# VOLANT Casing Running Tools (CRTi1-10.75)

## CRTi® Internal Grip Casing Running Tool

Volant's CRTi casing running tool is 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. Casing drilling is achieved through the standard tool configuration, but if increased flow is desired, Volant's Highflow[1] option features a larger through hole for additional fluid flow. This tool is mechanically activated in tension and both rotational directions solely by top drive control using TAWG® wedge grip technology.

This patented architecture puts control in the hands of the driller, reducing the need for third party support to run casing. Intuitive operations for pipe engagement and release closely emulate the familiar make and break steps used to run drill pipe – stab, rotate to the right to engage and reverse to disengage. Similarly, rig in and rig out steps are simple, intuitive and efficient.

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.

## Tool Model: CRTi1-10.75 Specification Summary

### Base Tool Characteristics[2]

| | | | |
|---|---|---|---|
| CRTi Rated Load Capacity | Hoist | ton (tonne) | 1,250 (1,133) |
| | Torque | ft.lbs (N.m) | 125,000 (169,400) |
| Combined Load Large Hoist | Hoist | ton (tonne) | 1,200 (1,088) |
| | Torque | ft.lbs (N.m) | 80,000 (108,400) |
| Combined Load High Torque | Hoist | ton (tonne) | 1,110 (1,006) |
| | Torque | ft.lbs (N.m) | 125,000 (169,400) |
| Set-Down Load Capacity[3] | | ton (tonne) | 100 (90) |
| Typical Circulation Pressure Limit[4] | | psi (MPa) | 5,000 (34.4) |
| Maximum Pressure End Load | | ton (tonne) | 750 (680) |
| Base Tool Length[5] | | in (mm) | 80.4 (2,045) |
| Base Tool Weight[6] | | lbs (kg) | 1,951 (890) |
| Diametrical Stroke | | in (mm) | 1.0 (25.4) |
| Through Hole | | in (mm) | 2.25 (57.2) |
| Maximum Flow Rate[7] | | gpm ($m^3$/min) | 1,450 (5.50) |
| Tool Joint | | | 8.63 REG |
| Turns to Stroke Out | | | 0.62 |

Tool Configuration with

Integral Slip Dies

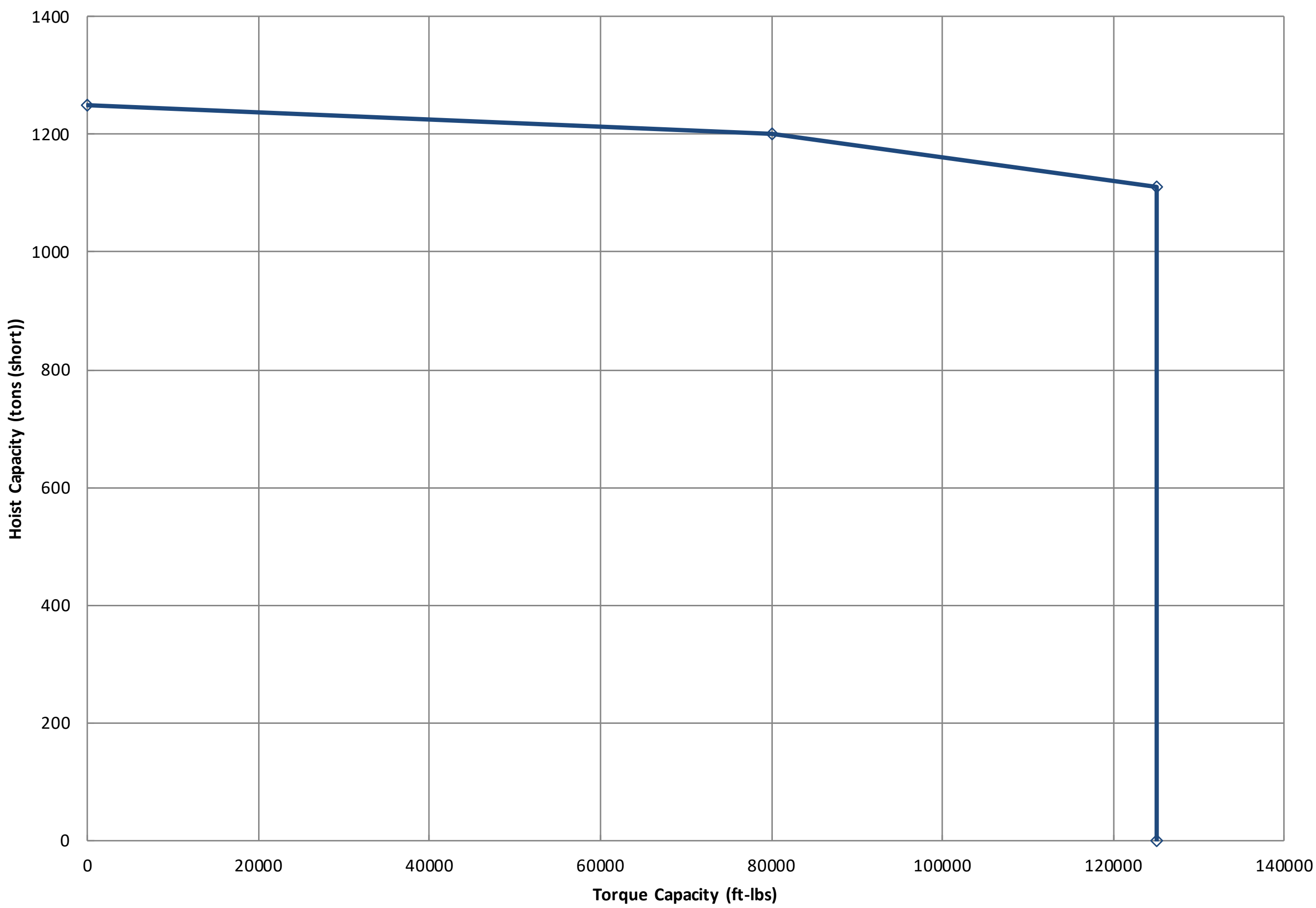
## Tool Model: CRTi1-10.75 Specification Summary

**Casing Seal Assembly and Tool Length**

| Casing Seal Description | Seal Type | Casing Size in (mm) | Overall Tool Length in (mm) |
|---|---|---|---|
| Swivel Casing Seal | Packer Cup | 10.75 (273.1) - 13.38 (339.7) | 93.4 (2,372) |
| | Wedge Seal | 16.0 (406.4) - 26.0 (660.4) | 89.9 (2,283) |

## Combined Load Operation Curve

Please refer to the Base Tool Characteristics on page 1 of this Specification Summary for 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 9.13 in (231.8 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.

$F_{die}$ = efficiency x $F_{casing}$

For example, from API 5C2 the pipe body yield for 16.0 in x 84.0 ppf J55 (406.4 mm x 125.0 kg/m J55) casing is 1,326,000 lbs (601.4 tonne). The slip efficiency for slip die 104422 used to run this casing is 80%. Therefore, the die hoist limit is:

80% × 1,326,000 lbs = 1,060,800 lbs = 530.4 ton

or

80% × 601.4 tonne = 481.1 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
$\sigma Y_{casing}$ 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 104422 to run 16.0 in x 84.0 ppf J55 (406.4 mm x 125.0 kg/m J55) casing, the die torque limit is:

0.03257 ft.lbs/psi/ppf × 84.0 ppf × 55,000 psi = 150,473 ft.lbs

or

4.3037 N.m/MPa/(kg/m) × 125.0 kg/m × 379.2 MPa = 203,995 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 ($ID_{mandrel}$).

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

For example, for circulation pressure of 500 psi (3.45 MPa) and casing nominal ID of 15.01 in (381.3 mm) the hoist reduction is:

0.79 × 500 psi × ((15.01 in)$^2$ - (2.25 in)$^2$) = 86,994 lbs ~ 43.5 ton

or

0.79 × 3.45 MPa × ((381.3 mm)$^2$ - (57.15 mm)$^2$) = 387,358 N ~ 39.5 tonne.

Therefore, the maximum hoist for this tool reduces to 1,250.0 - 43.5 = 1,206.5 ton (1,094.6 tonne) or the maximum hoist for die 104422 (in step 3) must reduce to 530.4 - 43.5 = 486.9 ton (441.7 tonne).

Please contact Volant for further information.

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## Summary of Selected Die Sizes[8]

| Die P/N | Nominal Pipe Size | | Max. Pipe Weight[9] ($W_{casing}$) | | Min. Pipe Weight[10] ($W_{casing}$) | | Max. Tool Diameter | | Approximate Tool Weight | | Slip to Pipe Body Load Efficiency | Torque Factor ($K_{torque}$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (in) | (mm) | (ppf) | (kg/m) | (ppf) | (kg/m) | (in) | (mm) | (lbs) | (kg) | (% Fy) | (ft.lbs/psi/ ppf) | (N.m/MPa/ (kg/m)) |
| 104432 | 10.75 | 273.1 | 55.5 | 82.59 | 32.8 | 48.83 | 20.0 | 508 | 2,109 | 960 | 80% | 0.04444 | 5.872 |
| 104267 | 10.75 | 273.1 | 79.2 | 117.86 | 55.5 | 82.59 | 20.0 | 508 | 2,100 | 955 | 80% | 0.05066 | 6.694 |
| 104433 | 11.75 | 298.5 | 71.0 | 105.66 | 42.0 | 62.50 | 20.0 | 508 | 2,215 | 1,010 | 80% | 0.04589 | 6.063 |
| 104434 | 11.75 | 298.5 | 94.0 | 139.89 | 71.0 | 105.66 | 20.0 | 508 | 2,180 | 990 | 80% | - | - |
| 104498 | 12.75 | 323.9 | 58.4 | 86.88 | 47.1 | 70.09 | 20.0 | 508 | 2,445 | 1,110 | 80% | 0.04257 | 5.625 |
| 101955 | 13.38 | 339.7 | 72.0 | 107.15 | 48.0 | 71.43 | 20.0 | 508 | 2,490 | 1,130 | 80% | 0.03748 | 4.952 |
| 104422 | 16.0 | 406.4 | 97.0 | 144.35 | 65.0 | 96.73 | 20.0 | 508 | 2,826 | 1,290 | 80% | 0.03257 | 4.303 |
| 104542 | 16.0 | 406.4 | 129.5 | 192.72 | 97.0 | 144.35 | 20.0 | 508 | 2,765 | 1,260 | 80% | - | - |
| 104423 | 16.77 | 426.0 | 83.7 | 124.56 | 69.4 | 103.28 | 20.0 | 508 | 2,970 | 1,350 | 80% | 0.03146 | 4.157 |
| 104424 | 18.0 | 457.2 | 129.0 | 191.97 | 117.0 | 174.12 | 20.0 | 508 | 3,070 | 1.400 | 79% | - | - |
| 104421 | 18.63 | 473.1 | 117.0 | 174.12 | 87.5 | 130.21 | 20.0 | 508 | 3,341 | 1,520 | 79% | 0.02867 | 3.788 |
| 104425 | 18.63 | 473.1 | 139.0 | 206.85 | 106.0 | 157.75 | 20.0 | 508 | 3,290 | 1,500 | 80% | - | - |
| 104426 | 20.0 | 508.0 | 129.3 | 192.42 | 94.0 | 139.89 | 20.0 | 508 | 3,578 | 1,630 | 70% | 0.02541 | 3.357 |
| 104494 | 20.0 | 508.0 | 147.0 | 218.76 | 118.0 | 175.60 | 20.0 | 508 | 3,500 | 1,590 | 73% | - | - |
| 104427 | 20.0 | 508.0 | 166.6 | 247.93 | 147.0 | 218.76 | 20.0 | 508 | 3,900 | 1,770 | 75% | - | - |
| 104428 | 22.0 | 558.8 | 184.5 | 274.57 | 180.0 | 267.87 | 20.0 | 508 | 3,810 | 1,730 | 72% | - | - |
| 104429 | 22.0 | 558.8 | 228.8 | 340.49 | 228.8 | 340.49 | 32.0 | 813 | 4,355 | 1,980 | 73% | - | - |
| 102736 | 24.0 | 609.6 | 201.0 | 299.12 | 176.0 | 261.92 | 32.0 | 813 | 4,830 | 2,200 | 62% | - | - |
| 104430 | 26.0 | 660.4 | 219.0 | 325.91 | 201.3 | 299.57 | 32.0 | 813 | 5,315 | 2,420 | 58% | - | - |
| 104431 | 28.0 | 711.2 | 222.7 | 331.41 | 218.5 | 325.16 | 32.0 | 813 | 5,316 | 2,425 | 51% | - | - |

1. For details and availability on the Highflow option contact Volant sales at +1 780.784.7099
2. Characteristics are based on design objective of the standard tool components and are independent of specific limitations of cage and accessories.
3. 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.
4. 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.
5. Base tool length does not include casing seal assembly. Overall tool length depends on the casing seal arrangement.
6. Tool weight is approximate and represents 10.75" base tool configuration. Contact Volant sales for further information on tool weight at +1 780.784.7099
7. 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.
8. Common die sizes shown. All API casing sizes and weights with drift diameter above 9.13 in (231.8 mm) are available.
9. 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.
10. 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.



**Give us a problem.** Or just drop us a line if you want to know more.

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ISO 9001 Quality

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