A) DESCRIPTION

The DLH Packer is a hydraulic-set single-string retrievable packer and may be used in virtually any production application. Tubing pump pressure is used to set the packer and the setting force is locked into the packer by a body lock ring. A large internal by-pass reduces swabbing when running and retrieving. The by-pass closes when the packer is set and opens during the releasing process to allow pressure equalization. Shear screws are used to control the packer release.

These illustrations are designed to help gain a better understanding of how the DLH Packer functions as it is set and released. Please keep in mind the actions in these technical illustrations are shown in SUPER SLOW motion. Actual setting and releasing sequences occur RAPIDLY

NOTE$_1$: O-rings not shown in illustrations.

NOTE$_2$: DLH Packer shown in: 7” casing (26.0#/Ft). Refer to tech manual per size, connection, and casing weight for part descriptions.

NOTE$_3$: Refer to SETTING PROCEDURES (in tech manual) prior to SETTING SEQUENCE.

B) SETTING

B-1) SETTING SEQUENCE

B-1.1) Run DLH Packer downhole to a pre-determined depth (Fig. 1). Temporarily plugs work string below.

NOTE$_5$: By-pass valve is open (Fig. 1a) allowing any fluid and debris in annulus to by-pass flowing over elements. Arrows represent fluid flow path through by-pass valve (Fig. 1a, Fig. 1b) allowing pressure to equalize.

NOTE$_6$: Initiating shears screws are not sheared at this time (Fig. 1c).

B-1.2) Apply pressure to work string to initiate setting (pressure gauge is reference only - refer to tech manual for required PSI). Fluid in work string (blue) fills space between setting sleeve and lower cone (Fig. 2B). Once pressure (PSI) in work string becomes greater than force required to initiate setting, shear screws connecting setting sleeve to lower cone are sheared (Fig. 2b) and the following happens:

B-1.2.1) Setting chamber, lower cone, chamber cap, and lock ring move downwards (Fig. 2b).

B-1.2.2) Setting sleeve, rubber mandrel, bonded seal, upper cone, etc. move upwards (Fig. 2b).

B-1.2.3) By-pass valve closes (bonded seal contacts valve piston) preventing fluid in annulus to flow thru packer (Fig. 2a).

B-1.3) As pressure increases in work string, fluid (blue) in work string occupies space between setting sleeve and lower cone (Fig. 3C) - the following happens:

B-1.3.1) Upper cone activates upper slips (Fig. 3a).

B-1.3.2) By-pass valve is fully closed and sealed (Fig. 3b).

B-1.3.3) Lower cone activates lower slips (Fig. 3c).

B-1.4) As pressure increases in work string…

B-1.4.1) Elements are packed off (Fig. 3d, Fig. 4a).

B-1.4.2) Shears shear screws connecting setting sleeve to rubber mandrel (Fig. 4b).

B-1.4.3) Setting sleeve moves upward (Fig. 4d) - setting force is held mechanically by lock ring (Fig. 4c).

B-2) SETTING SEQUENCE IMAGES

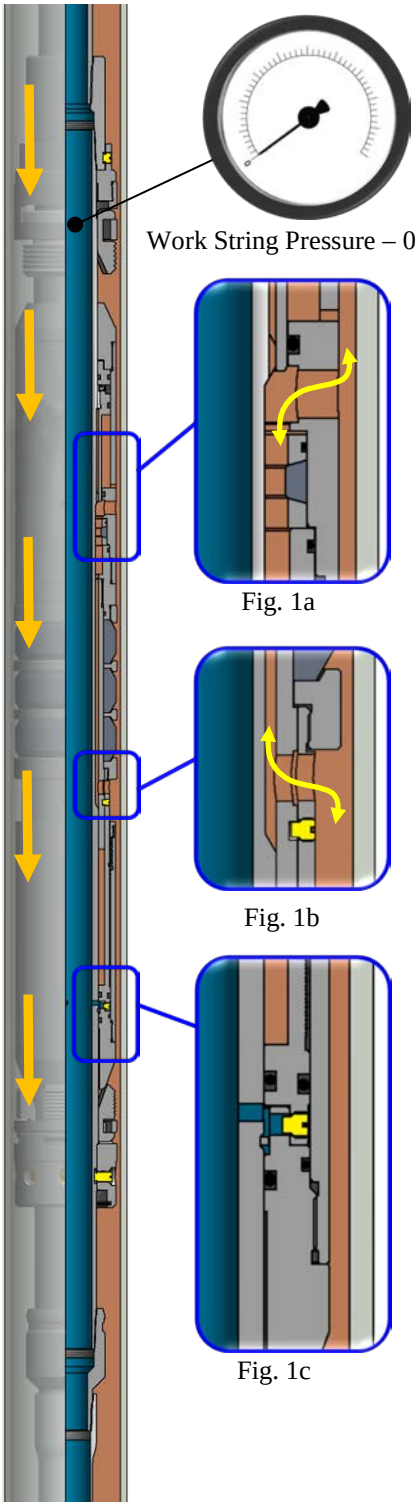

Fig. 1a

Fig. 1b

Fig. 1c

Fig. 1

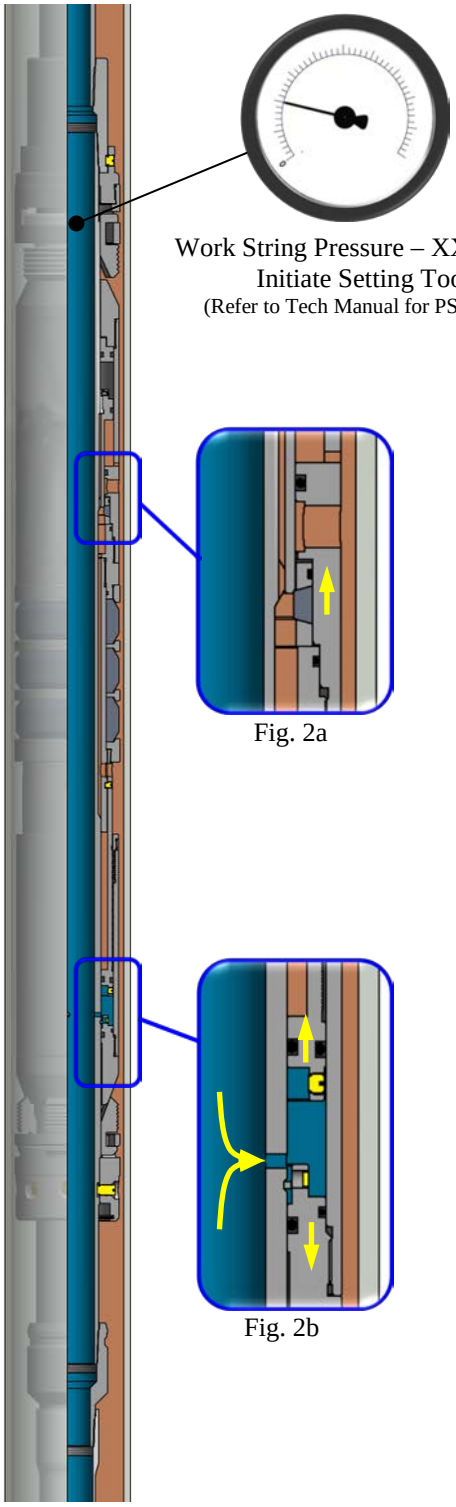

Fig. 2a

Fig. 2b

Fig. 2

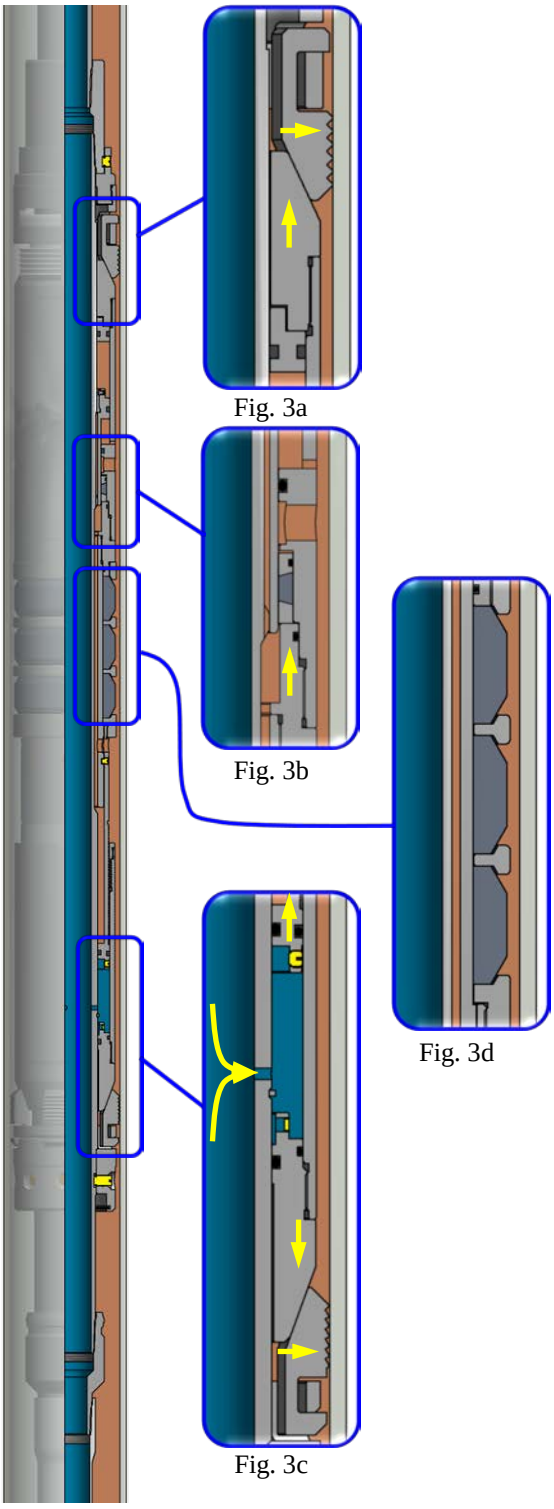

Fig. 3a

Fig. 3b

Fig. 3d

Fig. 3c

Fig. 3

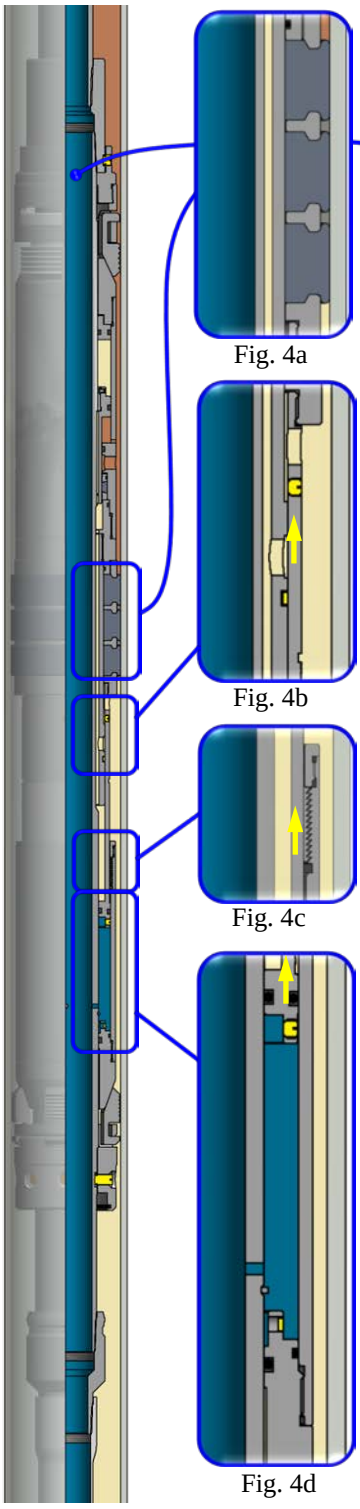

Fig. 4a

Work String Pressure – XXXX PSI
Recommended Setting Pressure
(Refer to Tech Manual for PSI value)

Fig. 4b

Fig. 4c

Fig. 4d

Fig. 4

C) RELEASE

C-1) RELEASING SEQUENCE

C-1.1) DLH Packer 7” (26.0#) casing - packer is set (Fig. 5).

C-1.2) Pull tension (pick up) on work string (and inner mandrel) (Fig. 6) to:

C-1.2.1) Shear the shear screws connecting top sub to upper slip support (Fig. 6a).

C-1.2.2) Shear the shear screws connecting lower slip body to inner mandrel (Fig. 6c).

C-1.2.3) Open by-pass valve – wait a few minutes allowing annulus pressure and work string pressure to equalize (Fig. 6b, Fig. 7c).

C-1.2.4) Shoulder on inner mandrel contacts upper slip support (Fig. 6a, Fig. 7a).

C-1.2.5) Release upper slips (Fig. 7b, Fig. 8a).

C-1.2.6) Elements relax (Fig. 7d, Fig. 8b). Wait ten (10) minutes minimum for elements to relax before pulling DLH Packer out of hole (Fig. 8b).

C-1.2.7) Release lower slips (Fig. 8c, Fig. 9a).

C-1.2.8) Bottom sub is pulled into lower slip body. An internal ring in the lower slip body snaps into a groove on bottom sub (Fig. 8d, Fig. 9b).

C-1.3) Pull DLH Packer from the hole (Fig. 10).

C-1.4) RELEASING SEQUENCE IMAGES

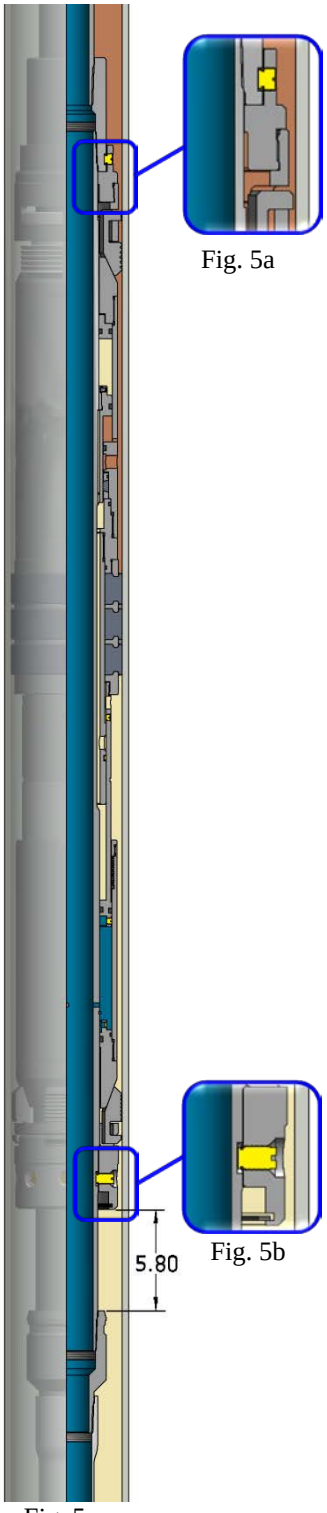

Fig. 5a

Fig. 5b

Fig. 5

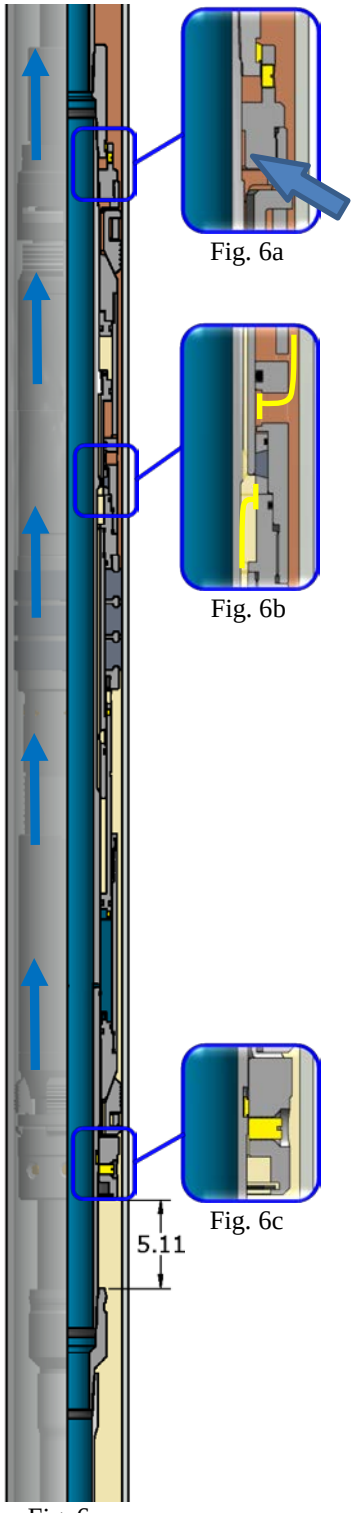

Fig. 6a

Fig. 6b

Fig. 6c

Fig. 6

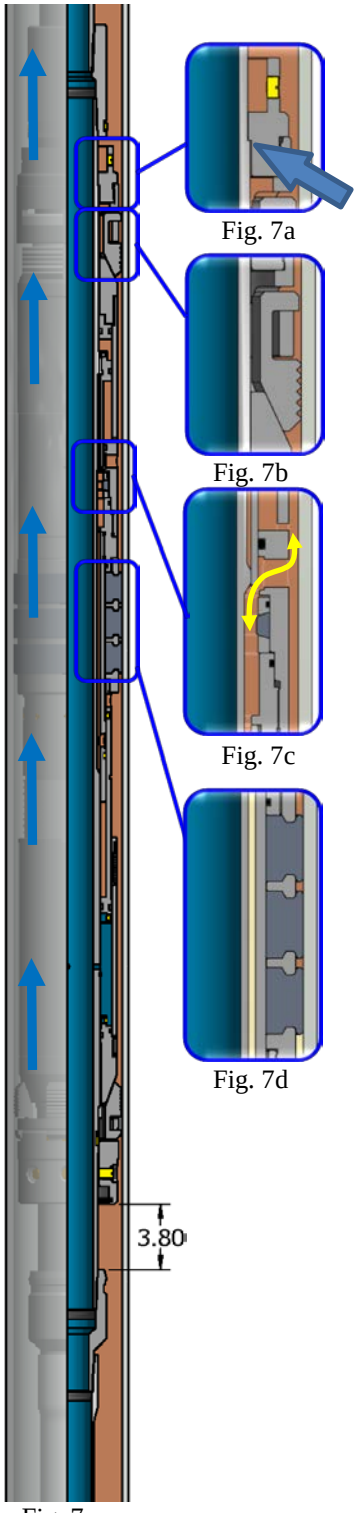

Fig. 7a

Fig. 7b

Fig. 7c

Fig. 7d

Fig. 7

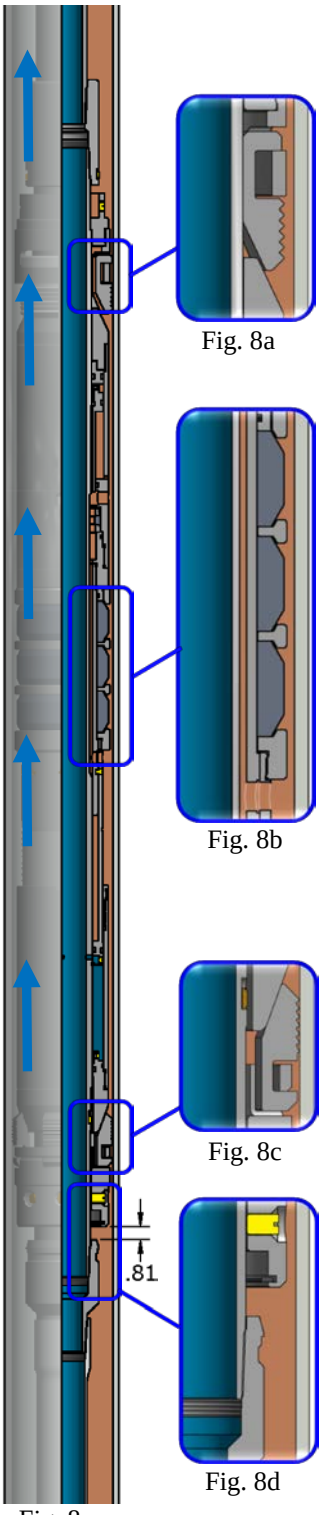

Fig. 8a

Fig. 8b

Fig. 8c

Fig. 8d

Fig. 8

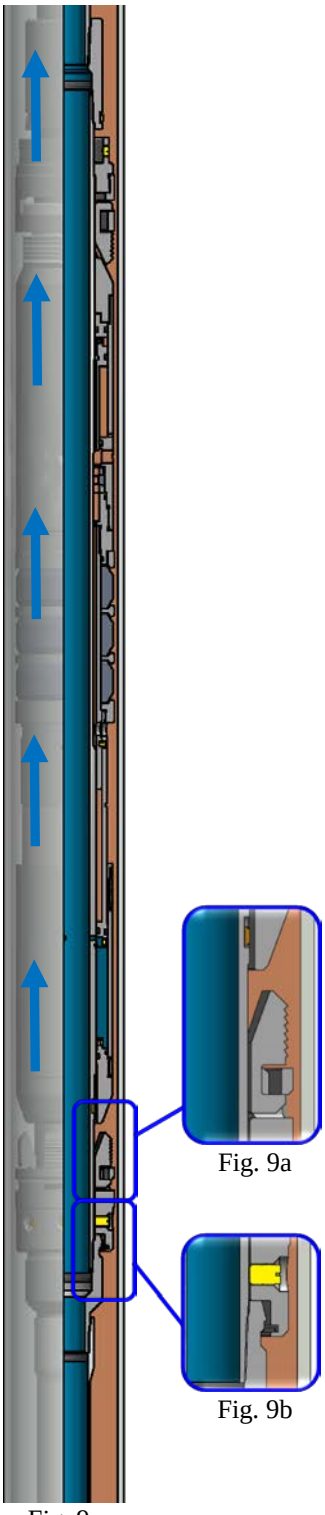

Fig. 9a

Fig. 9b

Fig. 9

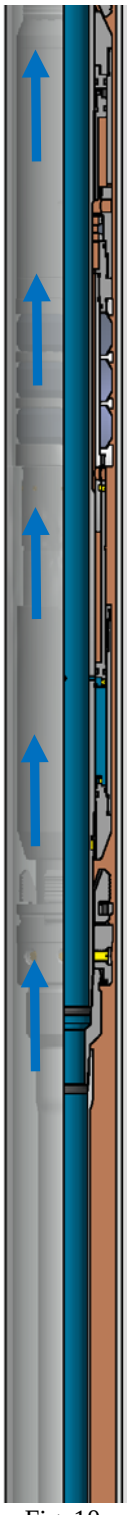

Fig. 10

D) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
10/06/2015	A	Created new document;	-	-