop collars: a friction-grip type and a set-screw type. The friction grip type is hinged and incorporates a nut/bolt assembly which, when tightened, draws the stop collar into a friction grip around the circumference of the pipe. It is manufactured from steel that meets ASTM A 569 specifications. The set-screw type is a one piece model that slips on the pipe and is held in place by tightening set screws against the casing. It is manufactured from steel that meets AISI M 1020 specifications. This design offers superior holding capability and is especially applicable in close tolerance situations. Davis stop collars are stocked in all popular sizes ranging from 4 1/2 to 20. Unusual sizes are available on request.

Davis Spherical Stand-Off Device*



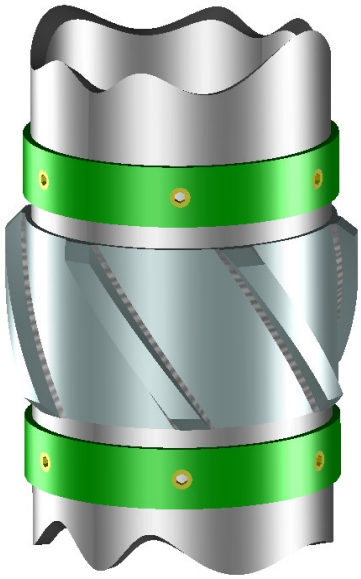
Spherical Stand Off Device

A new product that Davis is introducing is a spherical shaped stand-off device. This device is designed to promote positive stand-off, and significantly reduce the drag forces that are normally associated with other positive stand-off devices. Features/benefits include:

- Spherical curvature of the blades in the vertical direction significantly reduces drag, prevents the blades from having "plowing effect," and reduces build up of cuttings around stand-off device.
- Spherical curvature of the blades around the circumference prevents edge of blades from embedding into formation for applications when casing is rotated.
- Blade shape and spacing of blades allows for optimum flow area around the blades of the device.
- Aluminum material prevents damage to the OD of the casing or previous casing strings, and reduces friction.
- Special high performance coating further prevents damage to casing strings and prevents galvanic corrosion. Coating also reduces tendency for cuttings to adhere to blades of device and reduces friction.
- Designed for both common and close tolerance applications.
- Utilized on applications for rotation or reciprocation.

* US Patent Pending

Davis Solid Body Flow Diverter



Solid Body Flow Diverter

The Davis Solid Body Flow Diverter (SBFD) provides a rigid means of holding casing off the well bore. With blades placed at an angle, it creates a swirling motion that promotes more cleansing action for mud removal, more circulating area, and sufficient contact with the bore wall to provide centralization and prevent wall ticking. SBFDs can be installed to remain stationary or move freely on the casing. Length of movement is determined by placement of stop devices or by couplings where applicable. In stationary positions, SBFDs will normally provide stand-off to allow circulation all around the casing string. When allowed to move freely, they serve as a series of bearings during reciprocation to reduce frictional drag.

Available in most casing/hole size configurations, the SBFDs have been successfully used to:

- Maintain centralization through positive stand-off.
- Enhance the effects of mud-wash pumped ahead of cement slurries.
- Aid in the removal of gelled mud from the annulus.
- Reduce torque required for casing rotation.
- Create a spiral turbulance around the casing to promote uniform cement bounding.

Davis Centralizer Application Analysis

Davis will, on request, run a computer analyzed program that will recommend centralizer placement and project casing stand-off. All that is required are some simple pipe and well data, including casing size, casing weight, casing seat, hole size, mud weight and, when deviation is present, full survey data, including kick-off point, rate of build and final deviation. Since centralization is most critical through the cemented interval, anticipated top of cement is also requested.

With these data, the computer can be set up to run the spacing/stand-off programs in two different modes. The first and most effective mode is "variable spacing." In this program, the relevant well data are entered and the computer calculates the number of centralizers to run, and how to space them, in order to meet whatever percent stand-off the customer desires for cement emplacement. The second mode is "constant spacing." Using the same data required for the variable spacing mode, this program calculates what stand-off can be expected when the customer rather than the computer dictates the number of centralizers to be run, and at what spacing they will be run.