

Addendum to EDMS document 1392936 “Instruction Manual for inserting the CMS ZDCs using the HXTC crane”

In addition to the ZDC detectors in the TAN instrument slot at Pt5, this slot also contains a Beam Radiation Monitor (BRAN). The HXTC crane is used in exactly the same manner as with the ZDC to remove and insert the BRAN between the TAN slot and an external Shielding Sarcophage. The procedural steps and times for the lifting of the BRAN with the HXTC crane are identical to those of the ZDC (described in EDMS 1392936).

The only procedures unique to the BRAN are the use of a dedicated fixture for attaching The BRAN to the Crane, and the procedures for emergency removal of the BRAN in case Of HXTC crane failure. These procedures are outlined in this document.

The BRAN has a mass of ~45 kg, and presents only ~ 10% of the crane’s tested operating Capacity.



BRAN installed in TAN alongside ZDC detectors on 56 side of Pt5

BRAN FIXTURE. The bran fixture is a 2 piece system: the upper Assembly is bolted to the crane, the lower is bolted to the BRAN Lifting point.

BRAN lifting Point: accepts M8 bolt



BRAN Fixture lower assembly Shown bolted to model BRAN

BRAN Fixture Upper Assembly Mounted on Crane



BRAN fixture assembly mated With 6mm pin

The Technical Reference for the BRAN fixture is found at:

http://newton.physics.uiowa.edu/~pdebbins/CMS_ZDC_Crane_Documents_Archive_2014/BRAN_Documents/

To lift the BRAN the following steps are performed:

1. Affix the lower fixture element to the BRAN (M8 x 25 bolt), either in TAN or Sarcophage (2 minutes)
2. Bring the Sarcophage into position alongside the TAN (5 minutes).
3. Lower the crane carrier beam to mate the upper fixture element with the lower (5 minutes).
4. Pin the elements together (1 minute).
5. Perform the crane operations identically to the ZDC, either moving BRAN from TAN to Sarco or Sarco to TAN (15 minutes).
6. Remove the lower fixture from the BRAN (2 minutes)

These, very conservative, time estimates are based on tests with BRAN mock-up on the real TAN and crane.



Sarcophage shown placed
With alignment marks on LHC
Tunnel floor.



Lifting of BRAN (model) with HXTC Crane
And BRAN fixture.

Risk Analysis

The weight of BRAN represents only 10% of the working capacity of the crane, so the probability of malfunctioning is considerably lower than the already low probability Studied for ZDC case.

The only possible problem that can be foreseen is an event of crane failure, where the load remains stuck between the TAN and the Sarcophage. In that case we foresee similar recovery steps as utilized for the BRAN located at IP1.

The IP5 BRAN Fixture lower assembly, which is attached to the BRAN during Lifting operations provides for attachment of flexible slings and rigid handles 250mm In length. These allow for the hand lifting by two persons of the BRAN, unpinning of the Fixture, and placement of the BRAN in the best location given the current position of the System (either into the TAN slot or to the sarcophage). If required, a spare empty sarcophage is located in the ZDC bunkers at Pt5.

Recovery procedure:

In case of a problem with the crane the recovery procedure will be supervised by the radioprotection team to ensure respect of ALARA principles. If required, a mobile shielding panel can be provided by CMS technical team in order to further protect the operators.

There are two possible ways to remove the BRAN depending on where in the possible trajectory it got stuck:

1. Eyelets attached at the end of the bar on the top of BRAN can be used to fix lifting straps that then can be used to lift BRAN either directly by hand or by use of a cross bar. This is the preferred option as it can be done in any position of the BRAN and requires only threading the strap through already existing eyelets.

2. Depending upon the location of the BRAN relative to the TAN, 1 or 2 lifting bars can be screwed rapidly onto the bar on top of the BRAN. These provide a rigid handle for additional capability to maneuver the BRAN. In any case 1 bar can always be attached.

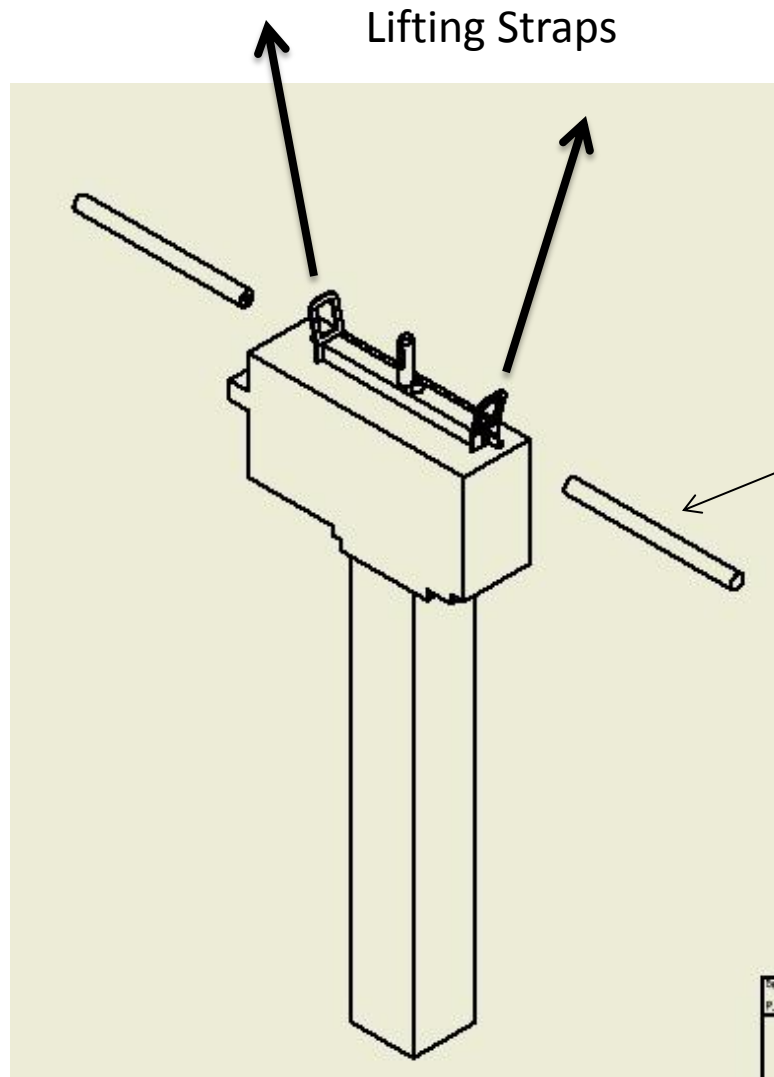
Breakdown of time required for each operation as measured during tests with a mock-up:

1. Bringing of the lifting handles and straps from storage in ZDC bunker (3 minutes)
2. Slings of straps through eyelets and/or bolting of the handles in place (2 minutes)
3. Lifting the BRAN and disconnection from the crane (1 minute)
4. Move of the BRAN either into TAN or into the sarcophage (2-3 minutes).

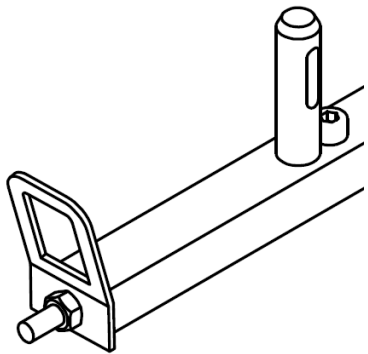
The timing of these procedures will be confirmed during the trial installations of the BRAN model in the presence of HSE and RP.

BRAN Emergency Handling Points

Any combination of Straps and rigid bars Can be quickly affixed to Fixture when needed.



250mm BAR
2 independent bars can be Rigidly screwed onto Threaded studs of the Fixture Lower assembly.



Detail of Strap Eyelets and Threaded stud of Fixture Lower assembly



BRAN lifting point – accepts M8 bolt 15mm thread depth

Lower fixture element
Mounted on Wooden
BRAN model

Test lifting
Of Wooden
Model into
TAN – all ok.



With the **best available** information regarding BRAN

- Fixture is made
- Wooden BRAN model made
- Fixture + Model practiced on 45 side
- Sarco markings (floor placement) established

45 side looks ok for BRAN installation

Wooden model and
Complete fixture.

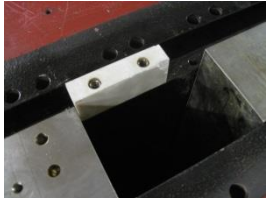
Fit check of fixture with BRAN in
Sarco – all ok. BRAN was not lifted.



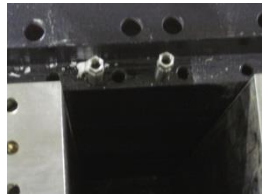
Other Preparations for BRAN Installation



45 Side BRAN mounting block located forward of normal placement (200mm slot front – BRAN cntr). 56 BRAN is in normal location



This causes an impact with the Stainless Bars. No drilling required. The original TAN holes exist. Simply relocate pins back to original place



There are ceramic chips and a Hex Wrench in the TAN slot below BRAN Location. Need to clean out. Wrench is likely activated.

56 side crane – 2 working days needed to make sarco alignments and Check out procedures with model BRAN. Assume we want to install Both BRANs on the same day.

Lifting straps – If the emergency recovery hardware is required to be on hand During the BRAN lifting then Approved straps will need to be provided.

