

An Integrated PIE Strategy within AEA Technology

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ABSTRACT

Over the last few years an extensive review of active facilities within AEA Technology has been undertaken and this has resulted in a major programme of rationalisation and consolidation of capabilities. This strategy concentrates all the active work on two major and complementary facilities, these are Building 13 (B13) at Windscale and Building 220 (B220) at Harwell. Decommissioning of the other active facilities is in progress and the essential capabilities previously offered by these facilities are being established either in B13 or B220. A key aspect of the strategy is the capability to transfer samples rapidly and in a cost effective manner between the two facilities, thereby fully utilising their complementary nature. Historically, different types of engineering posting systems were established at B13 and B220 and this paper describes the systems which have been developed for the transfer of materials between the facilities and the interfacing of the two posting systems.

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1.0 INTRODUCTION

A coherent strategy for the rationalisation and development of active facilities in AEA Technology has been established and is in the process of implementation. This strategy is based on the elimination of all unnecessary duplication of capabilities together with the consolidation and focusing of all future work in two complementary facilities, namely B13 at Windscale and B220 at Harwell. All other shielded facilities are now in the process of being decommissioned and as part of this rationalisation programme, key functions which were previously conducted in these buildings are being transferred to either B13 or B220.

2.0 THE ACTIVE FACILITIES

The capabilities of the two facilities are summarised as follows:

B13 is a refurbished facility designed to modern standards for undertaking high volume post-irradiation examination (PIE), the handling of all types of thermal reactor fuel and the provision of a wide range of active handling and waste conditioning capabilities. The facility is capable of handling complete fuel assemblies and has a highly developed flask handling capability. In addition, it has a range of mechanical testing capabilities and advanced electron optical techniques for the characterisation of fissile and non-fissile materials plus techniques for the characterisation of the thermal properties of high burn-up fuel.

This facility is composed of a main cell line containing 13 concrete cells which are linked by a Fuel Element Transport (FET) Corridor, plus some separate lead shielded cells and laboratory areas.

Material can be received into the main cell line by several routes:

- a) by transfer of a flask into the two end cells through shielded interlocks
- b) by connecting a transfer flask to posting ports located on the faces of the cells
- c) by posting through ports on the roof of the cells.

Materials are transferred between cells using a trolley in the FET Corridor or through the posting ports on the cell face or openings in the cell roof.

B220 at Harwell contains a modern, flexible remote handling facility (B220.29) where large and complex apparatus can be assembled to carry out detailed physical and chemical experimental programmes on a wide range of radioactive materials, including irradiated fuel, clad and structural materials. The facility comprises five shielded cells with full containment and seven shielded cells for non fissile work. The building also contains a comprehensive range of radiochemical capabilities, advanced chemical and electron optical analytical techniques and mechanical testing. This close coupling of in-cell work, radiochemistry, electron optical analysis and mechanical property characterisation has produced a powerful and unique combination.

The other two active facilities at Harwell, B393 and B459, are now in the process of being decommissioned and it has been necessary to transfer key work

functions previously conducted by these buildings to B220.29. An example is this is the requirement for B220.29 to act as the head-end station at Harwell for the direct receipt of transfer flasks.

B13 and B220 are complementary, having individual strengths in different aspects of shielded work. Their combination provides AEA Technology with a wide-ranging capability for conducting a wide range of tasks on fuel and irradiated materials. The strategy is to utilise and optimise the strengths of the two facilities by segregating the incoming work stream between them, based on their suitability for the individual tasks under consideration and availability. In broad terms the B220.29 capabilities are eminently suitable for undertaking small-scale specialised studies on fuels, other radioactive materials and structural materials where novel examination techniques are required to investigate and determine chemical, physical or mechanical properties. An example of this is the behaviour of irradiated fuel under fault conditions. In contrast, the main focus of B13 is on large-scale PIE, component evaluation, active handling operations and underwater examination support.

A key aspect of the above strategy is the ability to transfer samples between the two facilities in a rapid and cost effective manner. Two routes have been established depending on the size and activity of the materials:

- (i) Engineered double-lidded postings for large payloads, using Modular Flasks.
- (ii) The use of relatively small transfer flask assemblies for the transport of small samples.

A complication in the interfacing of the double-lidded posting is that historically different engineered posting systems were chosen for the two facilities. B13 at Windscale has a La Calhene system installed whereas B220.29 at Harwell uses the Drath and Schrader system. To overcome this problem a system has been developed for the transfer of a sealed material canister in a UKAEA Modular Flask, with the canister being able to interface with the posting ports at each facility.

3.0 THE INSTALLED POSTING SYSTEMS

In Building 13 at Windscale, A La Calhene 270mm/105mm combination port is installed in one of the cells on the main cell line .

In Building 220.29 at Harwell, the cell posting system was designed using the Drath & Schrader system. 210/295 combination ports are installed, with the 210mm port used primarily for the UKAEA Modular Flasks and the 295mm port for the Padirac RD20 Flask. As part of the rationalisation programme there is a requirement for B220 to act as the head-end receipt station for transport flasks at Harwell and flasking tables and handling equipment have been installed to provide the necessary infrastructure to enable receipt of a wide range of different types of flask.

4.0 MATERIAL TRANSFER SYSTEM - ENGINEERED POSTINGS

Following a review of the possible options for the interfacing of the La Calhene and Drath & Schrader postings systems it was agreed that a system should be developed to enable the transfer of a sealed material canister between the two facilities with the following features:

- a) The material canister to incorporate a La Calhene 105mm lid and flange to interface with the two facilities and be transportable in a UKAEA Modular Flask.
- b) Material canister lid to interface with the B13 cell line at Windscale, via the 105mm port on the installed La Calhene 270/105 combination port.
- c) Material canister lid to interface with a La Calhene 105mm port as part of the B220 posting line, as a precursor to posting through the existing Drath & Schrader 295mm port onto the cell line.

This scheme has been successfully implemented and a description of the key components is as follows:

4.1 The Material Transfer Canister

The material canister is shown in Figure 1. The canister comprises a sealed internal sample enclosure with an internal diameter of ~90mm and length of 1150 mm. The front of the container consists of a specially engineered alignment head which incorporates a La Calhene 105mm lid and flange for the interfacing with the posting ports at each facility. This alignment head is a critical feature which enables compliance of the canister end to allow it to be presented perpendicular to the posting port. A lead filled shield plug is connected to the end of the canister for connection to push rods, with a spring loaded thrust feature, to facilitate transfer of canister from the Modular Flask to the posting port. The rodding joints have been designed to prevent any accidental separation during any rotational operations.

The shield plug is also used to secure the canister to the Modular Flask during transportation operations, as shown in Figure 2. The Modular Flask is fitted with a reduction sleeve to centralise the canister within the flask.

4.2 The Posting Line at B13, Windscale

A liner tube is fitted through the cell wall in order to reduce diameter (to ~220mm) and position the material canister at the correct height to interface with the La Calhene 105mm port. The "hot" end of the sleeve contains a guide feature to assist the alignment with the La Calhene port. The transfer from the Modular Flask to the cell face is shown in Figure 3a and 3b. The rodding assembly allows the operator to apply a suitable pressure to the canister for it to fully engage the La Calhene port whilst still allowing the canister to be rotated to effect operation. Once engaged the port can be opened in the normal way.

4.3 The Posting Line at B220, Harwell

Postings in B220.29 are conducted utilising the Drath & Schrader 295/210 combination port. The cell wall aperture is fitted with a reduction sleeve which reduces the sleeve bore to approximately 220mm, as shown in Figure 4. The cell "hot end" of the sleeve incorporates a sealed bulk head with a Drath & Schrader can lid feature for interfacing with the port and positioned within the bulkhead is a manually operated La Calhene 105mm port. A constant axial load is applied by means of 3 spring lugs, which engage into a groove machined into the liner, to seal the sleeve against the Drath & Schrader port.

The transfer from the Modular Flask to the cell face is shown in Figures 5a and 5b. The rodding assembly allows the operator to apply a suitable pressure to the canister for it to fully engage the La Calhene port whilst still allowing the canister to be rotated to effect operation. Once the canister is engaged into the La Calhene port, the Drath & Schrader port can be opened thereby allowing the La Calhene port to operate and the posting of the payload into cell to be conducted.

5.0 MATERIAL TRANSFER SYSTEM - NON ENGINEERED POSTINGS

The transfer of low activity samples between the two facilities may also be conducted by the use of vertically loaded/unloaded flasks. A new set of 3 'nested' flasks has recently been designed and is in manufacture. The package combination used for a given shipment being dependent upon the sample size and shielding requirements.

6.0 CONCLUSION

A major rationalisation of active facilities is in progress in AEA Technology, with the work now concentrated on two major and complementary facilities - B13 at Windscale and B220 at Harwell.

A key component of this rationalisation is the ability to rapidly and cost effectively transfer samples between the two facilities. This is being effected by means of two transport options, depending on the size and activity of the materials.

(a) Engineered double-lidded postings for large payloads, using the Modular Flask. A system has been developed for the double lidded engineered postings which interfaces between the La Calhene posting system in B13 at Windscale and the Drath & Schrader posting system in B220 at Harwell.

(b) The use of a 'nested' flask assembly for the transport of low activity samples.

7.0 ACKNOWLEDGEMENTS

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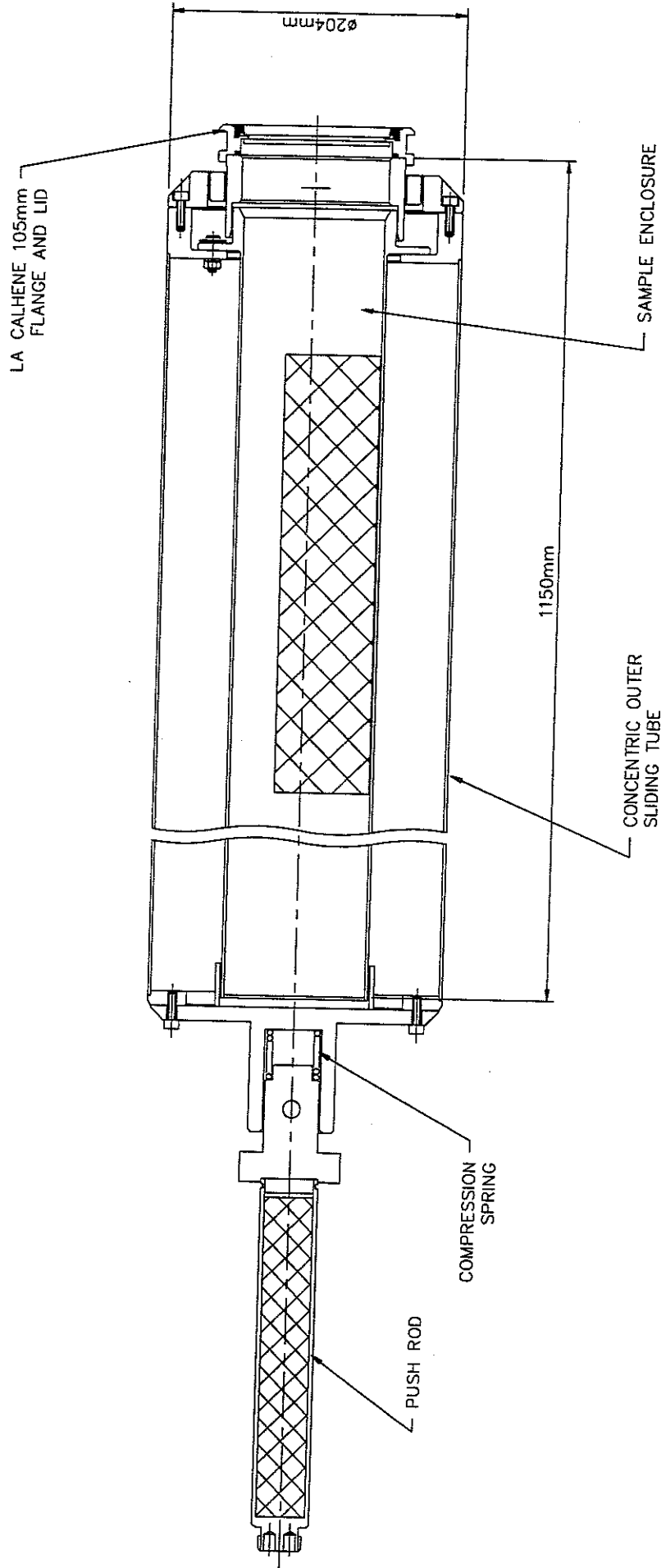


FIGURE 1

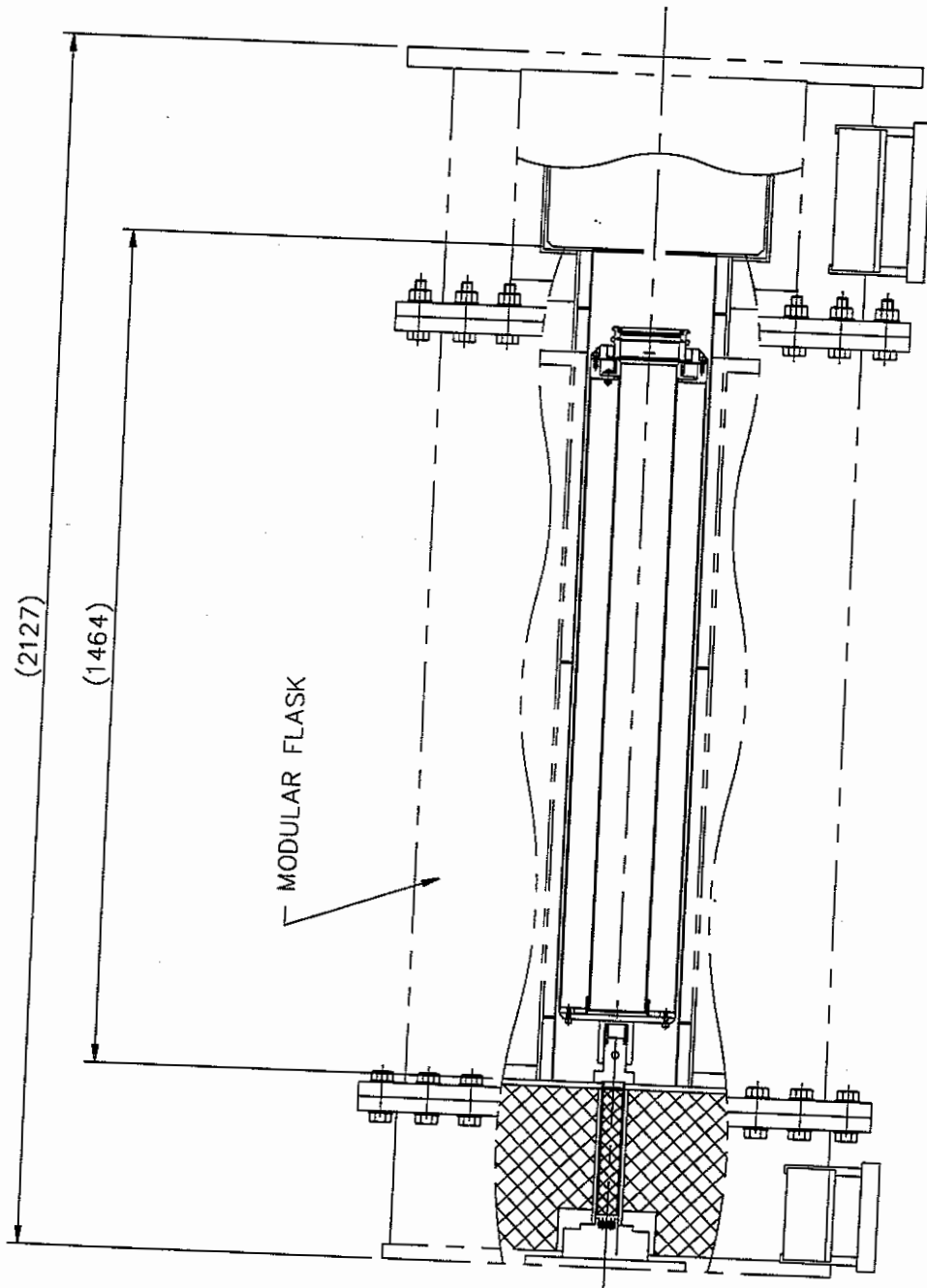
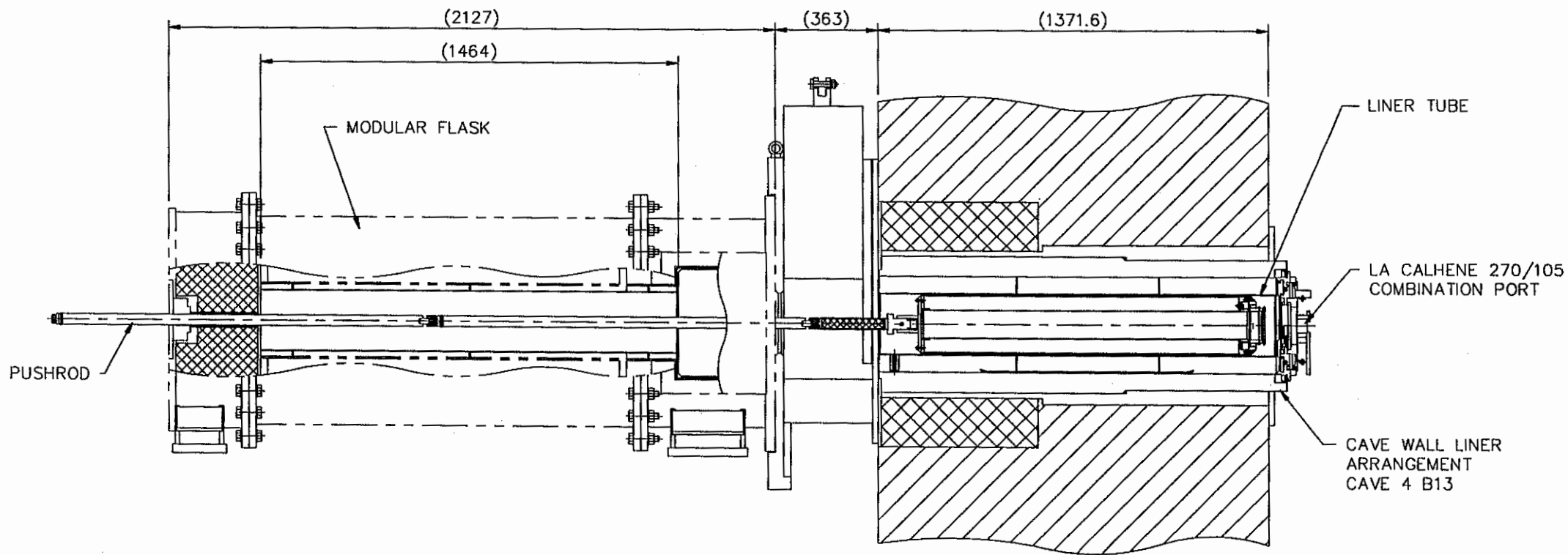
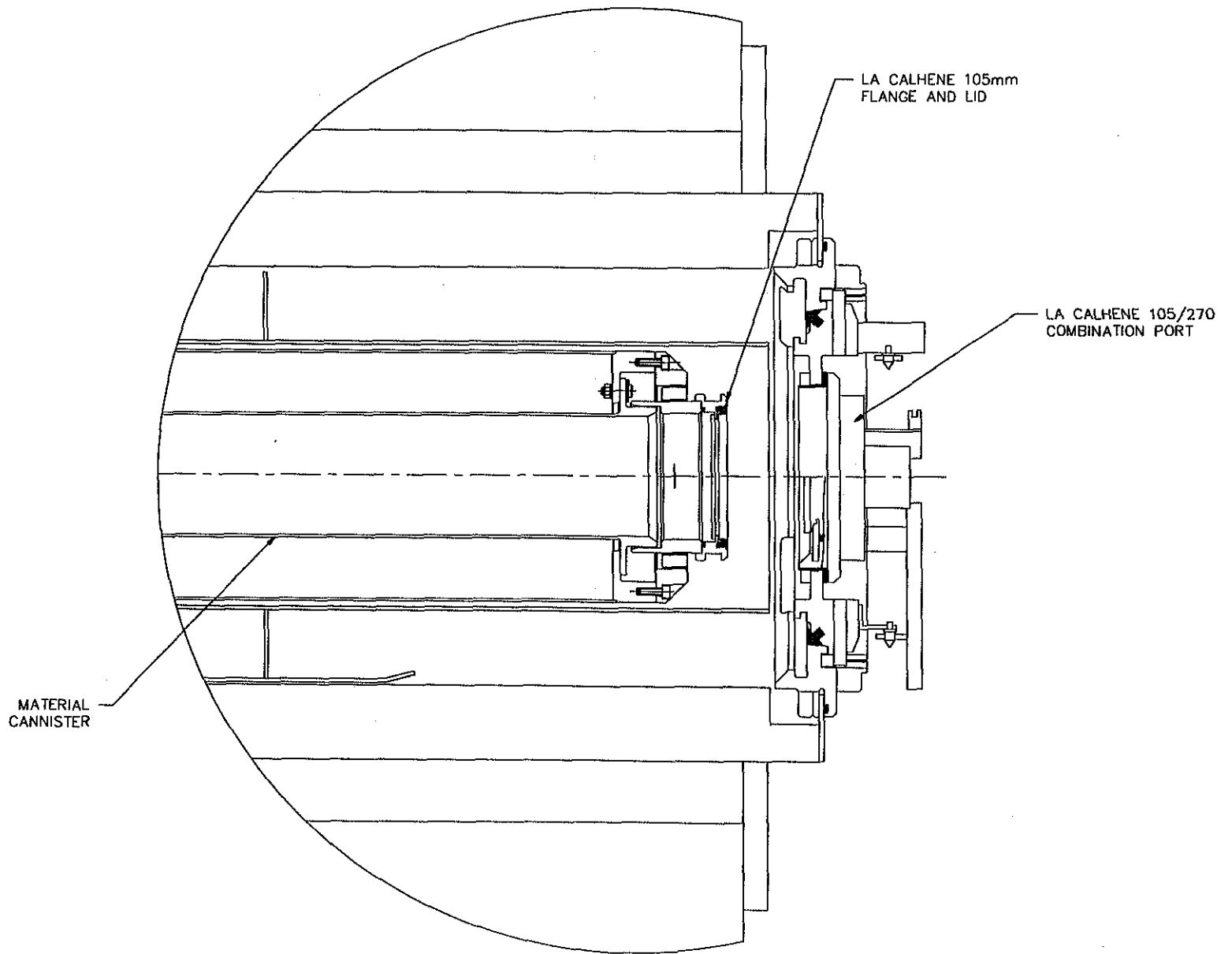


FIGURE 2



POSTING ARRANGEMENT AT WINDSCALE

FIGURE 3a



POSTING ARRANGEMENT AT WINDSCALE

FIGURE 3b

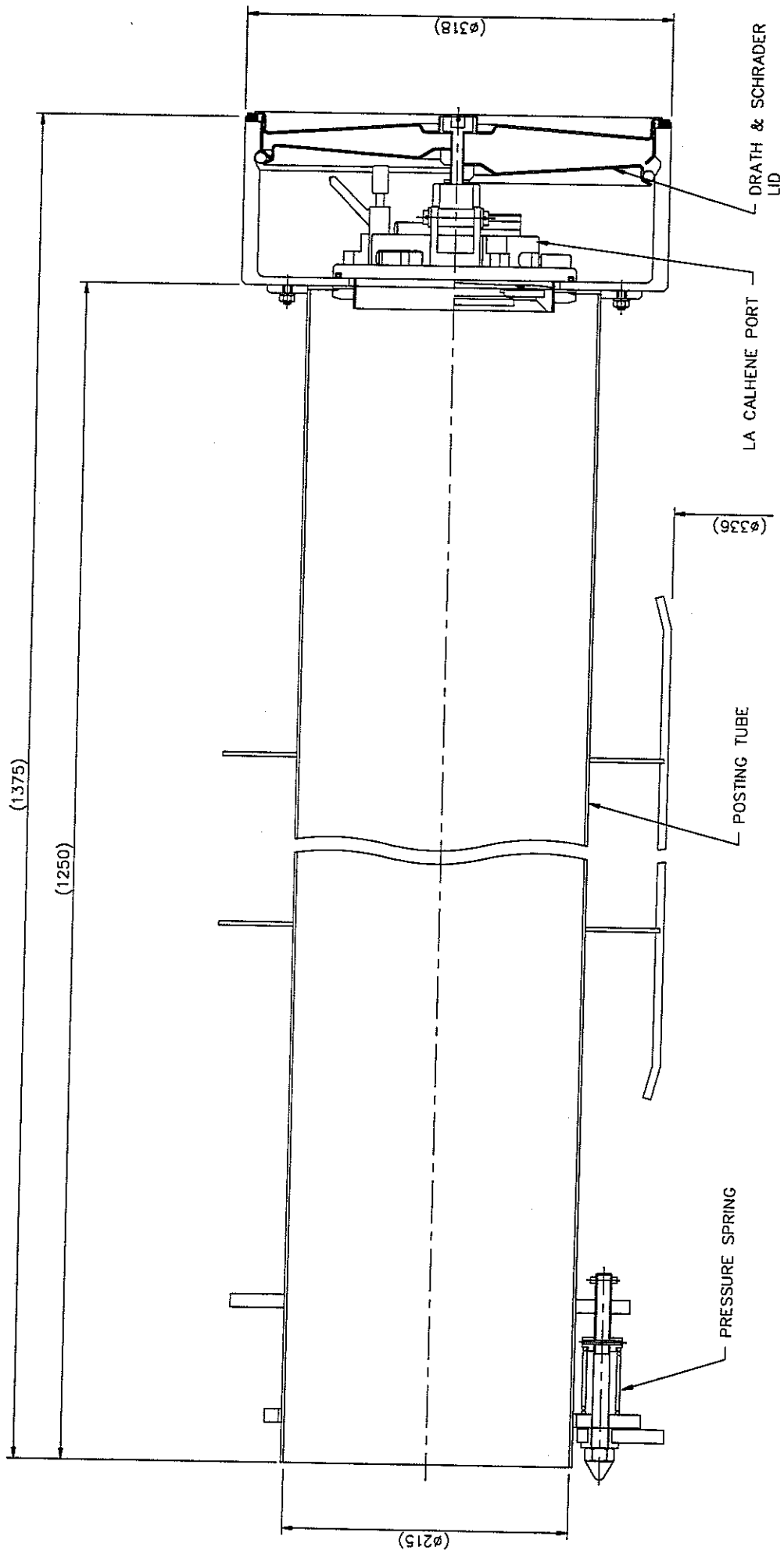
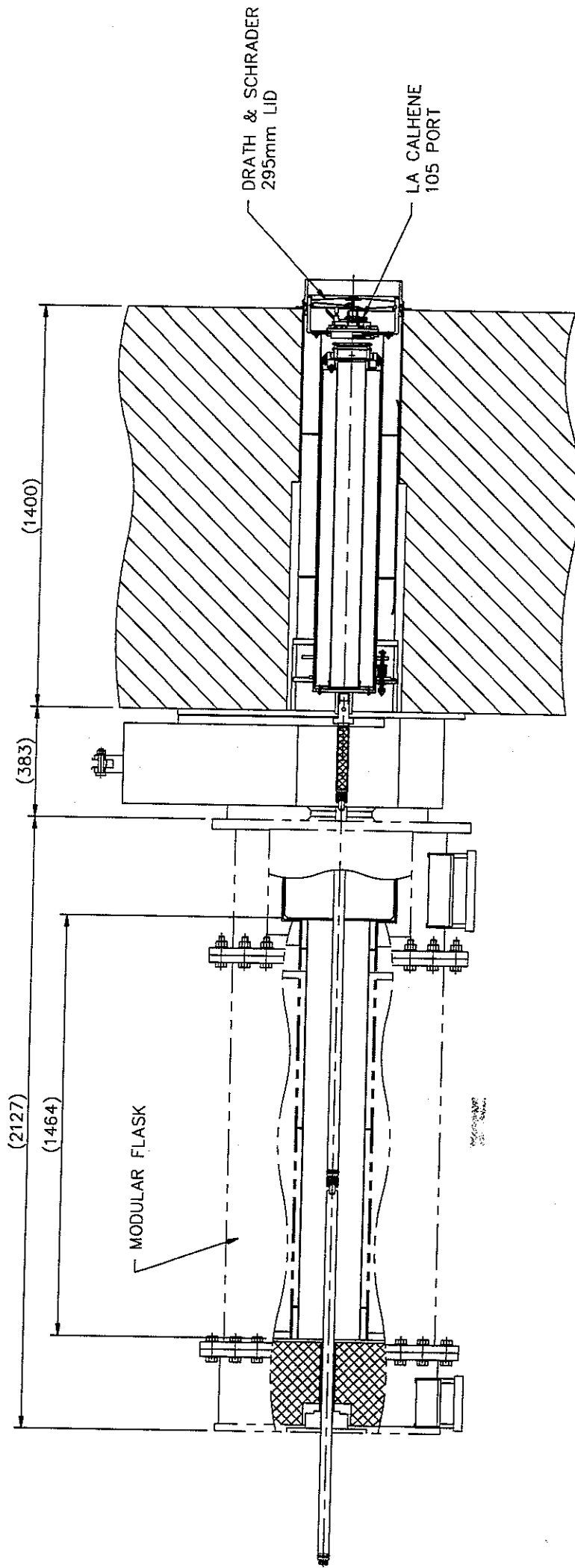
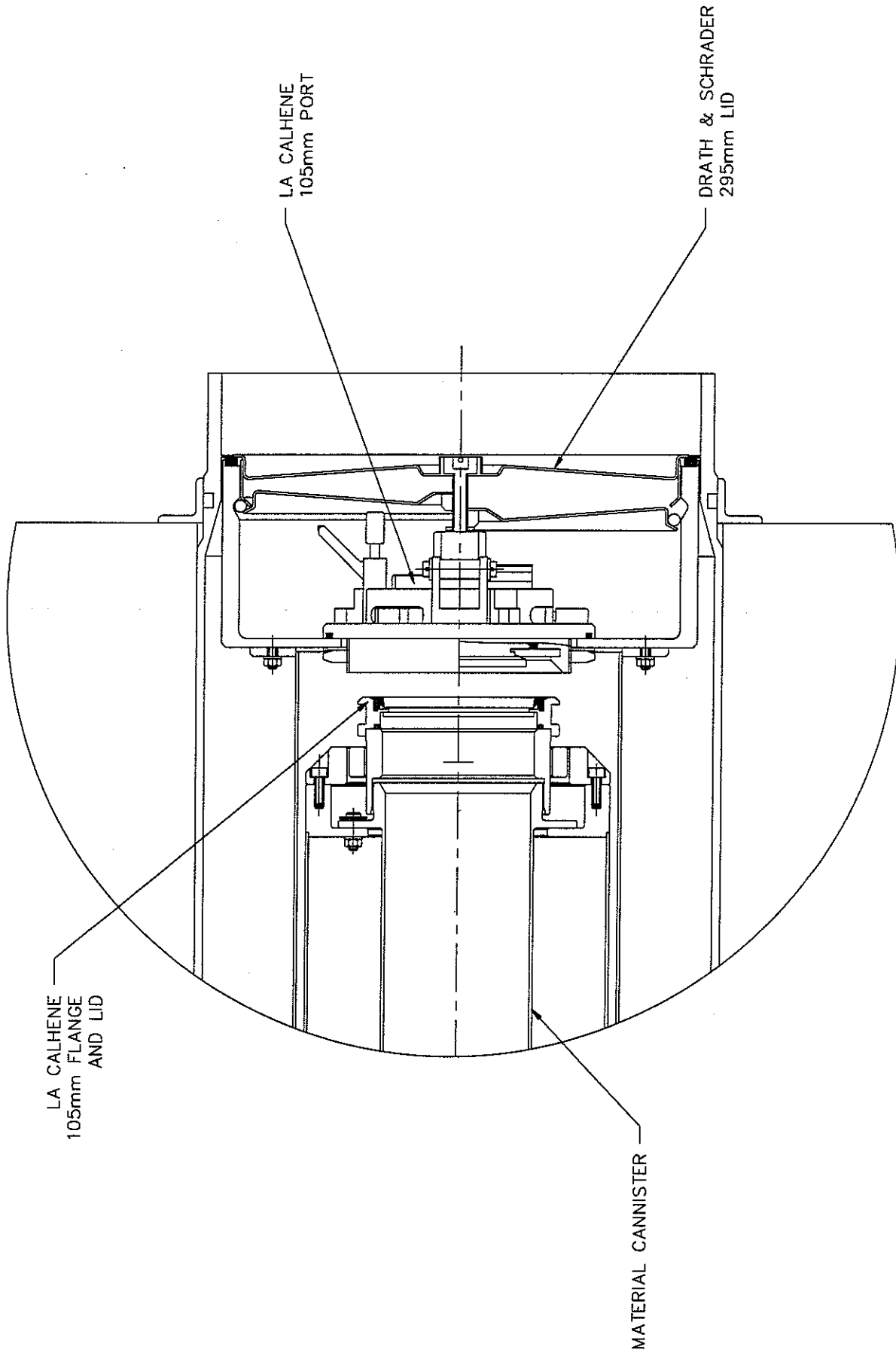


FIGURE 4



POSTING ARRANGEMENT WITHIN B220.29 AT HARWELL

FIGURE 5a



POSTING ARRANGEMENT WITHIN B220.29 AT HARWELL

FIGURE 5b