

SPECIFICATION FOR MOBILE DIGITAL TRAILERS FOR BREAST SCREENING

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PREFACE

This specification is for mobile breast screening units (MBSUs) in which digital mammographic x-ray equipment is housed and in which screening for breast cancer by the NHS Breast Screening Programme (NHSBSP) is carried out.

The original specification *Guidance Notes for Health Authorities and NHS Trusts on Requirements for Breast Screening Mobile Trailers and Drawing Vehicles* (MDD/93/33) was published in 1993. This latest edition has been condensed, and certain areas which are not directly applicable to radiographic practice or which are covered in other standards or guidance notes have been omitted. The comments and revisions given in NHSBSP Report 01/08 Addendum to MDD/93/33 are included. Other relevant guidance notes for health authorities and NHS Trusts are listed in Appendix 2.

This document is based on the specification used in the tendering process for the trailer framework agreement that came into operation in June 2009.

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GLOSSARY

For the purposes of this document the following definitions apply:

Contractor the supplier of the mobile breast screening unit.

Drawing vehicle a heavy motor vehicle or tractor unit designed to draw the mobile breast screening unit on public roads.

Generator it is expected that the most practical solution to having an auxiliary power supply will be to have an electrical generator integrated with the mobile breast screening unit.

Mobile breast screening unit (MBSU) an enclosed mobile structure comprising floor, external walls and roof, internal walls and accommodation furnishings, engineering and building services, mammographic x-ray equipment and associated services, mounted on a wheeled chassis constructed to be moved by towing.

Offeror the trailer manufacturer or mobile breast screening unit manufacturer.

Trust the NHS Trust or contracting authority that is buying the mobile breast screening unit.

1. GENERAL

- 1.1 The mobile breast screening unit (MBSU) described in this specification should be capable of travelling a minimum of 10,000 miles per year over both public and private roads. It may be required to be parked for long periods, up to six months or more, at remote, poorly lit locations and left unattended out of normal working hours, for periods up to five consecutive days. In addition, the provision of on-site electrical, water and drainage services cannot be guaranteed. Thus, the MBSU must be capable of functioning as an independent island unit, without any need for connection to any permanent external services. The MBSU will spend most of its life exposed to the full rigours of the environmental elements, throughout all seasons of the year. A high level of security and vandal resistance will also be required.
- 1.2 It is of particular importance that the MBSU is designed and constructed to meet the purpose for which it is intended to be used throughout its expected life (*of at least ten years*). It should be designed to withstand the full impact of the weather and other conditions which it is likely to encounter while in service.
- 1.3 The MBSU must be designed to be functionally efficient so as to achieve high patient throughput rates, typically at six minute intervals throughout the working day. It should provide an aesthetically pleasing and relaxed environment for the patients who are undergoing mammographic examinations and for the staff providing the service.
- 1.4 The design of the MBSU should allow easy means of access to component parts which must be reached for control and operational purposes or which need to be regularly inspected.
- 1.5 The maintenance and servicing of the MBSU is an important consideration. Therefore particular emphasis should be given to the design to ensure that, so far as is reasonably practicable, the materials and equipment used require minimum or no maintenance.

2. REGULATIONS

- 2.1 The whole of the MBSU, including all materials, equipment and services built into them, shall comply fully with the relevant statutory legislation, EC directives, regulations, codes of practice and British Standards.
- 2.2 Guidance on electrical provision for x-ray installations is given in the *Medical Electrical Installation Guidance Notes (MEIGaN) (Version 2, September 2007)*,¹ and the application of these to the trailers used by the NHSBSP can be found in *Guidance Notes for the Installation of Electrical Supply for NHSBSP Mammography Trailers* (NHSBSP Equipment Report 0503).² New MBSUs must comply with these requirements.
- 2.3 A list of applicable regulations is given in Appendix 1, together with links to the internet sites on which further information can be found.
- 2.4 References applicable to the drawing vehicle and the roadworthiness of the MBSU are not given as they lie outside the scope of this specification.

3. VEHICLE AND TRAILER UNIT

- 3.1 The MBSU should provide a stable and steady platform for the x-ray equipment to provide a vibration free environment for optimum operation. Consideration should be given to the optimum location of the x-ray set to minimise vibration. Certain types of digital detector are particularly susceptible to environmental changes in the temperature range and the rate of change of temperature. Therefore it is important that a sufficient level of insulation is built into the body of the MBSU to reduce internal temperature variation.
- 3.2 An air conditioning/heating system should be capable of maintaining the ambient room temperatures at the levels stipulated by the mammography equipment manufacturer. An auxiliary heating system will be required to maintain the room temperatures at the specified levels when the MBSU is vacant.

Coupling device

- 3.3 In the event that the normal drawing vehicle has to be withdrawn from service or is otherwise unavailable, the towing or coupling device attaching the vehicle and trailer must be compatible with those which are most commonly to be found in current use. A fifth wheel coupling height of 1150mm above the ground is a typical standard. This should enable a suitable alternative drawing vehicle to be used.

Road transportation

- 3.4 Facilities should be incorporated into the MBSU design to enable all services and loose items of equipment or fittings to be secured safely, in readiness for transportation of the unit by the drawing vehicle. The facilities should be simple to operate, readily accessible and clearly identified. The contractor should provide a suitable checklist for this purpose. Particular attention must be paid to securing the mammographic x-ray unit and its radiation protective screen and digital imaging equipment. (See Appendix 2 for relevant guidance notes.)
- 3.5 The supplier or manufacturer of the x-ray unit or digital imaging systems should be responsible for specifying where the equipment securing devices must be attached to the floors and walls and for specifying the loading imposed on the fixings when the trailer is in motion. The fixings and securing devices should be designed and specified by the appropriate manufacturer or supplier. Fixings and securing devices for furniture and other fittings supplied by the trailer manufacturer (the offeror) should be provided by the offeror. It should be the responsibility of the offeror to ensure that they understand the requirements of the supporting structure for the equipment securing devices within the floor and walls of the trailer and to ensure that these requirements are met.
- 3.6 Written instructions on how to attach and remove fixings and securing devices before and after movement of the trailer must be provided to the Trust by the supplier or manufacturer of the x-ray unit or digital imaging systems. It is the Trust's responsibility to ensure that these requirements are met. Failure to do this might result in damage to the mammography equipment.

See also section 29 of this specification.

4. ACCOMMODATION

4.1 The following list is provided for guidance:

- entrance lobby to reception
- reception and waiting area
- two or three individual patient changing cubicles (depending on workload and more in the case of a twin x-ray room unit). If there is a one-way workflow, one cubicle may be sufficient. Trusts may wish to have coat hooks attached to the walls of the cubicles or provide other means for the management of the woman's personal items
- x-ray room with emergency exit which can also serve for equipment loading purposes (two x-ray rooms on a twin unit)
- staff rest area
- internal general equipment store
- housings external to main trailer for the storage of
 - onboard generator
 - generator fuel tank
 - batteries plus associated chargers (if required by Trusts)
 - fresh water storage tank (if required by Trusts)
 - foul waste storage tank (if required by Trusts)
 - mains fresh water supply (if fitted)
 - incoming electrical supply connection
 - miscellaneous materials and equipment (eg cables and steps).

Further information relating to each area of the MBSU is given in the following paragraphs. It is not exhaustive and must be read in conjunction with other clauses throughout this document.

Entrance lobby

4.2 This should consist of a small area leading from the door at the top of the entrance steps outside the MBSU to the reception and waiting area. It should have an inner door, between the lobby and the reception area, containing a vision panel. This door should be lockable and weatherproof. Consideration may be given to an entry phone at the main entrance door and/or security cameras, with a switch for the door lock at the reception desk.

4.3 The entrance lobby will serve to

1. maintain privacy within the MBSU
2. minimise draughts and heat loss
3. assist with securing against the entry of unwanted persons.

4.4 The entrance lobby should have a mat for wiping feet, an umbrella stand and a light.

Reception and waiting area

4.5 This area should:

1. be capable of accommodating one receptionist (who may also be a radiographer) and no fewer than six clients
2. be accessible from the outside via the small entrance lobby
3. give direct access to the patient changing cubicles but not compromise the privacy of partially clothed clients
4. be arranged and decorated to present a welcoming environment
5. have comfortable bench seating made from material suitable for high throughput and which is easy to maintain
6. have a reception desk with drawers and an appropriate seat; the desk layout should allow confidentiality for client documentation
7. contain a securely mounted wall clock
8. be fitted with a control console integral to the reception desk assembly to provide the following facilities:
 - storage for mobile telephone
 - panic alarm button
 - staff to staff call button (if required)
 - entertainment services control unit (if required)
 - electrical supply alarm indicators
 - security alarm controls
 - double 13A switched socket outlet
 - computer network points
9. be provided with a notice board and/or a rack for health education leaflets
10. be fully air conditioned
11. comply with any specific local standards for infection control.

4.6 The requirements for privacy at the reception desk for patient confidentiality will depend on operational requirements. If questions of an exclusively non-sensitive nature are asked at the reception desk, and more personal information is obtained only when the patient is in the x-ray room, then the need for privacy at the desk is lessened. Otherwise, a separate area for confidential conversation with the patient may be required.

Changing cubicles

4.7 The changing cubicles should be adjacent to the x-ray room and easily accessed. The type of cubicle will depend on the handling procedure used. The alternatives are:

1. *Pass through.* The woman enters the cubicle, locks the door to the reception area and, when called, moves into the x-ray room through a second door. She then returns to the same cubicle, dresses and unlocks the door to reception to exit. This type is considered to be the most efficient in terms of security, space and throughput. The door lock must have provision for operation from the outside in an emergency.
2. *Single use.* The woman undresses in a cubicle leading from the reception area and, when called, takes all her belongings into the x-ray room. She dresses in a second cubicle, usually leading from the x-ray room and having an outside exit door, from which she leaves.
3. *Double use.* The woman undresses in a cubicle in the reception area and returns to the same cubicle to dress.

- 4.8 Each changing cubicle should provide the necessary facilities to suit its particular use. This may include a seat, clothes hook, storage space, and a mirror with small overligh located behind or to the side of the seat so as to avoid direct viewing into the mirror while seated. A curtain and track across the opening of the cubicle or solid door with lock on the inside must be provided. The seating must be sufficiently robust to cater for any woman. Signs explaining the procedures and other instructions or warnings to the patient as appropriate may be attached to the walls of the cubicle (eg 'keep valuables with you', 'wait until the radiographer calls you').
- 4.9 A single switched socket outlet mounted at low level may be needed in the changing area for cleaning purposes.

X-ray room

- 4.10 The x-ray room contains the x-ray equipment together with associated services such as digital imaging equipment involved in carrying out mammography examinations. The room wall and entrance door(s) must provide adequate protection against scattered radiation and sound insulation to ensure that normal level conversation within the room cannot be heard in the reception area.
- 4.11 Facilities within the x-ray room should include suitable services and connections to provide:
1. the digital imaging system
 2. the radiation protective screen
 3. temperature and humidity logging device
 4. worktops with cupboards below and above for storage and writing purposes
 5. a sink with hot and cold water for hand washing
 6. a dimmable lighting system
 7. a minimum of four twin 13A switched socket outlets for general purpose use; at least one socket should be located close to the x-ray unit to facilitate servicing and QA measurements
 8. staff call and panic call systems (if required by the Trust)
 9. air conditioning/heating to ensure stable environmental conditions
 10. an access door to outside the MBSU for emergency exit, servicing and loading equipment
 11. an operator chair and a patient seat or chair
 12. computer network points.
- 4.12 The room should be spacious enough to accommodate any digital equipment on the market, suitable* for breast screening, with equipment laid out to provide the most ergonomic solutions to the various tasks and activities carried out within it.
- 4.13 Care should be taken to direct any ventilation air discharge points away from the positions occupied by the patient and staff during the mammography examination.
- 4.14 Windows in the x-ray room should be above head height and provided with blinds to enable the room to be darkened. This may be necessary to allow the field light on the x-ray unit to be seen.

*Equipment evaluated and suitable for use within the NHSBSP.

Staff rest and beverage area

4.15 A small area is needed for use by staff for breaks away from client areas. Subject to space being available, the area should include:

1. comfortable seating
2. a small worktop with cupboard space
3. a double 13A switched socket
4. air conditioning/heating
5. a sink with hot and cold water

Additional optional items that may be required by the Trust include:

6. a small microwave oven
7. an electric kettle
8. a small refrigerator.

The Trust should decide who is to provide items 6, 7 and 8 at the time the contract for supply of the MBSU is drawn up, so that the costs are included.

4.16 Where any restrictions are imposed on the use of the facilities, these should be clearly displayed in a prominent position in the form of a notice.

Internal general equipment store

4.17 A floor to ceiling cupboard, containing shelves as necessary, is required which is sufficient to house items such as the following:

1. cleaning materials
2. brushes and shovel (for snow removal and general-purpose)
3. portable steps or single step stool
4. first aid kit
5. general materials and spares.

Additional optional items that may be required by the Trust include:

6. vacuum cleaner
7. coat hooks.

The Trust should decide who is to provide items 2 to 5 at the time the contract for supply of the MBSU is drawn up, so that the cost is included.

4.18 The storeroom should be naturally ventilated by means of suitable weatherproof grilles open to the outside.

External storage

4.19 External storage facilities should be designed in accordance with the requirements of the particular regulations or standards applicable to the function and type of materials and

equipment being housed within them. Storage accommodation should include space for water hoses and electric supply cables.

- 4.20 The storage units must be lockable and as secure as practicable to minimise the risk of their contents being stolen. They should also be incorporated into the general security alarm system. The storage units could be used to house the integral electrical generator.
- 4.21 Adequate ventilation, drainage and sealing of the storage units should be provided and any necessary lighting provided to enable them to be used during the daily preparation and closing down of the MBSU.

Fixtures and fittings

- 4.22 The MBSU supplier is generally able to supply a variety of fixtures and fittings according to local preference. Trusts may require suppliers to meet local requirements for surfaces to facilitate infection control.

5. BODYWORK CONSTRUCTION

- 5.1 Construction of the MBSU bodywork and trailer should be in accordance with all relevant legislation, standards and guidelines.
- 5.2 The MBSU should provide a stable and steady platform for the x-ray equipment to provide a vibration free environment for optimum operation.
- 5.3 It is important that a suitable level of thermal insulation is built into the body to meet the requirements stipulated by the mammography equipment manufacturer. The material advantages of good insulation are a reduction in the risk of condensation damage to the x-ray equipment and a substantial relief on the air conditioning and heating load. Measures to combat condensation should include drainage channels/holes in windows to allow condensation to drain away and the setting of heating or air conditioning when the trailer is not in use.

Room configurations

- 5.4 Since the room configurations will vary in the trailer layouts proposed by the various manufacturers, it would be unhelpful to make specific recommendations for internal room sizes. Offerors should use their expertise to design a suitable layout taking account of economic and ergonomic factors.

External access to the trailer

- 5.5 Steps providing external access to the reception/waiting area should be provided. These must be designed to be capable of being negotiated safely. The provision of protection from the weather and of anti-slip steps is essential.

- 5.6 The access stairs on an MBSU should be made of lightweight material for ease of assembly when the MBSU is relocated.
- 5.7 A chain or other suitable device, complete with signs, should be provided at a suitable location, eg at the foot of the stairs to notify persons when the MBSU is not in use together with other appropriate information.
- 5.8 Steps with hand rails providing occasional access to the x-ray room (via the access doors) are also required. Steps should be made of lightweight material with antislip treads.
- 5.9 The access doors to the MBSU should be capable of opening outwards to a position that enables them to be prevented from moving by way of a suitable hook or catch on the access steps.

Doors and windows

- 5.10 All doors and frames, both internally and externally, and all windows should comply with all relevant standards and guidelines. To minimise problems with condensation, the windows should be double-glazed and have drainage channels/holes to allow the condensation to drain away.

Levelling

- 5.11 Suitable means should be provided to enable the MBSU trailer to be levelled and stabilised on uneven ground while in service and without the drawing vehicle.
- 5.12 The devices should be simple to operate and effective in operation.
- 5.13 Levelling indicators should be fitted, and should be observable directly by the persons carrying out the levelling, to enable the degree of level to be determined.

6. PIPEWORK AND FITTINGS

- 6.1 All pipework and fittings used by the various mechanical services installations should, unless otherwise stipulated, be compliant with all relevant standards, regulations, codes of practice and guidance notes.
- 6.2 The number of connectors used should be as small as possible. Each connector should be of a design that will prevent loosening in normal service but will allow reliable repeated disconnections and reconnections while maintaining full performance standards without leaks.

7. AIR CONDITIONING/HEATING SYSTEM AND AUXILIARY HEATING SYSTEM

Air conditioning/heating system

- 7.1 An air conditioning/heating system should be capable of maintaining the ambient room temperatures at the required levels as stipulated by the digital equipment suppliers. This is typically a range of 20–24°C for outside temperatures covering the usual seasonal range. The system should be powered from the domestic electrical supply to the trailer, which may be derived from a landline or onboard generator. The rating of the unit should take account of all heat losses and gains, including the gains produced by the x-ray unit and associated equipment as well as staff, patients and solar heat.
- 7.2 The controls should be easily accessible, reliable and simple to operate.
- 7.3 The pre-set operating temperatures should be achievable within one hour of switching on the heating system. The system should have the capacity to operate unattended, reliably and automatically during the working day, and throughout a 24 hour, seven day period, including holidays.

Temperature control

- 7.4 Digital imaging equipment is sensitive to ambient temperature variation, and rapid changes in temperature and extremes of temperature can severely damage digital detectors. Temperature control in the x-ray imaging room is particularly important and an environmental monitoring device should be installed.

Auxiliary heating system

- 7.5 When the MBSU is vacant, an auxiliary heating system is required to maintain the room temperature to the requirements of the mammography equipment manufacturer.
- 7.6 Storage containers for batteries and other items affected by adverse weather conditions should also be included.
- 7.7 Systems may also be considered that use time and/or temperature control for the generator, allowing the generator to be switched on automatically to power the normal heating system when required.
- 7.8 It should be emphasised that the auxiliary heating system is principally provided to ensure adequate temperatures for the x-ray and digital imaging equipment and not as an alternative heating source to the air conditioning/heating system.

Logging device

- 7.9 A logging device should be installed to monitor the range and rate of change of the environment in the x-ray room, to keep track of any changes that could affect the digital equipment. Some such devices have the facility to send either an email or a text to notify any changes and require a computer to be running continuously on the MBSU. Other simpler devices may be standalone but provide only basic alarm monitoring on the MBSU.

8. WATER AND DRAINAGE SERVICES

Mains water connection

- 8.1 Ideally a mains water connection should be available.
- 8.2 Hot water should be derived from the cold water system. A localised electric heater at each point of supply in the MBSU or an electric system that serves a number of points can be used.
- 8.3 Suitable thermal insulation must be provided to cold and hot water services, pipework, tanks and fittings.

On-board water and drainage services

- 8.4 If on-site water and drainage services for the MBSU are not available, such facilities must be supplied by means of a dedicated on-board system for hand washing and bottled water for drinking. The installation must be compliant with all relevant standards, regulations, codes of practice and guidance notes, including *Hot and Cold Water Supply, Storage and Mains Services* (Health Technical Memorandum (HTM) 2027).³ A maximum storage capacity of 12 hours' water requirements is recommended to avoid microbial contamination and loss of quality. The capacity of the water storage and drainage system tanks should be carefully assessed in relation to the daily requirement to ensure that a reasonable rate of turnover is achieved.
- 8.5 A means of visually checking the liquid level in the tanks or the provision of 'low water level' and 'drainage tank full' alarms is recommended.
- 8.6 The internal waste drainage system should be designed and installed to collect all foul waste fluids by way of gravity. It should be independent of the external roof drainage system designed to collect and discharge water to the ground. All pipework should be adequately sized to cope with the maximum flow rates likely to be received from the various overflows and waste outlets.

9. ELECTRICAL SERVICES

- 9.1 Electrical services associated with the MBSU trailer should be installed, tested and commissioned in accordance with all current legislation, standards, codes of practice and guidelines.
- 9.2 The following clauses relate particularly to the requirements of the MBSU accommodation but the principles should equally apply, where appropriate, to other parts of the complete vehicle assembly.

Electrical mains supply

- 9.3 Many of the sites used by the MBSU possess permanent landline electrical service connection points provided specifically for use by the breast screening service. In some instances, however, it is impracticable to provide such facilities or the owner of the site is unwilling to give consent for their use.
- 9.4 For sites where landline electrical mains supplies are not available, the MBSU should be fitted with a suitable on-board electrical generator to provide that service.
- 9.5 The Trust must define at the outset whether the electrical supply requirements to the MBSU will be derived from
1. a landline
 2. a generator
 3. multisource, ie provided with a generator but also capable of connection to a landline supply.

Landline electrical supply

- 9.6 A landline electrical mains supply facility should be terminated in an industrial weatherproof switched socket outlet. An electrical meter may also be provided. The design and construction of the outlet should comply with relevant standards and guidance notes. In addition to the electrical supply, the outlet can accommodate the water supply in an enclosed corner. It would then be a combined service connection box. The electrical requirements of the trailer will comprise the domestic load, which will be mainly air conditioning/heating and lighting, and the digital imaging equipment and the x-ray unit load, which will occur principally during the mammographic exposure. Details of the former will be derived from the installed domestic equipment data and the latter from the digital imaging equipment and x-ray unit suppliers.
- 9.7 *Further Revisions to Guidance Notes for Health Authorities and NHS Trusts on Mammographic X-ray Equipment Requirements for Breast Screening (MDA 01011)*⁴ recommends that mammography x-ray units should be suitable for operation from one of the following 50 Hz electrical supply systems:
- 400V +10% – 6% three phase
400V +10% – 6% three phase line to line
230V +10% – 6% single phase line to neutral.

- 9.8 Not all current designs of mammography x-ray unit can operate from a single phase supply, so it would be advisable to check the requirements with the x-ray equipment supplier. To cater for this and for other electrical services, the electrical supply parameters to the vehicle may be three phase or single phase with nominal parameters as follows:

400V, three phase, five wire (three phases, neutral and earth)
230V, single phase, three wire (line, neutral and earth).

- 9.9 A landline electrical mains supply facility typically comprises a 63 A (depending on the x-ray unit load), single phase (line and neutral), 230V, 50Hz, 30mA residual current protected source. A three phase supply is required if an existing three phase x-ray unit is to be used or if the vehicle is designed to support two x-ray units. If it is anticipated that the electrical requirements may increase at a future date owing to the provision of additional equipment or services, a higher rated supply should be considered at the outset.
- 9.10 The present trend in MBSU construction is towards three phase power. If single phase is to be used, consideration may be given to a 'load shedding' device. This device prevents the mains from cutting out by momentarily interrupting the supply to these items and is generally triggered from the x-ray warning light system.
- 9.11 A 32A supply is unlikely to be adequate for digital equipment and the consequent additional air conditioning requirements on a MBSU, and specific advice should be obtained from the equipment supplier. Breast screening centres with sites that have only a 32A supply for existing trailers will need to consider an upgrade to a 63A facility.
- 9.12 In addition to the load taken by the x-ray unit, another important requirement for the supply (to the x-ray unit) is the resistance of the supply line back to the substation source (line resistance). This determines the voltage drop that occurs in the line when an x-ray exposure is made. If this is too high, it can affect the tube voltage and tube current. However, x-ray generators on mammography x-ray units are low power devices. Therefore, unless the line resistance is excessive, the voltage drop is unlikely to be large and should be automatically compensated for by the x-ray unit.
- 9.13 It is important that the x-ray equipment supplier/manufacture is consulted about the maximum allowable line resistance when the electrical supply services are specified. Experience with mobile installations in the NHSBSP has suggested that most current mammography x-ray units can be operated over a range of line resistance values up to 0.6 ohms (Ω). Therefore, the line resistance of each mains outlet should ideally not exceed 0.4 Ω and in no case should exceed 0.6 Ω . Trusts are advised to ensure that the supplier/manufacture performs such tests as are necessary to confirm that the proposed equipment will function correctly from each mains supply. The tests should include measurement of the line resistance both between line and neutral and between line and earth.
- 9.14 The contractor should provide connection of the landline electrical supply from the purchaser's socket outlet to the MBSU by means of an appropriate length (to suit *all* site requirements) of suitably rated, double insulated cable of appropriate cross-sectional area and number of cores, fitted with appropriate impact resistant, weatherproof plugs at each end. The earth cable must be fully rated to provide a protective conductor which interconnects the main earthing terminal on the MBSU to the mains supply protective earthing system.

- 9.15 Secure storage facilities, protected by the MBSU security alarm system, accessible from outside the MBSU, should be provided to house the cable when not in use. In addition, owing to the weight of the cable and potential difficulty in handling, a cable storage drum can be provided to facilitate safe cable withdrawal and retrieval into the storage enclosure.
- 9.16 If necessary, portable protective ramps, a catenary system or other means should be provided to protect the cable where it traverses pathways.
- 9.17 If the MBSU has two x-ray rooms, the additional electrical power requirements for the x-ray equipment will need to be considered. As each of the x-ray units will require a separate switched and isolated supply, a three phase supply to the trailer should be provided. The rating of the three phase supply will typically be 400V at a minimum of 63A. The line resistance requirements are the same as for a single x-ray room trailer.

On-board generator

- 9.18 Where an electrical generator set is provided it should meet all current standards and guidelines. The rating must be sufficient to serve all electrical loads, including peak demands, at the rated voltage and frequency and within acceptable waveform requirements.
- 9.19 The generator should be appropriately suppressed to prevent the transmission of electromagnetic interference that may adversely affect the normal operation of services and facilities associated with the MBSU and suitably soundproofed. If an on-board generator is fitted, a carbon monoxide detector and alarm should be installed in the rooms closest to the generator.
- 9.20 Starting, control and operation of the generator should be simple to carry out.
- 9.21 Whilst running independently with the generator as the sole source of supply, it should *not* be necessary, for practical reasons, to have to install an earth rod nearby into the ground in order to provide a suitable true earth point for the electrical system. If static electricity becomes a concern, consideration should be given to the fixing of appropriate conductive trailing strips, or other suitable means, to provide electrical contact between the ground and main earthing terminal for the purpose of discharging. In addition, a restricted earth fault protective system, in the form of a core balance current transformer linked to a generator supply dropout contact, should be installed to monitor the generator output phase currents (upstream of the neutral earth connection) and to disconnect the generator if the current imbalance exceeds 30mAs.¹
- 9.22 A monitoring device should be included for the on-board generator to raise the alarm and warn a designated person should the generator stop working or functioning correctly.
- 9.23 The generator should have a fuel tank large enough for the MBSU to be operated for at least three days before refuelling is required.

Generator housed on trailer

- 9.24 A suitable, weatherproof, fire resistant, soundproof enclosure should be provided in which to house the generator. The enclosure should be secure and connected to the security alarm system.

- 9.25 To prevent possible impairment of x-ray image quality, the generator must be mounted on antivibration mountings, which will reduce vibration transmitted to the x-ray unit in the x-ray room to an acceptable level.

Generator housed in a separate enclosure

- 9.26 With this arrangement the generator is housed in a weatherproof, fire resistant, secure and soundproof enclosure, operated away from the MBSU. A suitable mechanism for removing the generator from its trailer housing (usually the end compartment of the trailer) must be provided. The housing should be security protected by the security alarm system.

10. MAINS DISTRIBUTION

- 10.1 The mains electrical distribution system associated with the MBSU should be designed and installed as a TN-S type system having separate neutral and earthing connectors throughout and taking into account the principles listed in the following paragraphs.¹
- 10.2 On a TN-S system the earth terminal is provided by the electricity supply authority. The majority of installations with an underground supply will be part of a system of this type. The consumer's earth terminal is connected by the supply authority to their protective earth conductor to provide a continuous path to earth.

Switching of incoming supplies

- 10.3 Where both landline and on-board generator incoming electrical supplies are provided, means should be provided to ensure that each supply can be manually or automatically selected or isolated safely without the risk of paralleling or other fault condition. A main switch should also be provided in a suitable location in the MBSU to enable the supply to be isolated from all MBSU low voltage emergency services.

Final distribution board

- 10.4 A final distribution board should be supplied and installed that complies with current standards and guidelines. The distribution board should be served from the main switch (see paragraph 10.2) and be complete with integral incoming supply isolator switch, residual current protective device, neutral and earthing bars and a lockable cover.
- 10.5 Space for additional miniature circuit breakers should be available within the circuit board. An adequate number of terminals of appropriate size and rating should be incorporated into the neutral and earthing bars, sufficient to accommodate all relevant conductors with no more than one conductor per terminal.
- 10.6 A chart should be attached to the inside of the distribution board detailing information such as the type, phase, rating and classification of the various protective devices and details of the various items of equipment and areas being served by each circuit.

Low voltage distribution cables

- 10.7 All low voltage cables provided should comply with and be installed according to current standards, codes of practice and guidelines. The installation of flame retardant, halogen free, low smoke and fume cables is advised. These cables are impervious to the ingress of water and will generate minimal smoke and toxic substances in the event of a fire.
- 10.8 Some equipment supplies need to be screened from other services in order to minimise the cross-coupling of electromagnetic interference that may cause unacceptable operational difficulties. Such supplies should be routed separately or electromagnetically screened.

11. PROTECTIVE EARTHING AND EQUIPOTENTIAL EARTH BONDING

- 11.1 The protective earthing and equipotential earth bonding system should comply fully with the requirements of current standards and guidelines. This should ensure that all earth fault protective devices operate satisfactorily and that unacceptable potential differences do not arise between component conductive parts; such differences could cause hazard to persons and equipment associated with the MBSU. It should not be necessary for the provision of an independent earth rod to be driven into the ground adjacent to the MBSU.

Main equipotential bonding

- 11.2 A main equipotential earth bonding bar should be provided in the incoming supply cupboard. The circuit protective conductor associated with the incoming supplies and the earthing bar of the final distribution board in particular should be connected. The bar and each conductor attached must be labelled to identify their functions.

Wiring and marking of supplementary equipotential earth bonding

- 11.3 Supplementary bonding conductors (coloured green/yellow), concealed where practicable, must be run to connect the various exposed conductive parts to the main equipotential earthing bar. The supplementary bonding conductors should be suitably attached to conductive parts and labelled (eg 'Safety Electrical Earth – Do Not Remove') if appropriate.
- 11.4 Wherever practicable the circuits should be wired radially to avoid the possibility of induced potentials and circulating currents within the earthing system.
- 11.5 Earth continuity must not depend solely upon the continuity of conduits or trunking; separate circuit protective conductors should be provided.

12. WIRING SYSTEM

- 12.1 All wiring should be installed flush concealed within the accommodation fabric or otherwise routed such that visible exposure is minimised. Where wiring has to be surface routed, it should be contained within suitable trunking or conduit as appropriate.
- 12.2 All cables and wire ways should be adequately supported to prevent sag or movement.
- 12.3 Wire ways should be designed and installed so as to facilitate replacement of defective wiring or additions to the system with minimal disruption to the accommodation fabric or interference with other services.
- 12.4 The effects of electromagnetic interference to or from other services should be taken into consideration when choosing materials and installing wire ways.

13. LIGHTING INSTALLATION

General lighting

- 13.1 Lighting levels relating to each room or area within the MBSU should not be less than those stipulated in current standards and guidelines.
- 13.2 Lighting within the x-ray room should be provided with controls to allow the level to be dimmed.

Emergency lighting

- 13.3 An emergency lighting system, in compliance with current standards and guidelines, should be installed to automatically provide the necessary levels of illumination and direction control for the safe evacuation of the MBSU following a complete failure of the electrical mains supply system.

External lighting

- 13.4 Suitable weatherproof, vandal resistant, fluorescent lighting units should be mounted external to the MBSU sufficient to satisfactorily illuminate the various entrance stairways and ramps. These lights should be controlled from a switch located immediately inside the main entrance door.
- 13.5 A locker lamp complete with control switch should be installed in each storage cupboard or equipment housing which is accessible from outside the trailer.
- 13.6 If local circumstances warrant it, automatically operated, vandal resistant security lighting should be installed on the MBSU to illuminate the immediate surrounding area whenever a person approaches the unit during periods of darkness.

X-ray warning lights

- 13.7 X-ray exposure warning lights must be provided at the entrance(s) to the x-ray room.

14. WIRING ACCESSORIES

- 14.1 An accessible means of isolation in the form of a switch should be provided adjacent to all electrical equipment.

15. LOW POWER INSTALLATION AND X-RAY ROOM REQUIREMENTS

- 15.1 The contractor will be required to supply and install all conduits, trunking, cables, switches, protective devices and general electrical accessories needed to provide a complete and satisfactory low power and services installation. The installation must meet the performance requirements of the various items of equipment and plant together with the purchaser's requirements, and fulfil the operational needs of the MBSU.
- 15.2 In addition to the fused spurs, flex outlets, switches and socket outlets, etc necessary to serve specific items of equipment, there should be at least one double 13A socket outlet in each major area of general purpose use. In addition a fused electric clock supply point should be fitted on the wall of the reception area.
- 15.3 Final connections to the various items of equipment from the final supply terminal outlet should be as short as practicable, particularly where exposed, in order to minimise the risk of damage to the cable. Flex outlets should be used wherever possible.
- 15.4 The contractor must provide the purchaser with copies of wiring and location diagrams of the installation.
- 15.5 All 13A circuits in the x-ray room must be on the same phase as the x-ray equipment, to prevent under fault conditions a voltage of up to 400V between separate units of equipment.
- 15.6 The main x-ray isolator in the x-ray room must be located in the control area adjacent to the x-ray equipment control unit.
- 15.7 An earth reference bar must be provided adjacent to the main x-ray isolator in the x-ray room.

16. COMPUTING AND TELECOMMUNICATIONS

- 16.1 The provision of a cellular telephone will be the preferred method of providing verbal contact with the MBSU. The Trust should specify the requirements for other forms of communication (eg fax) at the outset, so that the necessary provision can be made.
- 16.2 Suitable network points should be installed to enable connection between the main rooms in the MBSU and between the x-ray set and the on-board computers.
- 16.3 Mammography equipment suppliers should be consulted on the best means of image transfer but this must comply with NHS standards for security and confidentiality and encryption.⁵ It may include satellite links or links into hospital networks or web-based systems.
- 16.4 The local picture archiving and communications system (PACS) provider should be consulted on the procedure for image uploading to the local PACS network.

17. ENTERTAINMENT FACILITIES

- 17.1 The provision of background music or radio facilities may help in creating a more relaxed atmosphere for the patient. A further benefit may be the possible masking of confidential conversations with the radiographer(s) in the x-ray room.

18. NOISE LEVELS

- 18.1 As the MBSU is likely to be fitted with an on-board generator, a specification for maximum noise levels should be considered. Noise can significantly affect a person's ability to work efficiently or to relax. It is therefore essential that in the design of the MBSU consideration be given to minimising noise transmission throughout the unit.
- 18.2 The design of the MBSU should provide sufficient soundproofing to ensure confidentiality for conversations or activities taking place within the x-ray room and reception. A level below 60dB is recommended for both areas.
- 18.3 The operation and design of air conditioning equipment must take account of noise levels generated and transmitted.

19. PANIC ALARM SYSTEM

- 19.1 Consideration should be given to the fitting of a suitable panic alarm system with appropriately positioned buttons within the reception console and x-ray room(s). This may be integrated with the security alarm system, if fitted.

20. STAFF CALL SYSTEM

- 20.1 Consideration may be given to the provision of a staff call system between the reception area and x-ray room(s). The criterion for the provision of such a system will be based on the ability to communicate directly between these areas.

21. PROTECTION FROM LIGHTNING

- 21.1 Wherever practicable, precautions should be incorporated into the MBSU services design to prevent the effects of lightning strikes causing damage or interfering with the normal operation and safety of persons and equipment within the MBSU. Reference should be made to the various equipment manufacturers' recommendations and appropriate standards.

22. FIRE PRECAUTIONS

- 22.1 In respect of fire precautions, the design and construction of the MBSU should be in accordance with all relevant standards, regulations, codes of practice and guidance notes.
- 22.2 Particular attention should be given to using suitable flame retarding and fire resistant materials wherever practicable throughout all aspects of construction. This is especially important for materials which exhibit very low smoke and toxic fume emission properties.
- 22.3 A minimum of two fire escape routes and exits should be provided. Doors that provide a means of escape should be provided with steps.
- 22.4 The provision of fire extinguishers, fire blankets, fire resistant enclosures, signs, notices, instructions, etc should be in accordance with the requirements of the relevant standards and regulations and as requested by the purchaser's local fire authority, whom the contractor should consult.

Fire alarm system

- 22.5 A suitable fire alarm system, complying with all relevant standards and guidance notes, should be fitted to the MBSU. Ionisation smoke detectors, controlled from a control and indicator panel located in the reception area, should be sited in each of the principal rooms and interconnecting corridors. A suitably labelled dedicated electrical supply circuit should serve the fire alarm system from the local distribution board.

23. SECURITY

- 23.1 Trailers are often left unattended for long periods overnight and at weekends on remote sites that are poorly lit and easily accessible to the general public. The incorporation into the trailer design of a high level of security and vandal resistance is therefore essential.
- 23.2 Particular consideration should be given to the provision of the following:
1. facilities to prevent trailer theft
 2. security fittings and locks to all doors
 3. non-opening windows fitted with polycarbonate or toughened glass
 4. metal shutters which obscure and protect doors and windows
 5. a security alarm system
 6. a vision panel at the main entrance door
 7. a chain across the bottom of all sets of steps to the MBSU to deter access to emergency steps and prevent access to the trailer entrance door when the trailer is not in service
 8. the means to dismantle all non-fixed items external to the trailer at risk from a potential thief or vandal and store them in secure lockable cupboards, wired into the security alarm system.

24. SERVICES WHILST NOT OCCUPIED

- 24.1 There are a number of services and facilities which need to remain active during vacant periods. The MBSU must therefore be provided with an alternative source to power these services and facilities and maintain them fully operational until such time as the normal mains electrical supply is restored.
- 24.2 The services to which the above will apply may include:
1. emergency lighting
 2. fire alarm
 3. security alarm
 4. telecommunications equipment
 5. auxiliary heating and cooling system
 6. digital x-ray set
 7. computing facilities.
- 24.3 The alternative source of power may be derived from an auxiliary generator or suitable batteries with a charger or chargers of the appropriate type. The housing containing the batteries should be suitably fire rated, vented, secure and accessible for inspection and servicing as required.
- 24.4 In the event of the normal mains electrical supply failing, transfer to the alternative source of supply should be automatic. However, facilities must be provided for the isolation of all supplies (including alternative sources) while transportation or general servicing is being carried out. In this case devices which require an uninterruptible supply (eg those containing continuously operational software) must be provided with suitable dry batteries or generator.

25. RADIATION PROTECTION

- 25.1 The design and construction of the MBSU should comply with all relevant regulations, codes of practice and guidance notes relating to radiation protection requirements. Prior to construction of the MBSU, advice must be obtained from the Trust's radiation protection adviser (RPA).
- 25.2 Although the construction of the external walls of the trailer will usually provide sufficient shielding from radiation, this is unlikely to apply to the walls and doors forming the internal boundaries of the x-ray room. Additional protection on such walls and doors may therefore be necessary. The final decision on such matters lies with the RPA.
- 25.3 A radiation protective screen will be required adjacent to the mammography unit to protect the radiology staff. This should meet the recommendations set out in MDD01011.⁴
- 25.4 The x-ray room will be a 'controlled area' and must be provided with suitable warning signs.

26. PREPARATORY WORKS FOR X-RAY EQUIPMENT

- 26.1 The various services and facilities needed in preparation for the supply and installation of x-ray and associated equipment should be carried out in accordance with relevant standards and guidance notes (including MEIGaN 2007¹). This should be as stipulated by the x-ray equipment supplier or manufacturer, from whom the contractor should obtain all the required information.
- 26.2 The equipment for which such information is required is as follows:
1. the mammography x-ray unit complete with generator and control unit
 2. the digital imaging system.
- 26.3 Particular attention should be given to the design and installation of the preparatory works in respect of
1. floor and supporting wall loadings
 2. electrical supply requirements (in particular the value of the line resistance)
 3. heat output of the various equipments
 4. environmental requirements such as temperature and humidity.
- 26.4 It is important that the location and orientation of the various items of equipment is agreed with the Trust prior to commencing any pre-installation design work.
- 26.5 Special attention should be paid to the construction and fixing of the radiation protection screen and the provision of attachments to secure the x-ray unit, digital imaging system and other equipment to prevent damage in transit.

27. ACCEPTANCE, INSPECTION AND TESTING

- 27.1 The acceptance by the Trust or a nominated representative of an MBSU, following a successful inspection and testing exercise, will constitute the achievement of the contract's 'practical completion'. Thereafter, the unit will be regarded as being capable of normal use and subject to the terms of the warranty period. This exercise must demonstrate not only that the unit has been constructed in accordance with the Trust's requirements, but also that it is safe and fit for the purpose intended.
- 27.2 It is the contractor's responsibility to ensure that the units offered are fully operational, safe, of suitable quality and functionally acceptable. It is also incumbent on the Trust to ensure by means of thorough inspection and testing by qualified designated persons that this has been satisfactorily achieved.
- 27.3 Initial inspection of the MBSU may, by arrangement, be carried out at the contractor's premises. Inspection and performance testing by the purchaser should be repeated following delivery of the unit(s) to their premises and prior to final acceptance. This inspection will confirm that previous performance results are still valid and that any remedial work at the contractor's premises has been successfully carried out. This process will be facilitated by the screening centre using a standard written checklist for accepting new MBSUs.
- 27.4 Following inspection, the contractor will be required to put right (free of charge) all defects and failures in performance advised by the purchaser. A cycle of repairs and replacements together with repeat inspections and performance testing should continue until final acceptance by the Trust.
- 27.5 The Trust will not be deemed to have accepted the MBSU in its entirety until it has confirmed this in writing to the contractor.
- 27.6 Where delays to the bringing into service of the MBSU arise as a result of defects and failures in performance, the contractor will be required, by arrangement, to reimburse the purchaser for all reasonable financial loss and expense incurred as a consequence of the delay.
- 27.7 Acceptance and commissioning of the x-ray unit and associated digital imaging equipment will form a separate exercise and will normally be performed by the associated medical physics department. This should, by arrangement, include electrical and mechanical safety testing. General guidance is given in *Guidance on the Electrical and Mechanical Safety Testing of Mammographic X-ray Equipment* (NHSBSP Report 0301)⁶ and MEIGaN 2007.¹

Inspection

- 27.8 All items which are reasonably accessible should be visually inspected for signs of
1. damage (eg scratches, watermarks, cracks and wear)
 2. leaks
 3. undue distortion (eg floor flexing, warping)
 4. poor workmanship
 5. loose fittings.

- 27.9 The inspection process should also take into account the provision of
1. suitable labelling, warning notices, signs, identification markings, etc
 2. accommodation, equipment and services in accordance with the specified requirements
 3. documentation verifying compliance with statutory requirements
 4. user manuals and operating instructions.
- 27.10 All items which are considered unacceptable should be noted by the Trust and communicated to the contractor in writing.

Performance criteria

- 27.11 The performance criteria upon which the various structures, equipment and systems will be tested for acceptance and the extent of performance tests should be agreed between the Trust and contractor before the commencement of design and construction. In cases where the contractor cannot comply with the Trust's requirements, alternative proposals may be submitted to the Trust for discussion and agreement.
- 27.12 The contractor will be obliged to satisfy the Trust that the entire MBSU complies fully with the requirements of the agreed performance criteria.

28. USER TRAINING

- 28.1 In order to ensure their satisfactory operation, the contractor should allow for the costs of instructing and demonstrating to the Trust's staff the operation of all items of equipment considered necessary by the Trust. This training should be carried out shortly before the MBSU is brought into clinical service.
- 28.2 A list should be drawn up by the contractor, for submission to the Trust, scheduling all items, equipment and services associated with the MBSU which may require written instructions and/or demonstration of their use. The Trust should identify those items on which the staff will need training and agree with the contractor when the training will take place.

29. PREPARATION FOR TRANSPORTATION OR RELOCATION OF MBSUS

Securing equipment prior to transportation

- 29.1 All equipment located inside the MBSU must be secured prior to transportation or relocation. In particular there must be an effective means of securing the x-ray unit and its radiation protective screen and the digital imaging equipment with adequate fixing locations, as recommended by the equipment supplier. It is the responsibility of the suppliers of the x-ray

unit and digital imaging equipment to provide adequate information and written instructions on how to secure the equipment provided by them, ready for movement.

Responsibility for securing equipment

29.2 Equipment that has not been correctly secured may be damaged during transport, and this can result in unexpected high costs of repair or replacement and possible disruption of service. Arrangements for moving the MBSU may be made locally (eg by the local NHS Trust) or by an outside contractor. In either case, responsibility for correctly securing *all* the equipment located inside the MBSU, including the x-ray unit and digital imaging equipment, should be clearly defined. If the MBSU staff or local organisations take responsibility, it may be advisable to ensure that adequate insurance cover is provided for the equipment installed in the MBSU. If the responsibility lies with an outside contractor, the contract should clearly state that any damage due to incorrect securing of equipment is the contractor's liability.

30. ROUTINE SERVICE AND MAINTENANCE

30.1 This should include all aspects of the MBSU. The trailer manufacturer will normally be responsible for maintenance of the trailer and associated options. The appropriate supplier or service organisation will maintain the x-ray unit and digital imaging systems. Maintenance of the motor generator, air conditioning unit, auxiliary heating, etc must also be considered and appropriate arrangements made.

30.2 A comprehensive 12 month parts and labour warranty is required for the build, conversion and specified items; an option to extend may be included at the Trust's request. Trusts should also be given the option of taking out a maintenance agreement at the time of purchase.

30.3 An annual electrical safety check is required on the trailer facilities.

30.4 The roadworthiness of the MBSU should be checked annually.

31. UPGRADING EXISTING TRAILERS

31.1 Consideration must be given to Trusts that may require refurbishment of their analogue trailers.

REFERENCES

1. *Medical Electrical Installation Guidance Notes (MEIGaN)*, Medicines and Healthcare Products Regulatory Agency, Version 2 September 2007 (or later edition when applicable).
2. *Guidance Notes for the Installation of Electrical Supply for NHSBSP Mammography Trailers*. NHS Cancer Screening Programmes, 2003 (NHSBSP Equipment Report 0503).
3. *Water Systems: Health Technical Memorandum 04-01. The Control of Legionella, Hygiene, 'Safe' Hot Water, Cold Water and Drinking Systems. Part A: Design, Installation and Testing*. Department of Health Estates and Facilities Division, 2006 (Health Technical Memorandum 04-01 Part A).
4. *Further Revisions to Guidance Notes for Health Authorities and NHS Trusts on Mammographic X-ray Equipment Requirements for Breast Screening*. NHS Cancer Screening Programmes, 2001 (MDA01011).
5. www.connectingforhealth.nhs.uk/systemsandservices
6. *Guidance on the Electrical and Mechanical Safety Testing of Mammographic X-Ray Equipment*. NHS Cancer Screening Programmes, 2003 (NHSBSP Report 0301).

APPENDIX 1: REGULATIONS APPLYING TO THE USE AND DESIGN OF TRAILERS

Clean Air Acts, 1956 to 1978

Code of Practice for the Control of Legionellae in Health Care Premises

Control of Pollution Regulations

Control of Substances Hazardous to Health Regulations (COSHH)

Disability Discrimination Act 1995

Electricity at Work Regulations, 1989

Environmental Protection Act

Fire Precautions Act, 1971 and associated regulations

Health and Safety at Work Act, 1974 (together with all associated regulations, particularly the Workplace, Health, Safety and Welfare ACOP, 1992 and the Manual Handling Regulations)

Water Systems: Health Technical Memorandum 04-01. The Control of Legionella, Hygiene, 'Safe' Hot Water, Cold Water and Drinking Systems. Part A: Design, Installation and Testing. Department of Health Estates and Facilities Division, 2006 (Health Technical Memorandum 04-01 Part A).

Ionising Radiation Regulations, 1999, together with the associated Code of Practice and Guidance Notes

BS7671, IEE Wiring Regulations (current edition)

Medical Electrical Installation Guidance Notes (MEIGaN) Version 2 September 2007 (or later edition when applicable)

Telecommunications Act, 1984

Water bylaws

APPENDIX 2: GUIDANCE NOTES FOR THE NHSBSP

STD/89/10 Guidance Notes for Health Authorities on Stereotactic Devices for Fine Needle Aspiration and Positioning Marking of Impalpable Breast Lesions

MDD/91/13 Guidance Notes for Health Authorities on Specimen Radiography Cabinets and Accessories for use during Surgical and Pathological Procedures.

MDD/93/33 Guidance Notes for Health Authorities and NHS Trusts on Requirements for Breast Screening Mobile Trailers and Drawing Vehicles.

MDA/98/52 Further Revisions to Guidance Notes for Health Authorities and NHS Trusts on Ultrasound Scanners used in the Examination of the Breast with Protocol for Quality Testing.

MDA01011 Further Revisions to Guidance Notes for Health Authorities and NHS Trusts on Mammographic X-ray Equipment Requirements for Breast Screening.

Medical Electrical Installation Guidance Notes (MEIGaN) Version 2 September 2007 (or later edition when applicable)

APPENDIX 3: BRIEFING NOTES FOR TRUSTS

(For ease of reference, these notes follow the numbering of the sections on which they are based.)

1. GENERAL

The NHS Purchasing and Supply Agency (PASA) provides assistance with procurement of the mobile breast screening unit (MBSU) and NHS Supply Chain assists with procurement and delivery of the digital x-ray equipment.

2. REGULATIONS

2.1 Relevant regulations are listed in Appendix 1.

2.2 Service providers have a duty under the Disability Discrimination Act (DDA) 1995 to make reasonable adjustments to ensure that disabled people do not find it impossible or unreasonably difficult to access that service. This may include changes such as

- altering policies, procedures or practices which make it impossible or unreasonably difficult for a disabled person to access a service
- removing, altering or avoiding physical obstacles to access
- providing alternative methods of accessing the service if physical feature(s) make access unreasonably difficult for a disabled person.

Owing to the restricted space in mobile breast screening units, it is more appropriate to offer wheelchair users an appointment at a local static unit that is convenient for them.

Equal Access to Breast and Cervical Screening for Disabled Women. NHSBSP Publication (Sheffield) Cancer Screening Series No 2, March 2006.

4. ACCOMMODATION

4.1 General

The Trust must agree the exact accommodation requirements within the MBSU at the minicompetition[†] stage. Experience shows that great care has to be exercised in ensuring that the domestic furnishings and such items as shelves in cupboards are precisely specified. If not, they may be omitted; and since the fittings are made to measure such omissions are difficult to rectify after delivery.

4.2 Entrance lobby

Consideration may be given to an entry phone at the main entrance door and/or security cameras, with a switch for the door lock at the reception desk.

[†]A minicompetition is one in which tenders are invited from preferred suppliers under the terms of a framework agreement.

4.3 *Reception and waiting area*

Measures for ensuring privacy and confidentiality at the reception desk will depend on operational requirements. If questions of an exclusively non-sensitive nature are asked at the reception desk and the more personal information obtained when the patient is in the x-ray room, then the need for privacy at the desk is lessened. If not, a separate area for confidential conversation with the patient may be required.

4.7 *Internal general equipment store*

The Trust should decide who is to provide items 6 (vacuum cleaner) and 7 (coat hooks) at the time the contract for supply of the MBSU is drawn up, so that the cost is not omitted from financial provisions.

5. BODYWORK CONSTRUCTION

5.2 *Room configurations*

Since the room configurations will vary in the trailer layouts proposed by the various manufacturers, it would be unhelpful to make specific recommendations for internal room sizes. The offerors should use their expertise to design a suitable layout taking account of economic and ergonomic factors.

9. ELECTRICAL SERVICES

9.2 *Electrical mains supply*

The Trust must define at the outset whether the electrical supply requirements to the MBSU will be derived from

1. a landline
2. a generator
3. multiple sources, ie provided with a generator but also capable of connection to a landline supply.

9.3 *Landline electrical supply*

A 32A supply is unlikely to be adequate for digital equipment and the consequent additional air conditioning requirements on a MBSU, and specific advice should be obtained from the equipment supplier. Breast screening centres with sites that have only a 32A supply for existing trailers will need to consider an upgrade to a 63A facility.

It is important that the x-ray equipment supplier/manufacturer is consulted about the maximum allowable line resistance when the electrical supply services are specified. Experience with mobile installations in the NHSBSP has suggested that most current mammography x-ray units can be operated over a range of line resistance values up to 0.6 Ω . Therefore, ideally the line resistance of each mains outlet should not exceed 0.4 Ω and should in no case exceed 0.6 Ω . Prospective

purchasers are advised to ensure that the supplier or manufacturer performs such tests as are necessary to confirm that the proposed equipment will function correctly from each mains supply. The tests should include measurement of the line resistance both between line and neutral and between line and earth.

16. COMPUTING AND TELECOMMUNICATIONS

The Trust should specify the requirements for other forms of communication (eg fax) at the outset, so that the necessary provision can be made.

17. ENTERTAINMENT FACILITIES

The Trust should be aware that the use of recorded music could involve payment of fees to the Performing Right Society (PRS for Music).

27. ACCEPTANCE, INSPECTION AND TESTING

27.1 General

Initial inspection of the MBSU may, by arrangement, be carried out at the contractor's premises. Inspection and performance testing by the Trust should be repeated following delivery of the unit(s) to its premises and prior to final acceptance. This inspection will confirm whether previous performance results are still valid and whether any remedial work at the contractor's premises has been successfully carried out. This process will be facilitated by the screening centre using a standard written checklist for accepting new MBSUs.

Acceptance and commissioning of the x-ray unit and associated digital imaging equipment will form a separate exercise and will normally be performed by the designated medical physics department. This should, by arrangement, include electrical and mechanical safety testing. General guidance is given in NHSBSP Report 0301 (*Guidance on the Electrical and Mechanical Safety Testing of Mammographic X-ray Equipment*) and MEIGaN 2007.

27.2 Inspection

All items which are reasonably accessible should be visually inspected for signs of

1. damage (eg scratches, watermarks, cracks and wear)
2. leaks
3. undue distortion (eg floor flexing, warping)
4. poor workmanship
5. loose fittings.

The inspection process should also take into account the provision of

1. suitable labelling, warning notices, signs, identification markings, etc
2. accommodation, equipment and services in accordance with the specified requirements
3. documentation verifying compliance with statutory requirements

4. user manuals and operating instructions.

All items which are considered to be unacceptable should be noted by the Trust and communicated to the contractor in writing.

27.3 Performance criteria

The performance criteria upon which the various structures, equipment and systems will be tested for acceptance and the extent of performance tests should be agreed between the Trust and contractor before the commencement of design and construction. In cases where the contractor cannot comply with the Trust's requirements, alternative proposals may be submitted to the Trust for discussion and agreement.

The contractor will be obliged to satisfy the Trust that the entire MBSU complies fully with the requirements of the agreed performance criteria.

29. PREPARATION FOR TRANSPORTATION OR RELOCATION OF MBSUS

29.1 Securing equipment prior to transportation

All equipment located inside the MBSU must be secured prior to transportation or relocation. In particular the x-ray unit and its radiation protective screen and the digital imaging equipment must have an effective means of securing with adequate fixing locations as recommended by the equipment supplier. It is the responsibility of the suppliers of the x-ray unit and digital imaging equipment to provide adequate information and written instructions on how to secure the equipment provided by them, ready for movement.

29.2 Responsibility for securing equipment

Equipment that has not been correctly secured may be damaged during transportation, resulting in unexpected high costs of repair or replacement and possible disruption of service. Arrangements for moving the MBSU may be made locally (eg by the local NHS Trust) or by an outside contractor. In either case, responsibility for correctly securing *all* the equipment located inside the MBSU, including the x-ray unit and digital imaging equipment, should be clearly defined. If the MBSU staff or local organisations take responsibility it may be advisable to ensure that adequate insurance cover for the equipment installed in the MBSU is provided. If the responsibility lies with an outside contractor, the contract should clearly state that any damage due to incorrect securing of equipment is the contractor's liability.

30. ROUTINE SERVICE AND MAINTENANCE

This should include all aspects of the MBSU. The trailer manufacturer will normally be responsible for maintenance of the trailer and associated options. The appropriate supplier or service organisation will maintain the x-ray unit and digital imaging systems. Maintenance of the motor generator, air conditioning unit, auxiliary heating, etc., must also be considered and appropriate arrangements made.

A comprehensive 12 month parts and labour warranty is required for the build, conversion and specified items; an option to extend may be included at the Trust's request. Trusts should also be given the option of taking out a maintenance agreement at the time of purchase.

An annual electrical safety check is required on the trailer facilities.

The roadworthiness of the MBSU should be checked annually.

31. UPGRADING EXISTING TRAILERS

The option of upgrading an existing trailer may not be straightforward. Owing to the extra level of insulation required and the probable need for an on-board generator to maintain environmental conditions, the existing framework and chassis may be inadequate or too small to convert to the required design for a digital trailer.

The current age and condition of an existing trailer will also have an influence on the success or otherwise of achieving an upgrade to an existing trailer. Trusts are advised to establish whether the MBSU manufacturer would be able to upgrade the existing trailer at a cost-effective charge. If not, the manufacturer might be able to offer a trade in cost to offset the price of a new trailer.

The environmental requirements for computer radiography systems may be less stringent than for digital radiography systems, which may facilitate the re-use of a MBSU equipped with a film–screen system.

APPENDIX 4: INFORMATION TO BE PROVIDED BY CONTRACTORS TO TRUSTS ON COMPLETION OF MINICOMPETITION‡

The contractor must provide the Trust with sufficient details of the operational and technical features to enable all aspects of the design and construction to be assessed during the procurement process.

The contractor should not implement any proposals without the Trust's prior consent.

The following information should be provided as a minimum requirement:

1. general dimensional outline drawing plan and elevations of the external views of the assembly, suitably annotated to identify principal items
2. scaled plan and elevation drawings, detailing the proposed internal arrangements of the furniture, fixtures, fittings, accessories and equipment, etc
3. proposed electrical schematic wiring diagrams
4. mechanical services schematic and isometric drawings overlaid on to the scaled drawings
5. general description of
 - the method and type of construction of the accommodation, insulation, trailer and vehicle assembly, together with details of the materials to be used
 - vehicle assembly details (ie weights, floor loadings, coupling device, method of braking, wheels, suspension, manoeuvrability, range, trailer, levelling device, etc)
 - external environmental design considerations (eg weather tightness, heat losses, finishes, etc)
 - the various electrical, mechanical, plumbing and drainage services, together with associated equipment design criteria
 - equipotential earth bonding and earthing arrangements
 - radiation protection measures
 - security precautions
 - fire precautions
 - storage facilities and capacities of the fuel, water and drainage services.
6. estimated values for
 - maximum demands, prospective short-circuit current and earth loop impedance of the electrical services
 - consumption rates of fuel, water and other consumables relating to primary services
7. external service connection requirements, nominal ratings, capacity, connector details, flow rates, protection and isolation facilities, etc
8. schedule of all equipment including details of the manufacturer, model number and specification
9. outline programme for the design, construction, testing and commissioning of the unit being offered.

In order to protect all parties, it is essential to define clearly the responsibilities of all persons involved and to establish exactly what is to be purchased.

The successful contractor should prepare drawings and a detailed specification showing the agreed layout and options. When agreed, a nominated person representing the Trust and a representative of the contractor should sign the drawings and specification. Both parties should retain copies.

‡A minicompetition is one in which tenders are invited from preferred suppliers under the terms of a framework agreement.

The final drawings should also be available to the suppliers/manufacturers of the other equipment for their information.

The contractor should also draw up a detailed timetable of the production process and communicate this to the Trust and the other equipment suppliers/manufacturers. The dates on which particular equipment needs to be installed should be clearly identified. If there are any delays or if the timetable is adjusted, this must be communicated to all parties as soon as possible. This must also happen if there are delays to equipment deliveries.