

ActiveSET™ CRTi3-7.0

Specification Summary



ActiveSET™ CRTi® Internal Grip Casing Running Tool

Volant's ActiveSET™ CRTi® casing running tool is fully mechanical and designed for casing running or drilling with top drive equipped rigs to makeup, breakout, reciprocate, rotate, fill, circulate and cement casing and liner strings, reducing non-productive time and associated costs. A simple rig-up and rig-down further increases operational efficiency. The ActiveSET enhances the standard CRTi by streamlining tool activation to a single-step process by eliminating the need to manage set-down load while simultaneously rotating to the right. The tool engages by stabbing into the casing joint, allowing casing makeup to immediately begin.

The CRTi3-7.0 is available with various retrofit upgrades to improve function and performance, as well as enable a broader range of applications. The high-capacity mandrel upgrade (CRTi3-7.0HC₃₅₀) uses higher strength material to achieve an increased rated hoist capacity; the high-flow mandrel (CRTi3-7.0HF₂₄₀) has a larger through hole and a modified casing seal assembly arrangement to support higher fluid flow rate requirements for Casing while Drilling (CwD) operations. All CRTi3-7.0 tools now come standard with upgraded low-release cams that reduce the turns required to set and release the tool. All configurations are mechanically activated in tension and both rotational directions by top drive control using patented TAWG™ torque activated wedge grip.

Starting from the insertion diameter of the base tool (cage OD), selectable sizes of integral jaws/dies are used to configure the CRTi to support gripping casing of increasing internal diameter. Through the use of a patented extended reach die structure, the gripping diameter can be further increased to include casing sizes much greater than the base tool.



ActiveSET Base Tool Characteristics¹

| | | CRTi3-7.0 | CRTi3-7.0HC ₃₅₀ | CRTi3-7.0HF ₂₄₀ | |
|---|--------|---------------------------|----------------------------|----------------------------|----------------------------|
| CRTi Rated Load Capacity | Hoist | ton (tonne) | 320 (290) | 350 (317) | 240 (217) |
| | Torque | ft.lbs (N.m) | 50,000 (67,700) | 50,000 (67,700) | 39,000 (52,800) |
| Set-Down Load Capacity ² | | ton (tonne) | 100 (90) | 100 (90) | 100 (90) |
| Typical Circulation Pressure Limit ³ | | psi (MPa) | 5,000 (34.4) | 5,000 (34.4) | 5,000 (34.4) |
| Maximum Pressure End Load | | ton (tonne) | 250 (226) | 250 (226) | 190 (172) |
| Base Tool Length | | in. (mm) | 53.2 (1,355) ⁴ | 53.2 (1,355) ⁴ | 67.5 (1,715) ⁵ |
| Base Tool Weight ⁶ | | lbs (kg) | 825 (375) | 825 (375) | 820 (372) |
| Die Range | | in. (mm) | 7.0 (177.8) – 20.0 (508.0) | 7.0 (177.8) – 20.0 (508.0) | 7.0 (177.8) – 20.0 (508.0) |
| Diametrical Stroke | | in. (mm) | 0.61 (15.5) | 0.61 (15.5) | 0.61 (15.5) |
| Through Hole | | in. (mm) | 1.5 (38.1) | 1.5 (38.1) | 2.25 (57.5) |
| Maximum Flow Rate ⁷ | | gpm (m ³ /min) | 660 (2.50) | 660 (2.50) | 1,460 (5.55) |
| Maximum Rotational Speed ⁸ | | RPM | Unlimited | Unlimited | Unlimited |
| Tool Joint | | | NC50 or 6-5/8 REG | NC50 or 6-5/8 REG | NC50 or 6-5/8 REG |
| Turns to Stroke Out ⁹ | | | 1.48 / 0.72 | 1.48 / 0.72 | 1.48 / 0.72 |

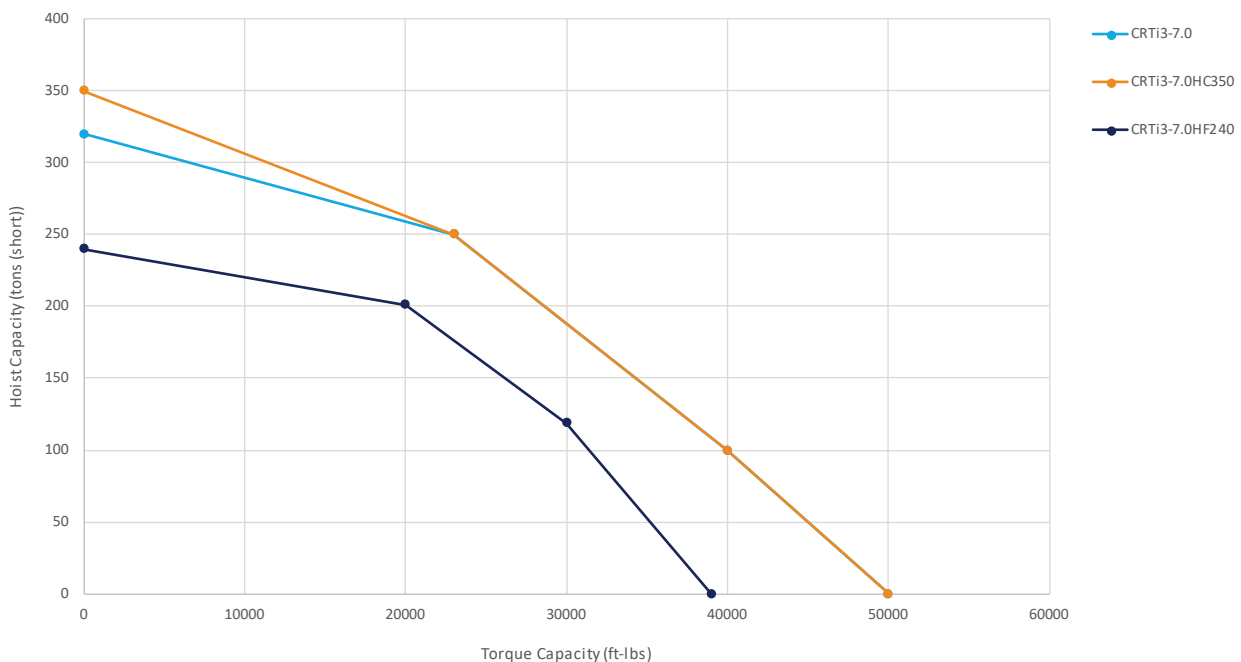


Casing Seal Assembly and Overall Tool Length

| Casing Seal Description | Seal Type | Casing Size | CRTi3-7.0 CRTi3-7.0HC350 Overall Tool Length | CRTi3-7.0HF240 Overall Tool Length ⁵ |
|-------------------------|-------------|-------------------------------|--|--|
| | | in. (mm) | in. (mm) | in. (mm) |
| Fixed Casing Seal | Packer Cup | 7.0 (177.8) | 62.5 (1,590) | - |
| | | 7.63 (193.8) | 62.3 (1,585) | - |
| | | 8.63 (219.1) | 62.5 (1,590) | - |
| | | 9.63 (244.5) | 63.1 (1,605) | - |
| | | 10.75 (273.1) | 63.5 (1,615) | - |
| | | 11.75 (298.5) | 64.6 (1,645) | - |
| | | 12.75 (323.9) - 13.38 (339.7) | 66.0 (1,680) | - |
| Swivel Casing Seal | Packer Cup | 7.0 (177.8) - 13.38 (339.7) | 64.5 (1,640) | 67.5 (1,715) |
| | | 8.63 (219.1) - 13.38 (339.7) | 67.5 (1,715) | 67.5 (1,715) |
| | Wedge Seal™ | 13.38 (339.7) - 20.0 (508.0) | 62.6 (1,595) | 67.5 (1,715) |

Combined Load Operation Curve

Please refer to the Base Tool Characteristics on page 1 of this Specification Summary for the numeric values such as CRTi Rated Load Capacity, Combined Load Large Hoist, and Combined Load High Torque illustrated in the graph below:





Tool Selection Guide

Step 1: Base Tool Selection The CRTi is available in a variety of dimensions and ratings. The Base Tool Characteristics table contains the ratings and overall dimensions of the tool. The required hoist, torque, set-down load capacity and maximum flow rate must be lower than or equal to the base tool rating. If combined hoist and torque is required for the casing running job, the combined hoist and torque point must fall below or on the combined load operation curve.

Step 2: Die Selection All API casing sizes and weights with drift diameter above 5.87 in. (149.1 mm) are available for this tool. Find the appropriate die for casing size and weight in the die table below. Some dies can run a range of casing weights.

Step 3: Die Hoist Capacity Tool hoist rating is based on API Specifications 8C; however casing load limit is further constrained by local interaction of slip dies with casing, which must not exceed the efficiency indicated for individual slip die sizes to avoid excess deformation. The slip to casing interaction hoist limit (F_{die}) can be found by the following formula where efficiency is the slip to pipe body load efficiency number (listed in the following table for every die) and F_{casing} is the casing hoist limit found in API Bulletin 5C2.

$$F_{die} = \text{efficiency} \times F_{casing}$$

For example, from API 5C2 the pipe body yield for 9.63 in. x 40.0 ppf L80 (244.5 mm x 59.53 kg/m L80) casing is 916,000 lbs (415.5 tonne). The slip efficiency for slip die 82157 used to run this casing is 75%. Therefore, the die hoist limit is:

$$75\% \times 916,000 \text{ lbs} = 687,000 \text{ lbs} = 343.5 \text{ ton}$$

or

$$75\% \times 415.5 \text{ tonne} = 311.6 \text{ tonne}$$

In case the base tool hoist rating is smaller than the calculated die hoist limit, the base tool hoist rating will be limiting.

Step 4: Die Torque Capacity

$$T_{die} = K_{torque} \times W_{casing} \times \sigma Y_{casing}$$

Where T_{die} is the torque limit due to slip die/casing interaction,

K_{torque} is the torque factor,

W_{casing} is the desired casing weight in ppf (kg/m), and

σY_{casing} is the casing yield strength in psi (MPa)

If no value is provided, tool rating will be limiting for all standard casing grades. For example, for die 82157 to run 9.63 in. x 40.0 ppf L80 (244.5 mm x 59.53 kg/m L80) casing, the die torque limit is:

$$0.01587 \text{ ft.lbs/psi/ppf} \times 40.0 \text{ ppf} \times 80,000 \text{ psi} = 50,784 \text{ ft.lbs}$$

or

$$2.097 \text{ N.m/MPa/(kg/m)} \times 59.53 \text{ kg/m} \times 551.6 \text{ MPa} = 68,858 \text{ N.m}$$

Where the base tool torque capacity is lower than the die torque capacity, the tool is limited to base tool torque capacity.

Step 5: Effect of Circulation Pressure

CRTi hoist capacity must be reduced by the pressure end load during circulation. The hoist reduction ($F_{EndPressure}$) depends on circulation pressure (P), casing nominal ID (ID_{casing}) and CRTi through hole ($ID_{mandrel}$).

$$F_{EndPressure} = 0.79 \times P \times (ID_{casing}^2 - ID_{mandrel}^2)$$

For example, for circulation pressure of 1,000 psi (6.89 MPa) and casing nominal ID of 8.84 in (224.5 mm) the hoist reduction is:

$$0.79 \times 1,000 \text{ psi} \times ((8.84 \text{ in.})^2 - (1.5 \text{ in.})^2) = 59,958 \text{ lbs} \sim 30.0 \text{ ton}$$

or

$$0.79 \times 6.89 \text{ MPa} \times ((224.5 \text{ mm})^2 - (38.1 \text{ mm})^2) = 266,432 \text{ N} \sim 27.2 \text{ tonne}$$

Therefore, the maximum hoist for the standard CRTi3-7.0 tool reduces to 320.0- 30.0 = 290.0 ton (262.8 tonne) or the maximum hoist for die 82157 (in step 3) must reduce to 343.5- 30.0 = 313.5 ton (284.4 tonne).

Please contact Volant for further information.





Summary of Selected Die Sizes¹⁰

| Die P/N | Nominal Pipe Size | | CRTi3-7.0 CRTi3-7.0HC350 CRTi3-7.0HF240 Max. Pipe Weight ¹¹ (W _{casing}) | | CRTi3-7.0HC350 Min. Pipe Weight ¹² (W _{casing}) | | CRTi3-7.0 CRTi3-7.0HF240 Min. Pipe Weight ¹² (W _{casing}) | | Slip to Pipe Body Load Efficiency | Torque Factor (K _{torque}) | |
|----------------------|-------------------|-------|---|--------|--|--------|---|--------|-----------------------------------|--------------------------------------|------------------|
| | (in.) | (mm) | (ppf) | (kg/m) | (ppf) | (kg/m) | (ppf) | (kg/m) | (% Fy) | (ft.lbs/psi/ppf) | (N.m/MPa/(kg/m)) |
| 80928 | 7.0 | 177.8 | 26.0 | 38.69 | 17.0 | 25.30 | 17.0 | 25.30 | 77% | 0.01643 | 2.171 |
| 104759 | 7.0 | 177.8 | 32.0 | 47.62 | 26.0 | 38.69 | 23.0 | 34.23 | 80% | 0.01822 | 2.408 |
| 81062 | 7.0 | 177.8 | 35.0 | 52.09 | 29.0 | 43.16 | 26.0 | 38.69 | 80% | 0.01899 | 2.509 |
| 105854 ¹³ | 7.0 | 177.8 | 42.7 | 63.54 | 38.0 | 56.60 | 38.0 | 56.60 | 80% | 0.02094 | 2.767 |
| 80986 | 7.63 | 193.7 | 33.7 | 50.15 | 26.0 | 38.69 | 24.0 | 35.72 | 71% | 0.01512 | 1.998 |
| 82279 | 7.63 | 193.7 | 39.0 | 58.04 | 33.7 | 50.15 | 29.7 | 44.20 | 76% | 0.01632 | 2.156 |
| 80987 | 8.63 | 219.1 | 32.0 | 47.62 | 24.0 | 35.72 | 24.0 | 35.72 | 80% | 0.01744 | 2.304 |
| 80824 | 8.63 | 219.1 | 36.0 | 53.57 | 28.0 | 41.67 | 28.0 | 41.67 | 80% | 0.01744 | 2.304 |
| 82118 | 9.63 | 244.5 | 36.0 | 53.57 | 32.3 | 48.07 | 32.3 | 48.07 | 73% | 0.0153 | 2.021 |
| 82749 | 9.63 | 244.5 | 40.0 | 59.53 | 36.0 | 53.57 | 32.3 | 48.07 | 73% | 0.01235 | 1.631 |
| 80825 | 9.63 | 244.5 | 43.5 | 64.74 | 40.0 | 59.53 | 36.0 | 53.57 | 74% | 0.01561 | 2.062 |
| 82157 | 9.63 | 244.5 | 47.0 | 69.94 | 43.5 | 64.74 | 40.0 | 59.53 | 75% | 0.01587 | 2.097 |
| 80988 | 9.63 | 244.5 | 53.5 | 79.62 | 53.5 | 79.62 | 47.0 | 69.94 | 76% | 0.01628 | 2.151 |
| 82021 | 10.75 | 273.1 | 40.5 | 60.27 | 32.8 | 48.81 | 32.8 | 48.81 | 63% | 0.01296 | 1.712 |
| 102335 | 10.75 | 273.1 | 45.5 | 67.71 | 40.5 | 60.27 | 35.8 | 53.28 | 63% | 0.01331 | 1.759 |
| 81323 | 10.75 | 273.1 | 51.0 | 75.90 | 45.5 | 67.71 | 45.5 | 67.71 | 66% | 0.01386 | 1.831 |
| 81085 | 10.75 | 273.1 | 60.7 | 90.33 | 55.5 | 82.59 | 55.5 | 82.59 | 68% | 0.01429 | 1.888 |
| 104435 | 10.75 | 273.1 | 65.7 | 97.77 | 60.7 | 90.33 | 60.7 | 90.33 | 69% | 0.01447 | 1.913 |
| 81955 | 11.75 | 298.5 | 47.0 | 69.94 | 42.0 | 62.50 | 42.0 | 62.50 | 55% | 0.01141 | 1.507 |
| 80833 | 11.75 | 298.5 | 54.0 | 80.36 | 47.0 | 69.94 | 47.0 | 69.94 | 56% | 0.01171 | 1.547 |
| 82070 | 11.75 | 298.5 | 60.0 | 89.29 | 54.0 | 80.36 | 54.0 | 80.36 | 58% | 0.01198 | 1.583 |
| 83052 | 12.75 | 323.9 | 52.0 | 77.38 | 47.1 | 70.09 | 47.1 | 70.09 | 51% | 0.01088 | 1.437 |
| 83002 | 12.75 | 323.9 | 58.4 | 86.91 | 50.0 | 74.41 | 50.0 | 74.41 | 51% | 0.01098 | 1.450 |
| 82327 | 13.38 | 339.7 | 54.5 | 81.10 | 48.0 | 71.43 | 48.0 | 71.43 | 45% | 0.00934 | 1.234 |
| 80828 | 13.38 | 339.7 | 61.0 | 90.78 | 61.0 | 90.78 | 54.5 | 81.10 | 47% | 0.00977 | 1.291 |
| 81064 | 13.38 | 339.7 | 72.0 | 107.15 | 68.0 | 101.20 | 68.0 | 101.20 | 49% | 0.01033 | 1.366 |
| 81504 | 15.0 | 381.0 | 92.5 | 137.66 | 92.5 | 137.66 | 92.5 | 137.66 | 45% | 0.00949 | 1.254 |
| 80826 | 16.0 | 406.4 | 65.0 | 96.73 | 65.0 | 96.73 | 65.0 | 96.73 | 25% | 0.00545 | 0.72 |
| 82440 | 16.0 | 406.4 | 75.0 | 111.61 | 75.0 | 111.61 | 75.0 | 111.61 | 27% | 0.00593 | 0.783 |
| 100078 | 16.0 | 406.4 | 84.0 | 125.01 | 84.0 | 125.01 | 84.0 | 125.01 | 29% | 0.0063 | 0.832 |





Summary of Selected Die Sizes¹⁰ (continued)

| Die P/N | Nominal Pipe Size | | CRTi3-7.0 CRTi3-7.0HC350 CRTi3-7.0HF240 Max. Pipe Weight ¹¹ (W _{casing}) | | CRTi3-7.0HC350 Min. Pipe Weight ¹² (W _{casing}) | | CRTi3-7.0 CRTi3-7.0HF240 Min. Pipe Weight ¹² (W _{casing}) | | Slip to Pipe Body Load Efficiency | Torque Factor (K _{torque}) | |
|----------------------|-------------------|-------|---|--------|--|--------|---|--------|-----------------------------------|--------------------------------------|------------------|
| | (in.) | (mm) | (ppf) | (kg/m) | (ppf) | (kg/m) | (ppf) | (kg/m) | (% Fy) | (ft.lbs/psi/ppf) | (N.m/MPa/(kg/m)) |
| 100079 | 16.0 | 406.4 | 109.0 | 162.21 | 109.0 | 162.21 | 109.0 | 162.21 | 33% | 0.00715 | 0.944 |
| 83003 | 16.77 | 426.0 | 77.0 | 114.59 | 77.0 | 114.59 | 73.3 | 109.08 | 24% | 0.00568 | 0.75 |
| 80832 ¹⁴ | 18.63 | 473.1 | 87.5 | 130.21 | 87.5 | 130.21 | 87.5 | 130.21 | 22% | 0.00489 | 0.646 |
| 81292 ¹⁴ | 18.63 | 473.1 | 97.7 | 145.39 | 97.7 | 145.39 | 97.7 | 145.39 | 25% | 0.00659 | 0.87 |
| 82956 ¹⁴ | 18.63 | 473.1 | 106.0 | 157.75 | 106.0 | 157.75 | 106.0 | 157.75 | 26% | 0.00683 | 0.902 |
| 81293 ¹⁴ | 18.63 | 473.1 | 111.0 | 165.19 | 111.0 | 165.19 | 111.0 | 165.19 | 27% | 0.00669 | 0.884 |
| 101407 ¹⁴ | 18.63 | 473.1 | 115.0 | 171.14 | 115.0 | 171.14 | 115.0 | 171.14 | 25% | 0.00567 | 0.749 |
| 81991 ¹⁴ | 20.0 | 508.0 | 94.0 | 139.89 | 94.0 | 139.89 | 94.0 | 139.89 | 27% | 0.00591 | 0.780 |
| 81799 ¹⁴ | 20.0 | 508.0 | 111.0 | 165.19 | 111.0 | 165.19 | 111.0 | 165.19 | 27% | 0.00603 | 0.796 |

- Characteristics are based on standard tool components and are independent of specific limitations of cage and accessories.
- Maximum allowable set-down load applied to the tool. Some set-down load may be reacted through the coupling. This rating does not take into account bearing load limitations of the coupling.
- CRTi tool circulation pressure capacity is generally governed by packer cup pressure capacity. Pressure capacity may be less than indicated if alternative seal arrangements are used.
- CRTi3-7.0 and CRTi3-7.0HC350 base tool length does not include casing seal assembly. To find overall tool length see *Casing Seal Assembly and Overall Tool Length* table.
- CRTi3-7.0HF240 base tool length does not change with casing seal assembly, base tool length is the same as overall tool length. Fixed Casing Seal is not available with this tool model.
- Tool weight is approximate and represents 7.0 in. base tool with ActiveSET configuration. Contact Volant sales for further information on tool weight at +1 780.784.7099
- Maximum flow rate is based on minimizing erosion rates when using typical fluids. Erosion rates may vary depending upon the fluid contents. Please inspect tool bore regularly.
- When rotating a casing/liner string during running/drilling operations, maximum rotational speeds are governed by top drive or casing connection specific limits.
- Turns to Stoke Out is the rotational limit during tool makeup (this may be exceeded in combined load scenarios). The old style cams require 1.48 turns to stroke out and low-release cams only require 0.72 turns to stroke out.
- Common die sizes shown. All API casing sizes and weights with drift diameter above 5.87 in. (149.1 mm) are available.
- Maximum pipe weight is defined by the API Specification 5CT drift diameter of the heaviest weight casing into which the CRTi tool assembled with the specified die set will fit.
- Indicated minimum pipe weight is based on the assumption that control of average pipe inside diameter over die grip interval does not allow pipe body area reduction less than 3.5% from nominal and additionally takes into account tool wear allowances, die penetration, casing deformation and diametrical stroke.
- Cage (P/N: 105853) must be run in conjunction with Keeper (P/N: 83001) and Integral Slips (P/N: 105854) to enable running 7.0 in. 38.0- 42.7ppf casing, with a reduced torque capacity of 35,000 ft.lbs. All other CRTi3-7.0 Integral Slips and Dies can be run with Cage (P/N: 105853) with a reduced torque capacity of 35,000 ft.lbs.
- Hoist limited to 320 tons (290 tonne).

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