

Buyers' guide

Operating tables

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General

Operating tables are designed to provide a surface that supports a patient's body during surgical procedures. They are a key component in the operating theatre environment and help ensure that operations are conducted in a safe and efficient manner.

Conventional operating tables consist of a modular, rectangle shaped tabletop supported by a fixed pedestal base (operating table system) or a movable base (mobile operating tables).

The operating table systems have different interchangeable tabletops that can be fitted to the fixed pedestal. The patient is placed onto a tabletop; this is then placed on to a trolley (sometimes called a transporter) to wheel the patient into the operating theatre where the tabletop is then fixed onto the pedestal.

Mobile operating tables have non-transferable tops. A tabletop is permanently attached to a movable base that has three to four castors or wheels and brakes. The patients are positioned on the operating tables and then wheeled into the theatre. The base and wheels are locked during surgical procedures to prevent movement.

The modular tabletop, for both types of bases, is usually split into head, body and leg/foot sections. The individual segments can be adjusted (or removed) to correctly position a patient. This can be done hydraulically using foot pedals, electrically using hand controls (see *Operational considerations*) or manually by the theatre staff. Accessories are available to attach to the tabletops to enhance the usability of the tables, particularly for orthopaedic procedures. This can allow more than one type of operation to be carried out on a particular table, which is essential to allow continuous workflow through the operating theatre and to increase overall efficiency.

In 2007/08 there were 8,606,493 main surgical procedures performed in England [1, 2]. Both major and minor surgery is performed on operating tables. Major surgery could include surgery of the head, neck, chest and abdomen and may involve lengthy recovery times. Minor surgery is often performed as a day case where the patient undergoes a procedure within the hospital but is released on the same day [3].

There are many different surgical specialties but they broadly fall into the following categories: cardiothoracic, general, neurosurgery, oral and maxillofacial, otolaryngology (ENT), paediatric, plastic/reconstructive, orthopaedics/trauma, urology, obstetrics/gynaecological and ophthalmic [3, 4]. Each surgical speciality has diverse requirements of an operating table as the patients can be positioned differently for every surgical operation that is performed. For example, patients who undergo an obstetric or gynaecological procedure may need a table that can be

placed into the lithotomy position (legs raised and sometimes split), whilst a person requiring an ophthalmic procedure will probably need a table that will convert to the chair position. Detailed information on table positioning can be found in *Operational considerations*.

There are two types of surgical operations performed that will be discussed in this guide; open and laparoscopic (also known as keyhole or minimally invasive surgery (MIS)). Open surgery has historically been the most commonly performed type of surgery, however, laparoscopic surgery is now much more frequently performed [1]. Robotic surgery is now growing in popularity and is performed in a similar manner to laparoscopic but causes even less trauma to the patient [5].

Open surgery involves cutting skin (sometimes 200mm in length) and tissues so the surgeon has direct access to the structures or organs involved [4, 6]. Laparoscopic surgery involves very small incisions (5-15mm) through the skin, body cavity or anatomical opening through which an endoscope / laparoscope is inserted. The surgeon views the area to be operated on by looking through a fibre optic light source inserted through a cannula (tube) into the incisions and operates using special instruments also inserted through the tube. Laparoscopic surgery specifically refers to operations within the abdominal or pelvic cavities. Keyhole surgery refers to other parts of the body such as the thoracic or chest cavity. These procedures are still considered major surgery and as with open surgery, are carried out under anaesthetic [7].

Scope

This buyers' guide compares all operating tables available in the UK at the time of writing. There are 10 manufacturers / suppliers providing a total of 55 operating tables available for purchase in the UK market. The *Market review* section of this guide compares the technical specifications for each table.

The information supplied in the specification tables was correct and confirmed in January 2009 by the manufacturers / suppliers. Operating tables that were not established as being available to the UK market have not been included.

The guide also investigates the ergonomics of the operating tables when used within an operating theatre. Ergonomics produces and integrates knowledge from the human sciences to match jobs, systems, products and environments to the physical and mental abilities and limitations of people. In doing so, it seeks to improve health, safety, well-being and performance.

There is a high risk of surgical patients developing pressure ulcers [8]. This guide contains a review of the different pressure-redistributing operating table surfaces,

available to the UK market, which can be used as aids to prevent the development of pressure ulcers in patients undergoing surgical procedures.

Ergonomics issues

The majority of current operating theatres have been designed to allow the performance of open conventional surgery [9]. However, both open and laparoscopic surgery requires specific operating table adjustability to maximise the safety and efficiency of each type of procedure. Table 51 (*appendix 3*) provides a review of published research which discusses the differences between open and laparoscopic surgery and how these impact upon the performance and health of surgical staff.

The height of the operating table influences the movement of the upper limbs and the degree of spinal flexion adopted by the surgeon and the assistant during all types of surgery. Table 52 (*appendix 3*) compares the different studies available regarding operating table height.

Working in partnership with the Ergonomic and Safety Research Institute (ESRI) at Loughborough University, a computer aided design (CAD) programme was used to model clinical scenarios for both open and laparoscopic surgical procedures. This involved a methodology based on anthropometric data which scrutinised the range of adjustment offered by different models of operating tables. Further ergonomic considerations sought to provide guidance on the optimal operating tables for applications where multiple users may be interacting with the tables within a theatre setting. The results are shown in the *Market review* section.

Pressure ulcers and surgical procedures

Pressure ulcers (also known as decubitus ulcers or pressure sores) are areas of localised skin damage caused by the occlusion of blood vessels. They are most commonly found at bony prominences of the body such as the sacrum, heels, shoulders and hips [8].

Pressure ulcers form when external pressure exceeds the tissue capillary pressure of 25 to 32 mm Hg. This pressure impedes blood flow for a period of time therefore altering tissue perfusion resulting in the formation of an ulcer [8]. The pressure 12.5mm below the skin surface is 3 to 5 times greater than the interface pressure [10]. This causes the deeper tissue to die first before working up to the surface tissue.

Tissue damage (leading to a pressure ulcer) after an intraoperative procedure, may not be visible for several days, due to the damage developing in the muscle and subcutaneous tissues and progressing outwards [8]. This delay is the reason why,

until recently, it was not realised that a pressure ulcer could form as a result of a surgical procedure and thus surgical patients had the potential to develop extensive pressure ulcer problems.

The incidence of pressure ulcer development in surgical patients ranges from 12% to 45% depending on which study is consulted [8]. A study from 1999 reports that patients who undergo a surgical procedure have a 90% greater chance of developing a pressure ulcer than in non-surgical hospital patients [11].

There are several surgical specific risk factors (intrinsic and extrinsic) that may increase the chance of a patient developing a pressure ulcer, see tables 53 & 54 in *appendix 3* for a more in depth explanation of these risk factors.

Operating tables' pressure-redistributing surfaces

Pressure ulcer reduction interventions include pressure-redistributing surfaces. These can be overlays or mattresses and vary in shape, size and material. Their aim is to reduce the magnitude and/or duration of pressure between the patient and the support surface. It is recommended that 'at risk' patients should be placed on a non-redistributing surface for no more than two hours [12, 13].

Operating tables are now usually supplied with pressure-redistributing mattresses as standard. However, older tables which do not have this type of mattress are still used in operating theatres. Table 55 (*appendix 3*) provides a summary of the studies comparing various different operating table mattresses.

The operating table mattress or overlay should be X-ray translucent to allow uninterrupted imaging of patients. It is very important that the correct X-ray translucent mattress is used as bubbles in fluid or air mattresses might show on X-rays which could lead to an incorrect diagnosis.

National guidance

One national guidance document exists for operating tables; this is summarised in table 1. Much of its key recommendations are now out of date due to technological advancements in surgical procedures and operating table design. The National Institute for Health and Clinical Excellence (NICE), Medicines and Healthcare products Regulatory Agency (MHRA) and the Royal College of Nursing (RCN) have developed guidance on pressure ulcers which supports the use of pressure-redistribution surfaces (table 2). Mattresses are discussed further in a previous CEP buyers' guide [14].

Table 1. National guidance on operating tables

Origin	Title	Key recommendations
<p>A report to the Department of Trade and Industry (DTI)</p> <p>This is a collection of reports commissioned by the DTI to a 'Working group' promoting the development and manufacture of British medical and surgical devices. The final compilation of the reports was undertaken by David Rosen and Chris Kemp.</p>	<p>The operating room of the year 2010, (1999) [15]</p>	<p>This report discussed the 1999 design of operating tables (as dictated by standard BS6859) and their future design (aimed at the year 2010). It is not an official guidance document; however it is relevant to the construction of modern operating tables. The report stated in 1999:</p> <ul style="list-style-type: none"> the maximum patient weight a table could take (BS6859) was 135kg the tables were height adjustable and accessories were available to aid in surgical procedures manual handling regulations encouraged the use of lightweight material, particularly for detachable parts and accessories increase in obesity in the UK will increase the demand for bariatric tables most of the tables that were available had manual controls with mechanical or hydraulic operation. Tables in future were expected to be powered with control handsets that give the operator information regarding the condition of the table, position of the table X-ray film systems were declining in 1999 and would probably be obsolete by 2010, so provision for cassette systems would no longer be necessary. This allows future tabletops to be thinner making it easier to manoeuvre the C-arm the likely increased use of MRI and ultrasound scanners in surgery will also affect table design MIS / laparoscopy may account for up to 75% of surgical procedures by 2010, which changes the requirements for the operating table. <p>The report summary proposed a number of innovations in operating table design:</p> <ul style="list-style-type: none"> use of new materials to improve imaging and reduce weight pre-programmable control systems using voice activation and joystick controls integration of operating table and robotic system controls integration of vacuum bead pads and inflatable systems in the table reduced minimum height greater load bearing capacity an offset column design to improve imaging access. <p>The report also states that in 1998 the European Union Medical Device Directive was implemented with which all operating tables sold in the European Union have to comply and bear a CE mark.</p>

Table 2. National guidance documents on pressure ulcer & pressure-redistribution products

Origin	Title	Key recommendations
National Institute for Health and Clinical Excellence (NICE)	Pressure ulcers: Prevention and pressure-relieving devices, 2003 [16]	<ul style="list-style-type: none"> ▪ A risk assessment should be undertaken by an appropriately trained person within 6 hours of patient admission. ▪ Assessment tools should be an aid and not replace clinical judgement. ▪ Risk factors must be considered when assessment is completed. ▪ Pressure-redistribution device allocation should be based on cost considerations and overall assessment of patient. ▪ All individuals assessed as being vulnerable to pressure ulcer development should be placed as a minimum on a high-specification foam mattress (see <i>Technical considerations</i>). ▪ Elevated risk patients should be placed on a pressure-redistributing device. ▪ All patients undergoing surgery should have a minimum protection of a pressure-reducing theatre mattress. ▪ All clinicians should be educated regarding pressure ulcer prevention, risk assessment and the selection, use and maintenance of support surfaces.
Royal College of Nursing (RCN) - commissioned by NICE	The use of pressure-relieving devices (beds, mattresses and overlays) for the prevention of pressure ulcers in primary and secondary care, 2004 [17]	<p>This report reiterates the clinical recommendations given by NICE [16], and identifies areas where further research is required:</p> <ul style="list-style-type: none"> ▪ Compare the different types of mattresses and overlays available to include cost-effectiveness and economic cost of devices. ▪ Investigate the impact of having a pressure ulcer on the quality of life of patients and carers. ▪ Evaluate the impact/effectiveness of patient assessment at the point of entry to healthcare. ▪ Evaluate the need for and frequency of the repositioning of patients. ▪ Improve the understanding of risk factors. ▪ Research patients' need for and use of pressure-redistributing devices across a 24hr period. ▪ Study the longevity of the different types of devices available. ▪ Evaluate the reductions in pressure ulcer incidence from mattress use in different clinical settings.
NICE	Pressure ulcer management National cost-impact report, cost analysis of the new recommendations in the prevention and treatment of pressure ulcers, 2005 [18]	<p>This report examines the cost impact of implementing the recommendations made in the 2004 RCN/NICE guidelines [17]:</p> <ul style="list-style-type: none"> ▪ Cost analysis showed that the implementation of the guideline is not quantifiable but is unlikely to have significant cost implications for the NHS. ▪ Clinicians consulted felt that the guidelines would not lead to a change in practice that would have a significant cost impact. Many nurses felt that the practices recommended in the guide were already being employed.

Origin	Title	Key recommendations
RCN - commissioned by NICE	Pressure ulcers: The management of pressure ulcers in primary and secondary care, 2005 [19]	<p>This quick reference guide provides evidence-based recommendations on the treatment and prevention of pressure ulcers in primary and secondary care utilizing previously published NICE guidelines [16, 17].</p> <ul style="list-style-type: none"> ▪ Patients with pressure ulcers should have access to pressure-redistributing support surfaces 24 hours a day. ▪ All patients assessed as having a grade 1-2 pressure ulcer should as a minimum provision be placed on a high-specification foam mattress combined with close observation and documented positioning and re-positioning regime. ▪ If there is any perceived/actual deterioration of affected areas, an alternating pressure (AP) mattress or overlay or a sophisticated continuous low pressure (CLP) system (low-air-loss or air-fluidisation system) should be used.

British standards

There is one British standard for operating tables with two parts: Part 1 applies to mobile operating tables and Part 2 applies to operating table systems that have a fixed pedestal and transferable tabletops [20, 21]. There is also a British standard (1992) for operating table mattresses and mattress sections [22].

The operating table standard was developed and published in 1987 and there have been no subsequent updates. As a result, parts of the standard do not reflect current technology and this has been noted where relevant in the following tables.

British Standard BS 6859: 1987: Part 1. Mobile general operating tables

This part of the standard specifies the requirements for mobile general operating tables with non-transferable tops of four or more sections (table 3). Specialist mobile operating tables and table accessories are not included. Dimensions for accessory clamps are specified to ensure accessories are interchangeable between tables.

Table 3. Summary of British Standard BS 6859:1987: Part 1. Mobile general operating tables

Dimensions and height (minimum length and maximum width)(mm))	
Tabletop (TT)	(Length) 1850 / (Width) 620 (inc. side bars).
Trunk section	(Length) 840 / (Width) 470 (excl. side bars).
Height	650 (minimum) with minimum of 200 adjustment upwards (excl. mattress).
Floor clearances	12 (between floor and table base).
General requirements* (minimum / maximum)	
Trendelenburg	35° (in less than 8 seconds) / 45°.
Lateral tilt	15° / 20°.
Break-back point	Extension 220° / Flexion 130°.
Chair position	Must be possible to adjust the TT to form a chair.
Table rotation	If the TT can be rotated in the horizontal plane with respect to the base then a mechanism to lock it in any position must be provided.
Mobility	<ul style="list-style-type: none"> ▪ Must be able to move in a forward & backward direction without lateral drift. ▪ Must be able to immobilise the table with a single control.
Head section	<ul style="list-style-type: none"> ▪ Capable of any angle between -45°±1° (downwards) / +10° (upwards) ▪ Quick release fitted with self-locking device capable of overriding adjustment control.
Single leg	Adjustable downwards to a minimum of 100°.
Divided leg	<ul style="list-style-type: none"> ▪ Minimum rotation outwards in horizontal plane of not less than 100°. ▪ Should have an independently adjustable down angle of 100° (minimum).

- Detachable sections**
- If both leg (Single leg) & head sections detach they should be interchangeable & not removable without the release of a locating / locking device.
 - The sections should not be removable without the release of a locating or locking device.

Table side bars (mm)

- Dimensions**
- The side bars should be manufactured from either stainless steel of grade 304S15 or 431S29 as specified in BS970: Part 1 or from a material of equivalent weight bearing resistance**.
 - Cross section: $31.5^{+0.25}_{-0.5} \times 6.2 \pm 0.15$
 - The gap between side bars should not be less than 10mm from the TT side.

Dimensions of side bar accessory clamps (mm)

- Accessory clamp sockets**
- Side bar socket: $32.5^{+0.5}_{-0.5} \times 7.0^{+0}_{-0.5}$.
 - Circular accessory socket: circle diameter $16.5^{+0}_{-0.5}$.
 - Rectangular accessory socket: $32.5^{+0.5}_{-0.5} \times 7^{+0}_{-0.5}$.
 - Square accessory socket: square with edge length $16.5^{+0.5}_{-0.5}$.

- Accessory rods**
- Circular section: diameter of cross section $16.5^{+0}_{-0.5}$.
 - Rectangular section: dimensions of cross section of rod $31.5^{+0.25}_{-0.5} \times 6.2 \pm 0.15$.
 - Square section: edge length of cross section $16.5^{+0}_{-0.5}$.

Radiographic requirements

- Tabletop**
- Space below the TT for an X-ray film cassette with dimensions of 383.5mm x 459mm**.
 - Must be possible to load an X-ray cassette from both head and foot ends of the table**.
 - A device must be provided to enable the X-ray film cassette to be placed in position**.

Mattress

- The TT must be covered by a removable, washable, antistatic mattress segmented or hinged to conform to the different configurations and TT size.
- Should be attached to the TT and not impede adjustments of the TT / fitting of accessories.

Design recommendations

Table base Should be designed to minimise obstruction to the feet and legs of theatre staff.

Floor loading Wheels/castors should result in low static/dynamic pressure on floor surfaces proportionate to ease of mobility with suspension that allows full contact with floor whilst table is being moved.

Brake Release of mechanism should not result in a significant drop in the height of the TT.

Radio-translucency of the tabletop

Tabletop (excl. mattress) Attenuation equivalent to no greater than 1mm thickness of aluminium determined from measurements of air Kerma under narrow beam conditions.

* For the different types of operating table positions, see figure 1 in *Operational considerations*.

** This is no longer relevant in the current market due to technological advancement, however it is included as this British Standard has yet to be updated to reflect this.

British Standard BS 6859: 1987: Part 2. Fixed-pedestal general operating tables

This part of the standard specifies requirements for fixed-pedestal general operating tables with transferable tops of four or more sections. Tables intended for specialist procedures and table accessories are not included. This standard mainly specifies the same requirements as Part 1 (summarised in table 3). The additional requirements in Part 2 are highlighted in table 4.

Table 4. Summary of British Standard BS 6859: 1987: Part 2. Fixed pedestal general operating tables

General requirements*	
Tabletop	If removable from base, release of locating / locking device required.
Pedestal unit	If this rotates, a mechanism should be provided to lock it in to any position.
Transporters for use with removable tabletop [used to transport patient in & out of theatre]	
Tabletop	<ul style="list-style-type: none"> ▪ Transfer of the TT between pedestal and transporter should be possible by manual control. ▪ The TT should be locked into the pedestal on takeover of the TT from the transporters. ▪ The TT should be achieving Trendelenburg position of not less than 15° whilst on the transporter.
Pre-positioning	Pre-positioning of patient or accessories should not affect stability of transporter / top combination.
Immobilisation	Provision should be made to immobilise the transporter.
Floor loading	Transporter should have large diameter wheels for easy manoeuvring & prevent damage to floors.
Brake	Release of mechanism should not result in a significant drop in the height of the TT.

* For the different types of operating table positions, see figure 1 in *Operational considerations*.

British Standard BS 2891: 1992: Operating table mattresses & mattress sections

This standard specifies requirements for removable operating table mattresses and mattress sections that have a flexible load-bearing core and waterproof cover intended for use on operating tables to give a flexible support between patient and the tabletop (table 5). Accessory pads are outside the scope of this standard.

Table 5. Summary of British Standard BS 2891: 1992: Operating table mattresses and mattress sections

Materials and construction	
Construction	<ul style="list-style-type: none"> ▪ The surface should provide a consistent pressure between the mattress and the patient across the whole area of contact. ▪ Adhesives should not have any harmful effects on the core or cover material. ▪ When supplied the mattress should be clean and free from objectionable odour and any substances that are likely to cause harm to the patient.
Cover	The cover should completely enclose the mattress core, be bonded to the mattress core and all joints should be on the side of the mattress.
Core	The core should be made from a flexible load-bearing material having no visible corrections or repairs.
Dimensions and height (mm)	
Length	Should be within +0 and -10 of the length of the operating table.
Width	Should be within +0 and -10 of the width of the operating table.
Thickness	Should not be less than 75 including the cover but excluding the fixings.
Fixings	
	<ul style="list-style-type: none"> ▪ Mattress should be capable of being attached to the operating table so that the movement of the mattress shall not exceed 10mm. ▪ Mattress should be attached to the TT and not impede adjustments of the TT / fitting of accessories.
X-ray translucency	
Mattress / mattress section	If the mattress is marked as X-ray translucent then it should have attenuation equivalent to no greater than 1mm thickness of aluminium determined from measurements of air Kerma under narrow beam conditions.
Storage	
	<p>All mattresses should be stored as specified in BS 3574**.</p> <ul style="list-style-type: none"> ▪ Should be stored in a cool dark dry place, not exceeding 25°C. ▪ Should not be folded. ▪ Should not be piled more than six high or subject to compression for long periods. If stacked for more than a month then paper should be placed between each mattress. ▪ Mattress fittings should not come in to contact with the tops of the mattresses. ▪ Avoid contact with oils, oil based antiseptics, grease, turpentine, motor spirit and other organic solvents, copper, brass, rusty iron, concentrated bleach and mineral acid.

** This has now been replaced. (See 'Applicable standards', table 6, Technical product requirements applicable to operating tables).

Technical product requirements

The Medical Devices Regulations 2002 [24] complement the British standards [20-22]. Operating tables are regarded as class I medical devices in accordance to Rule 1 in Annex IX of the Medical Devices Directive 93/42/EEC.

This classification defines an operating table as a non-invasive device that does not interact with the body. Table 6 lists all the general requirements and standards with which an operating table must comply before it is eligible to be sold in the UK.

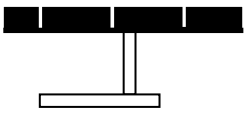
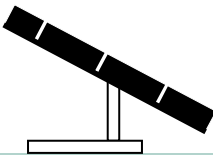
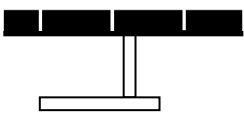
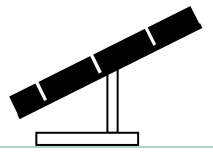
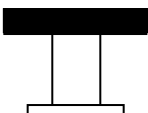
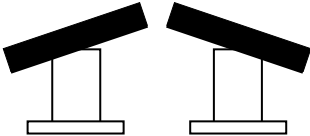
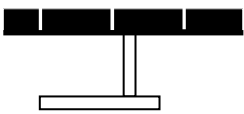
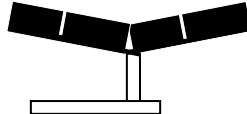
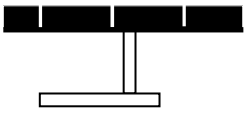
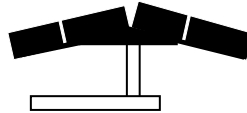
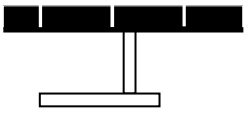
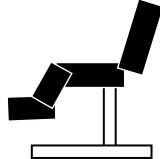

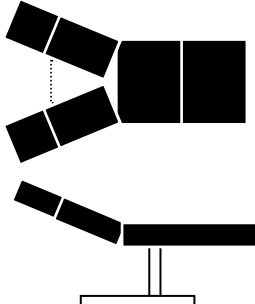
Table 6. Technical product requirements applicable to operating tables

Medical devices regulations	<ul style="list-style-type: none"> All products must comply with the Medical Devices Regulations 2002 [24].
Labelling & instructions for use	<ul style="list-style-type: none"> A copy of the user guide must be supplied with instructions for use and maintenance. All parts of the system should have the following permanently and prominently affixed: <ul style="list-style-type: none"> CE mark according to the appropriate class from MDD 93/42 EEC [25] name of the manufacturer (and/or supplier if different) model and serial or batch number year of manufacture safe working load.
Cleaning / decontamination	<ul style="list-style-type: none"> Cleaning instructions should be provided, including any information on specific cleaning products that must or must not be used. Products must comply with the national infection control guidelines [26] and must be easy to clean and disinfect.
Applicable standards	<ul style="list-style-type: none"> Should comply with relevant MHRA guidance [27]. Operating table mattresses, overlays, pads and foams should meet appropriate standards and indicate against which standards they have been tested: <ul style="list-style-type: none"> BS 7177 (specification for resistance to ignition of mattresses) [28] BS 6807 (methods of test for assessment of the ignitability of mattresses) [29] BS EN597-1 (assessment of the ignitability of mattresses – smouldering cigarette) [30] BS EN597-2 (assessment of the ignitability of mattresses – match flame equivalent) [31] Should comply with BS EN 60601 (electrical safety) [32].
Flame retardancy	<ul style="list-style-type: none"> All foam used in the products should comply with Flame Retardancy Ignition source 5 BS 5852 [33] and therefore should have “combustion modified high resilience”. Covers should meet Flame Retardancy Ignition source 5 BS 5852 [34]. All products that are supplied to the NHS must comply with the NHS Firecode Document HTM 87 [35]. This requires compliance with BS 7177:1996 [28] – the specification for resistance to ignition of mattresses, divans and bed bases.

Operating table positions

An operating table can be adjusted to different positions; the most common are listed in figure 1. The starting position is usually when the tabletop is level. Patients would be lying in a supine (on back) or prone (on front) position and the table is positioned horizontal to the ground. The pedestal is centred, but end pedestals are available.

Figure 1. Different operating table positions

Starting position (supine/prone)	Name of position	Diagram of position	Position use examples
	Trendelenburg (head lowered, feet elevated)		<ul style="list-style-type: none"> Used to reduce risk of shock. Improves access to pelvis as bowel moves proximally.
	Reverse Trendelenburg (head elevated, feet lowered)		<ul style="list-style-type: none"> Can be used to prevent or relieve patient choking. Reduces venous oozing during head and neck surgery.
	Lateral tilt		<ul style="list-style-type: none"> Allows surgeons better access to anatomy. Used in obstetrics to prevent the baby from pressing on the mother's abdomen, causing her to faint.
	Flexion		<ul style="list-style-type: none"> Flexion and extension can be of individual segments. Back surgery. Kidney surgery. Gall bladder surgery. Abdominal surgery.
	Extension		
	Chair		<ul style="list-style-type: none"> Ophthalmic surgery. Neurosurgery. Shoulder surgery.
	Lithotomy (split leg)		<ul style="list-style-type: none"> Obstetrics. Gynaecological surgery. Perineal surgery. Urology.

Device selection / features

The operating table chosen should be matched to the users' needs. Table 7 provides a detailed explanation of the product characteristics which would be useful for clinicians to consider when choosing a particular device.

Table 7. Operational characteristics of operating tables

Model range / Operation type	Manufacturers usually provide a range of models to cover all aspects of surgery. Accessories are also available to further adapt the tables to specific needs. Trauma surgery in particular requires a large number of different accessories – different modules fixed on and taken off depending on the operation.
Tabletop design	Most tables are now modular in design; usually three or four segments per tabletop – head, leg and one or two body/back sections. On some tables the segments can be manoeuvred independently of the base to allow better positioning and these sections can be attachable to or detachable from the tabletop. The different sections can be heavy and sometimes difficult to attach or position correctly. Some tables have powered or hydraulic mechanisms to manoeuvre the sections into position. The more sections that are available the more adaptable the table is. Some tabletops are just one piece – these are usually the imaging tables.
Base	The tables are available with fixed (operating table systems) or movable (mobile operating tables) bases. The base should be as small as possible so that it does not obstruct the surgeon. The bases are usually attached with either an end or centre pedestal to the table top. In many cases end pedestals are preferred by staff as these ensure maximum c-arm coverage. Some tables have the facility to move off centre if there is a longitudinal slide facility on the table.
Tabletop dimensions	Patients have now, on average, increased in breadth and stature since the standard width and length operating tables were designed [36]. The regular size tables may not fit some patients. Patients' heels can now rub against the edge of the bed which can cause pressure ulcers. Accessories (extenders) to broaden either/both the length and width may be required. However, the table must still permit surgeons to operate safely. The extenders are very unpopular with surgeons as they press into their abdomen when they reach over.
Weight	Patient: A higher percentage of bariatric patients are now treated [36]. The tables should have a maximum patient weight clearly stated to ensure safety standards are met and there is no possibility of table failure. The maximum patient weight on a table is different when the table is flat (level) than when it is placed in to different positions. For example, one particular table can operate safely with a patient weighing up to 500kg when level but this reduces to a maximum of 260kg when the table is in the Trendelenburg position. Table: A heavy table can be difficult to manoeuvre, particularly with a patient in situ. Powered tables may be easier to move.

Table adjustments / positions	<p>The different table positions have been demonstrated in figure 1.</p> <p>The height adjustability is very important due to potential medical problems arising for the surgeons if tables are positioned incorrectly, as discussed in the <i>Introduction</i>. This has become more relevant with the growth of laparoscopic type surgery due to the increased length of the surgical instruments that are used.</p> <p>Longitudinal slide is very important for two reasons: it allows the imaging field to be extended (sometimes patients are turned round in the operation to get the required access to the C-arm equipment) and pressure ulcer formation can be prevented if the table can be moved rather than the patient having to be re-positioned.</p> <p>Tables are often available with a normal (one piece) leg section and a split leg section to enable surgical procedure flexibility.</p> <p>Tabletop rotation allows the surgeon closer access to the patient.</p>
Manoeuvrability	<p>During stakeholder consultation with NHS theatre staff, the brakes and manoeuvrability of operating tables were mentioned as being two of the most important considerations when choosing a table model. This has become a particular issue due to the increase of bariatric patients and associated manual handling problems. All staff agreed that electrical adjustment was very important and is much preferred than manual adjustment. Manual overdrive systems are available if the electrical system should fail.</p> <p>Brakes need to be secure and not allow movement of the tables.</p> <p>The wheel designs on some tables make them very difficult to manoeuvre, particularly if the table is heavy and unwieldy. Large wheels or castors ensure easier manoeuvrability. Some tables have powered drive units, which allow the table to be moved using a control system, rather than manually by staff. Integral track stabilisation enables the table to follow a straight line when it is being moved.</p>
Mattress	<p>The evidence presented in the <i>Introduction</i> suggests that patients would benefit from a pressure-redistributing mattress on an operating table.</p> <p>The width and length of the mattress are relevant to ensure the products will fit operating tables. The weight of the mattress and accessories should be considered in addressing manual handling issues for the clinicians who use them.</p> <p>The mattress should be x-ray translucent to allow imaging of the patient to be performed.</p>
Preset positions	<p>Preset positions include flex, urology (extension), chair and return to level (not available on all tables). A button on a control panel manoeuvres the table into these positions. It is a quick method of adjusting the tables, very useful for staff that may have had to position the table manually otherwise; making manual handling of the table easier as a result.</p>
Imaging capabilities	<p>The tabletop construction is important as it has to be an X-ray translucent material to allow imaging to take place. The joints of a table may not be X-ray translucent so this will limit the coverage. It is important to know the exact imaging coverage a table is capable of since the patient may have to be repositioned during surgery if the table is not able to provide the required coverage.</p> <p>X-ray cassettes were previously an essential requirement for operating tables but digital imaging has now replaced this method so cassette channels are no longer required.</p>
Hand controls / power	<p>According to staff, images used on the controls can be confusing and not always obvious what feature the image is intended for. The table can be adjusted / operated either manually by staff, or using electrically operated controls. The controls can either be a hand control that is attached to the table or a wall mounted unit. Other control features include back up column control (if the hand control fails) and a serial interface port.</p>
Purchasing	<p>A product can be bought, rented or provided as part of a contracted service. See <i>Purchasing</i> for details.</p> <p>Suppliers will usually provide demonstrations of their products for training purposes. This should include the accessories that have been bought as part of the system.</p>

Economic considerations

There was no economic evidence identified that evaluated the use of operating tables. However, there can be significant economic implications associated with the choice and use of operating tables.

Whole life costing

To establish the total cost of ownership of an operating table, whole life costing was undertaken to highlight the key cost considerations during the life cycle of an operating table. This is intended to be an illustration of the whole life costing of an operating table rather than providing a comparative analysis for the market. The analysis covers the acquisition, operating, maintenance and end of life costs of a table.

The indicative purchase price for an operating table is £30,000 and it is assumed that the life of the table will be ten years. There is no definitive lifespan of an operating table but 10 years was considered an 'average' lifespan after consultation with theatre staff. The acquisition costs included the purchase price and training. Commissioning costs are not included, however there may be differences in these costs depending on whether maintenance and repair services are carried out in house or provided as a service by the manufacturer. A service contract will require ongoing management, which will have time cost implications. Although training on the use and maintenance of operating tables tends to be provided free by the manufacturer, training costs were calculated as the opportunity cost of having a surgical staff member and a medical engineering technician unavailable for their main duties. From correspondence with a manufacturer, standard training would take a day. Based on a theatre practitioner on Band 5 of Agenda for Change [37] at £14.74 per hour (based on the median of the pay range for 08/09 divided by 1547 hours per year) and a medical engineering technician also at Band 5, both undertaking the training for a 7.5 hour day, the opportunity cost of the training would be £221.10.

A service and maintenance agreement with the manufacturer is estimated to cost £1000 per year and will cover two services, any repair and minor parts. To determine any in house maintenance and repair costs of an operating table, the time costs can be estimated based on the cost of a medical engineering technician at Band 5 [37] and associated overheads. Batteries would need replacing after approximately five years at an approximate cost of £500 and the required work would take an hour. Similarly, it is assumed that hand controls would be replaced every three years, costing £400 and would also take an hour of a technician's time.

Energy consumption associated with charging batteries and running handsets has not been included in the analysis, but would be included as an operating cost. Also

no cost has been assigned to the disposal of a table because free disposal tends to be offered by the manufacturer.

The analysis did not include the accessories that each operating table could offer as this will be dependent on the type of table and the requirements of the purchaser. There will be additional costs associated with consumables, operation and maintenance that would need to be accounted for. However the costs of mattresses have been included, assuming that they will need to be replaced every 18 months. (This is an estimate, not a definitive figure). The cost of replacement mattresses is included in the total costing at £4174 [38], but this does not include any cleaning and maintenance costs. An overview of whole life costing estimation for an operating table excluding accessories is provided in table 8.

Table 8. Estimated whole life costing of an operating table (excluding accessories)

	Year 1	Year 2	Year 3	Year 4	Year 5
Acquisition costs					
Purchase price	£30000				
Training	£221.10				
Consumables, Maintenance & Repair costs					
Mattress replacement		£4174		£4174	
Annual service		£1000	£1000	£1000	£1000
Handset replacement				£414.74	
Battery replacement					
Total annual cost	£30221.10	£5174	£1000	£5588.74	£1000
	Year 6	Year 7	Year 8	Year 9	Year 10
Acquisition costs					
Purchase price					
Training					
Consumables, Maintenance & Repair costs					
Mattress replacement	£4174		£4174		£4174
Annual service	£1000	£1000	£1000	£1000	£1000
Handset replacement		£414.74			£414.74
Battery replacement	£514.74				
Total annual cost	£5688.74	£1414.74	£5174	£1000	£5588.74

The total estimated cost of maintenance and repair, which includes technician time and parts (including the replacement mattresses), would be £31,628.96.

The total cumulative lifetime cost of owning an operating table is £61,850.06. The total net present value of an operating table is calculated at £59,685.31 at a discount rate of 3.5% [39]. The greatest costs of owning an operating table are the initial purchase price of the table and the replacement of pressure-redistributing mattresses.

Table functionality

There are cost benefits associated with the functionality of a table. There can be significant efficiency gains and therefore time savings from acquiring a table with C-arm access. Without the appropriate C-arm access additional time may be required during an operation to reposition the patient or move equipment. As an illustration, it is estimated that a minute of operating time can cost £15 [40]. If the repositioning of a patient adds an additional ten minutes to the operation there is a time cost of £150. The requirement for C-arm access will depend on the type of operation being undertaken.

Pressure ulcers

The choice of mattress used with the operating table is important due to the risk of developing pressure ulcers associated with surgery. Mattresses are discussed further in the *Introduction*, *appendix 3*, and in a previous CEP buyers' guide [14].

The economic implications of developing pressure ulcers can be vast. If a patient develops a pressure ulcer, the cost of treatment and the length of time spent in hospital increase. Published data on the economic impact of pressure ulcers are variable. This may be due to different grades of pressure ulcers being examined, variation in patient population and the diversity of care settings [18]. Bennett et al (2004) [41] reported that approximately 412,000 individuals develop a new pressure ulcer annually in the UK, with a total cost of £1.4 - £2.1 billion. This equates to 4% of the total NHS expenditure (2000 data), with the majority of costs due to nursing time. The average cost of treating one pressure ulcer per patient ranges from £1064 for a grade 1 ulcer to £10,551 for a grade 4 ulcer, due to increased incidence of complications [41].

The significant costs of owning an operating table are the initial purchase price of the table and the mattresses used. Also, consideration of the functionality of the table and effectiveness of the mattress can have significant economic implications on the wider health care system. Choice of mattress can affect the risk of acquiring pressure ulcers which will have consequences on resources used to treat a patient and hospital length of stay. An appropriate table can improve efficiency within the operating theatre and potentially save time costs.

Cancelled Operations Initiative

Cancelled operations are a waste of resources and time. They bring the additional administrative burden of re-scheduling appointments or a blank theatre slot. They are distressing and inconvenient for patients and when the patients themselves cancel operations, they can also be problematic for the hospital. Identifying the different types of cancellation, understanding the reasons and then tackling them appropriately, improves the throughput of patients along the 18 week pathway. Eliminating cancellations reduces work and increases the flow of patients through the referral to treatment pathway [42].

One of the aims of the buyers' guide is to provide comparative specifications and performance data for operating tables to support the COI, by facilitating purchase of more flexible theatre equipment.

Purchasing procedures

The Trust Operational Purchasing Procedures Manual provides details of the procurement process [43].

European Union procurement rules apply to public bodies, including the NHS, for all contracts worth more than £90,319 (from January 1st 2008) [44] (*appendix 2*). The purpose of these rules is to open up the public procurement market and ensure the free movement of goods and services within the EU. In the majority of cases, a competition is required and decisions should be based on best value.

NHS Supply Chain, a ten year contract operated by DHL on behalf of the NHS Business Services Authority, offers OJEU compliant national contracts or framework agreements for a range of products, goods and services. Use of these agreements is not compulsory and NHS organisations may opt to follow local procedures [45].

Sustainable procurement

The UK Government launched its current strategy for sustainable development, *Securing the Future* [46] in March 2005. The strategy describes four priorities in progressing sustainable development:

- sustainable production and consumption – working towards achieving more with less
- natural resource protection and environmental enhancement – protecting the natural resources and habitats upon which we depend
- sustainable communities – creating places where people want to live and work, now and in the future
- climate change and energy – confronting a significant global threat.

The strategy highlights the key role of public procurement in delivering sustainability.

This section identifies relevant sustainability issues and provides some guidance on how these can be incorporated into procurement decision making processes.

Decontamination

Cost effective decontamination, repair and refurbishment of the device should be offered to extend serviceable life.

End-of-life disposal

Consideration should be given to the likely financial and environmental costs of disposal at the end of the product's life. Where appropriate, suppliers of equipment placed on the market after the 13th August 2005 should be able to demonstrate

compliance with the UK Waste Electrical and Electronic Equipment (WEEE) regulations (2006) [23]. The WEEE regulations place responsibility for financing the cost of collection and disposal on the producer. Electrical and electronic equipment is exempt from the WEEE regulations where it is deemed to be contaminated at the point at which the equipment is scheduled for disposal by the final user. However, if it is subsequently decontaminated such that it no longer poses an infection risk, it is again covered by the WEEE regulations, and there may be potential to dispose of the unit through the normal WEEE recovery channels.

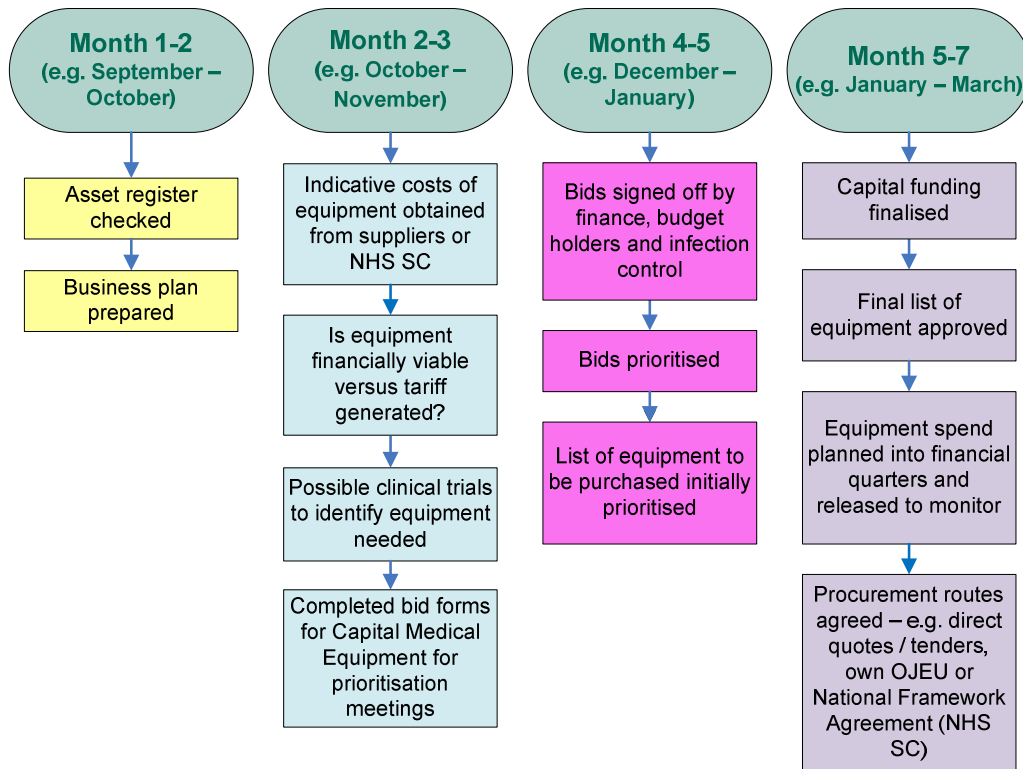
Purchasing decision

The method for operating table procurement varies across NHS trusts. Local practice has been developed and applied to include mini-tendering procedures, either independently or with the support of the relevant regional collaborative procurement hub. Both long term (up to 10 years) and shorter term contracts have been established either with one manufacturer supplying one range of table or with multiple manufacturers supplying a variety of tables and accessories. Contracts usually include the provision of maintenance and training, as well as numerous other options, for example mattress replacement.

Within the various NHS trusts, operating table contract specifications are usually designed by the purchasing team in consultation with key clinicians; for example surgeons, operating department practitioners, theatre nurses and theatre managers. However, the person responsible for the ultimate purchasing decision can vary between trusts. Whilst clinicians who will be using the tables are consulted regarding their preference, due to the high cost of the product the final decision is often made by senior management.

An overview of the purchasing process within NHS trusts for all capital equipment including operating tables is provided in figure 2. The process and timescales are indicative and may vary on a trust to trust basis.

Figure 2. Overview of a generic purchasing process at NHS trust level [45]. Reproduced with permission from Louise Stenson at NHS Supply Chain April 2009.



Market overview

The market review provides key product specifications for 55 operating tables provided by 10 suppliers to the UK market. Nine suppliers are UK based and one (Merivaara Oy) is based in Finland. Two companies supply the same operating tables (Europa Medical Services are the distributors for the manufacturers Merivaara Oy).

Specification tables

Table 9 lists the operating table models by supplier. The companies have been presented in alphabetical order starting with the first letter of the suppliers' name. Supplier contact details are given in *appendix 1*.

The specifications for each operating table model are provided in tables 10 to 18 and are listed by supplier in alphabetical order. Table 19 provides the specifications for operating table mattresses.

Table 9. Operating table models and suppliers (manufacturers and distributors)

Company	Table model	Total
BERCHTOLD UK Ltd (M)	Operon B710, Operon B712, Operon B810, Operon D850	4
Eschmann Equipment Ltd (M)	T30a ⁺ /m ⁺ , T20m ⁺ , T20 a ⁺ , T10m, T10e, MR, Specialist Stille, T50	8
Essentialink Ltd (D)	Bicakcilar 2000R, Bicakcilar 550S, Bicakcilar 550SE, Bicakcilar Mobiline 660, Bicakcilar 650	5
Europa Medical Services (D)* Merivaara Oy (M)*	Practico I, Practico II, Rapido, OP1700, OP1650, Promerix, Promerix B3	7
Lab-Med Ltd (D)	Opmaster motorised 506, Opmaster 531, Opmaster 508	3
MAQUET Ltd (M)	Magnus (system), Alphamaquet (system), Alphamax, Alphastar, Alphaclassic, Betaclassic, Deltaclassic, Orthostar, Betastar	9
Melyd Medical Ltd (D)	Schaerer Mayfield Arcus, Schaerer Mayfield Axis 400/600, Schaerer Mayfield Axis 500/700	3
STERIS Ltd (M)	Cmax Transfer™, Cmax S, Surgimax, Himax, Amsco 3085SP, SurgiGraphic® 6000 Image guided	6
TRUMPF Medical Systems (M)	TruSystem 7500, JUPITER (system), SATURN (system), TITAN, JUPITER Universal Carbon X-tra, MARS 2.XX, Mars Enduro, SATURN select (mobile), MERKUR, JUPITER Universal	10

* These two companies supply the same operating tables. See table 13.

(Key: D = distributor M = manufacturer)

In the following tables where surgery type is specified: All specialities = Cardiothoracic, General, Neurosurgery, Oral and Maxillofacial, Otolaryngology (ENT) Paediatric, Plastic/reconstructive, Orthopaedics/Trauma, Urology, Obstetrics/gynaecological, Ophthalmic.

BERCHTOLD UK Ltd

Figure 3. Operating tables supplied by BERCHTOLD UK Ltd

Model	
Operon B710	
Operon B712	
Operon B810	
Operon D850	

Table 10. BERCHTOLD UK Ltd – operating table specifications

Table model	Operon B710	Operon B712	Operon B810	Operon D850
Surgery type				
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design				
Tabletop sections	5	5	4	4
Detachable / Powered	4 / 2 (manual head)	4 / 2 (manual head)	2 / 2 (manual head)	3 / 2 (manual head)
Base				
Mobile / Fixed (width mm)	Mobile*	Mobile*	Mobile*	Mobile*
Tabletop dimensions (mm)				
Width (with side rails)	580	580	580	585
Width(no side rails)x Length	530 x 2060	530 x 2060	530 x 1900	525 x 2065
Weight (kg)				
Patient (maximum) / Table	350 / 280	350 / 280	273 / 280	450 / 280
Table adjustments				
Height (mm)	720-1140	660-1020	700-1200	565-1160
Trendelenburg	+30° / -30°	+30° / -30°	+30° / -30°	+30° / -31°
Lateral tilt	20° / 20°	20° / 20°	20° / 20°	20° / 20°
Longitudinal slide (mm)	x	x	300	425
Flexion / Extension	x	x	225° / 80°	225° / x
Back section	+70° / -70°	+70° / -70°	+80° / -45°	+90° / -45°
Leg section	+70° / -70°	+70° / -70°	+2° / -105°	+30° / -105°
Split leg section	✓	✓	✓	✓
Body / kidney elevator	x	x	✓ 76mm	✓ 85mm
Headrest	✓(double jointed)	✓(double jointed)	+90° / -90°	+45° / -90°
Chair position	✓	✓	✓	✓
Tabletop rotation	x	x	x	x
Manual handling / Manoeuvrability				
Wheel design / Braking	Multi-direction castors / self- levelling floor locks and brakes; electronic hand control with manual backup			
Integral track stabilisation	✓	✓	x	✓
Mattress (mm)				
Pressure-redistributing / depth	✓ / 60	✓ / 60	✓ / 60	✓ / 60
Type / Tabletop fixing	Soft foam core 3 layer / Replaceable Velcro strips			
X-ray translucent	✓	✓	✓	✓
Preset positions				
Flex/Urology/Chair/Level	Flex / Chair / Level	Flex / Chair / Level	Flex / Chair / Level	All
Imaging capabilities (mm)				
Imaging coverage	1070-1470 (head) 720 (foot)	1070-1470 (head) 720 (foot)	980 (head) 1400 (foot)	1000-1175 (head) 1100-1400 (foot)
Tabletop construction	Translucent phenolic		Carbon fibre	Carbon fibre
Controls				
Corded hand control	✓	✓	✓	✓
Back up column control	✓ (independent)	✓ (independent)	✓ (manual hydraulic backup)	
Serial interface port	✓	✓	✓	✓
Purchasing				
Buy/Rent/Both - Warranty	Both - 12 months full parts and labour			
Equipment demonstration	Written instructions provided and demonstration by UK sales team.			

* Width not supplied

Eschmann Equipment Ltd

Figure 4. Operating tables supplied by Eschmann Equipment Ltd

Model	Model
<p>T30 a⁺ / m⁺ base</p> 	<p>T10 e</p> 
<p>T20 m⁺</p> 	<p>T50</p> 
<p>T20 a⁺</p> 	<p>MR</p> 
<p>T10 m</p> 	<p>Specialist Stille</p> 

Table 11. Eschmann Equipment Ltd – operating table specifications

Table model	T30 a ⁺ / m ⁺ base	T20 m ⁺	T20 a ⁺	T10 m
Surgery type				
All specialities / Laparoscopic	General, orthopaedic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design				
Tabletop sections	Up to 6	Up to 5	Up to 5	Up to 5
Detachable / Powered	Up to 5 / up to 3	Up to 3 / 2	Up to 3 / 2	Up to 3 / 2
Base				
Mobile / Fixed (width mm)	Mobile (545 _a /610 _m)	Mobile (610)	Mobile (545)	Mobile (610)
Tabletop dimensions (mm)				
Width(no side rails)x Length	546 x 1885-2135	546 x 2102	546 x 2102	546 x 2102
Weight (kg)				
Patient (maximum) / Table	450 / 379**	450 / 279	450 / 279	250 / 180
Table adjustments				
Height (mm)	720-1120	720-1120	720-1120	753-1053
Trendelenburg	35° / 35°	35° / 35°	35° / 35°	30° / 30°
Lateral tilt	18° / 18°	18° / 18°	18° / 18°	15° / 15°
Longitudinal slide (mm)	x	250	250	x
Flexion / Extension	90° / 230°	90° / 230°	90° / 230°	100° / 215°
Back section	Flexion 90°	Flexion 90°	Flexion 90°	Flexion 90°
Leg section	-100° / +55°	-100° / +55°	-100° / +55°	-100° / +55°
Split leg section	✓ (accessory)	✓ (accessory)	✓ (accessory)	✓ (accessory)
Body / kidney elevator	n/a – achieved by flexion (separate accessory is also available)			
Headrest	45° / 45°	45° / 45°	45° / 45°	45° / 45°
Chair position	✓	90°	90°	80°
Tabletop rotation	x	x	x	x
Manual handling / Manoeuvrability				
Wheel design / Braking / Integral track stabilisation	3 position brake m: castor covers a: lower profile, for C-arm access	4 x 125mm Ø castors & covers. 3 position brake pedal, fully locked option	Base foot pedals control brakes, wheels & castors. Locked straight-line steering & 360° mobility	4 x 125mm Ø castors & covers. 3 position brake pedal, fully locked option
Mattress (mm)				
Pressure-redistributing / depth	✓ / 50	✓ / 50	✓ / 50 + 80	✓ / 50 or 80
Type / Tabletop fixing	Visco elastic foam, moulded, anti-static, no seams / Non-Velcro			
X-ray translucent	✓	✓	✓	✓
Preset Positions				
Flex/Urology/Chair/Level	Level	Level	Level	x
Imaging capabilities (mm)				
Imaging coverage	Full table length			
Tabletop construction	Radiolucent Acrylic / ABS top			
Controls				
Corded hand control	✓	✓	✓	✓
Back up column control	✓	✓	✓	x
Serial interface port	RS232	RS232	RS232	x
Purchasing				
Buy/Rent/Both - Warranty	Both - △	Both - △	Both - △	Both - △
Equipment demonstration	✓	✓	✓	✓

△ Information not provided by supplier ** Full orthopaedic configuration

Table 11. Eschmann Equipment Ltd – operating table specifications (continued)

Table model	T10 e	T50	MR	Specialist Stille
Surgery type				
All specialties / Laparoscopic	✓ / ✓	Obstetrics & gynaecology	✓ / ✓	Imaging
Tabletop design				
Tabletop sections	4	3	Up to 5	2
Detachable / Powered	Up to 3 / 2	2 / 2	Up to 3 (D)	1 (D)
Base				
Mobile / Fixed (width mm)	Mobile (550)	Mobile (610)	Mobile*	Mobile*
Tabletop dimensions (mm)				
Width(no side rails)x Length	546 x 2102	546 x 2102	515 x 1800	550 x1950-2220
Weight (kg)				
Patient (maximum) / Table	250 / 230	300 / 195	135 / 274	200 / 274.5
Table adjustments				
Height (mm)	703-1003	720-1120	735-1048	711-1092
Trendelenburg	30° / 30°	+35° / -35°	+45° / -45°	+25° / -25°
Lateral tilt	15° / 15°	18° / 18°	15° / 15°	15° / 15°
Longitudinal slide (mm)	✕	✕	✕	711 / 254 (lateral)
Flexion / Extension	100° / 215°	✕	45°/20°	✕
Back section	Flexion 90°	90°	90°	✕
Leg section	-100° / +55°	Articulated leg	-95° / +10°	✕
Split leg section	✓	n/a	✓ (accessory)	✕
Body / kidney elevator	n/a	n/a	✕	✕
Headrest	45° / 45°	45° / 45°	90° / 90°	✕
Chair position	100°	90°	90°	✕
Tabletop rotation	✕	✕	360°	✕
Manual handling / Manoeuvrability				
Wheel design / Braking / Integral track stabilisation	As T20 a+	As T20 m+ & T10m	Combined 3 position castors, wheel & brake pedal	Movement controlled via handset
Mattress (mm)				
Pressure-redistributing / depth	✓ / 50 or 75	✓ / 50	✓ / 50 or 80	✓ / 76
Type / Tabletop fixing	Visco elastic foam, moulded, anti-static, seamless / Non-Velcro			Slow recovery foam
X-ray translucent	✓	✓	✓	Fully
Preset positions				
Flex/Urology/Chair/Level	✕	Level	✕	Level
Imaging capabilities (mm)				
Imaging coverage	Full table length		530(w) x 1549/1829(l)	
Tabletop construction	Radiolucent Acrylic / ABS top		Radiolucent acrylic	Carbon fibre
Controls				
Corded hand control	✓	✓	n/a	Ergonomic
Back up column control	✕	✓	n/a	Back up in base
Serial interface port	✕	✓	n/a	✕
Purchasing				
Buy/Rent/Both - Warranty	Both - △	Both - △	Both - △	Both - △
Equipment demonstration	✓	✓	✓	✓

△ Information not provided by supplier * Width not supplied

Essentialink Ltd

Figure 5. Operating tables supplied by Essentialink Ltd

Model	
Bicakcilar 2000R	
Bicakcilar 550 (S-hydraulic, SE-electrical)	
Bicakcilar Mobiline 660	
Bicakcilar 650	

Table 12. Essentialink Ltd – operating table specifications

Table model	Bicakcilar 2000R	Bicakcilar 550S (hydraulic)	Bicakcilar 550SE(electrical)	Bicakcilar Mobiline 660	Bicakcilar 650
Surgery type					
All specialities / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓	C-arm & Radiosurgery	Minor & transport
Tabletop design					
Tabletop sections	4	4	4	2	2
Detachable / Powered	4 Powered	4 Powered	4 Powered	2 Detachable	△
Base					
Mobile / Fixed (width x length (mm))	Mobile (370 x 830)	Mobile (550 x 800)	Mobile (550 x 800)	Mobile (630 x 1880)	Mobile (620 x 1300)
Tabletop dimensions (mm)					
Width(with side rails)x Length	515 x 1920	465 x 1950	465 x 1950	640 x 1900	590(710) x 2050
Weight (kg)					
Patient (maximum) / Table	310 (table)	302 (table)	262 (table)	152 (table)	138 (table)
Table adjustments					
Height (mm)	740-1070	800-1030	815-1145	830-1130	635-995
Trendelenburg	30° / -30°	25° / -25°	25° / -25°	10° / -10°	10° / -10°
Lateral tilt	30° / 30°	20° / 20°	20° / 20°	✖	✖
Longitudinal Slide (mm)	250	✖	✖	✖	✖
Flexion / Extension	105° Flexion	130° / ✓	130° / ✓	✖	155° Flexion
Back section	75° / -45°	75° / -15°	75° / -15°	✓	✖
Leg section	-90°	-90°	-90°	✖	✖
Split leg section	90°	90°	90°	✖	✖
Body / kidney elevator	105°	130°	130°	✖	155°
Headrest	18° / -90°	20°/ -90°	20°/ -90°	45°	55°/ -65°
Chair position	✓	✓	✓	✖	✖
Tabletop rotation	355°	360°	360°	✖	✖
Manual handling / Manoeuvrability					
Wheel design / Braking / Integral track stabilisation	Anti-static castors			Anti-static castors with straight line stabilisation, central braking by foot pedal	
Mattress (mm)					
Pressure-redistributing / depth	△	△	△	80	80
Type / Tabletop fixing	Anti-bacterial, w/proof polyurethane			△	△
X-ray translucent	△	△	△	△	△
Preset positions					
Flex/Urology/Chair/Level	✖	✖	✖	✖	✖
Imaging capabilities (mm)					
Imaging coverage	✓	✓	✓	Full C-arm	✖
Tabletop construction	HPL compact laminate			△	△
Controls					
Corded hand control	✓	△	△	△	△
Back up column control	△	△	△	△	△
Serial interface port	△	△	△	△	△
Purchasing					
Buy/Rent/Both - Warranty	△	△	△	△	△
Equipment demonstration	△	△	△	△	△

△ Information not provided by supplier

Europa Medical Services / Merivaara Oy

Figure 6: Images of operating tables supplied by Europa Medical Services / Merivaara Oy



Model		Model	
Practico I - 20010 / 20 / 30		Practico I, II & Promerix have special version for shoulder surgery in beach chair.	
Practico II – 30020 / 30		Rapido	
Promerix		OP1700	
Promerix B3		OP1650	

Table 13. Europa Medical Services / Merivaara Oy – operating table specifications

Table model	Practico I - 20010/20	Practico I - 20030	Practico II - 30020
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	4-5	4-5	4-5
Detachable / Powered	3-4 Powered	3-4 Powered	3-4 Powered
Base			
Mobile / Fixed (width mm)	Mobile (535)	Mobile*	Mobile*
Width (with side rails)	590	590	594
Width(no side rails)x Length	540 x 2040 (normal) / 2070 (split leg)		540 x 2150
Weight (kg)			
Patient (maximum) / Table	180 / 165	135 / 175	180 (reverse) 225 (normal) / 170
Table adjustments			
Height (mm)	730-1030	780-1080	595-895
Trendelenburg	-26° / +26°	-26° / +26°	-25° / +25°
Lateral tilt	20° / 20°	20° / 20°	20° / 20°
Longitudinal slide (mm)	×	300	×
Flexion / Extension	110° / 210°	110° / 184°	110° / 220°
Back section	-30° / +70°	-4°/ +70	-40° / +70°
Leg section	-90° / +25°	-90° / +25°	-90° / +45°
Split leg section	-90° / +25°	-90° / +25°	-90° / +45°
Body / kidney elevator	120mm (optional)	×	✓
Headrest	-45° / +45°	-45° / +30°	-45° / +30°
Chair position	✓⌘	⌘	⌘
Tabletop rotation	Traversing & non traversing available		Non-traversing
Manual handling / Manoeuvrability			
Wheel design / Braking / Integral track stabilisation	125mm Ø anti-static swivelling twin castors / Central braking / Track stabilisation		Directional manual castors, floor lock
Mattress (mm)			
Pressure-redistributing / depth	50 + 80		65 + 80
Type / Tabletop fixing	Moulded Integral skin (IS) Visco elastic memory foam (VEF) / Velcro or pins		
X-ray translucent	△	△	△
Preset positions			
Flex/Urology/Chair/Level	×	×	×
Imaging capabilities (mm)			
Imaging coverage	Table length		
Tabletop construction	Glass bead blasted, stainless steel, high-pressure laminate, X-ray permeable		
Controls			
Corded hand control	✓	✓	✓
Back up column control	×	×	×
Serial interface port	×	×	×
Purchasing			
Buy/Rent/Both - Warranty	Both - △	Both - △	Both - △
Equipment demonstration	✓	✓	✓

⌘There is a specialist version now available for shoulder surgery in the beach chair position; all dimensions are the same. Maximum load of 135kg with longitudinal displacement.

* Width not supplied △ Information not provided by supplier

Table 13. Europa Medical Services / Merivaara Oy – operating table specifications (continued)

Table model	Practico II - 30030	Promerix	Promerix B3
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	4-5	4-7	4-7
Detachable / Powered	3-4 Powered	6 Powered	6 Powered
Base			
Mobile / Fixed (width mm)	Mobile*	Mobile (610)	Mobile (610)
Tabletop dimensions (mm)			
Width (with side rails)	594	594	594
Width(no side rails)x Length	540 x 2150	540 x 2100	540 x 2100
Weight (kg)			
Patient (maximum) / Table	180 (reverse) or 225 (normal) / 180	275 / 325	325 (normal) 275 (slide) / 300
Table adjustments			
Height (mm)	665-965	650-1110	610-1070
Trendelenburg	-25° / +25°	-35° / +35°	-35° / +35°
Lateral tilt	20° / 20°	25° / 25°	25° / 25°
Longitudinal slide (mm)	300	410	410
Flexion / Extension	110° / 220°	100° / 225°	100° / 225°
Back section	-40° / +70°	-45° / +80°	-45° / +80°
Leg section	-90° / +45°	-105° / +70°	-105° / +70°
Split leg section	-90° / +45°	✓	✓
Body / kidney elevator	✓	110mm (optional)	110mm (optional)
Headrest	-45° / +30°	-45° / +45°	-45° / +45°
Chair position	✓⌘	✓⌘	✓
Tabletop rotation	Traversing	Traversing	Fixed, non-traversing
Manual handling / Manoeuvrability			
Wheel design / Braking / Integral track stabilisation	Directional manual castors, floor lock	125mm Ø double castors, hydraulic floor lock, 5 th wheel optional	
Mattress (mm)			
Pressure-redistributing / depth	65 + 80 (request)		
Type / Tabletop fixing	Moulded IS or VEF / Velcro or pins		
X-ray translucent	△	△	△
Preset positions			
Flex/Urology/Chair/Level	✕	All ☒	All ☒
Imaging capabilities (mm)			
Imaging coverage	Table length		
Tabletop construction	X-ray permeable, high-pressure laminate		
Controls			
Corded hand control	✓	✓	✓
Back up column control	✕	✓	✓
Serial interface port	✕	✓	✓ (+USB)
Purchasing			
Buy/Rent/Both - Warranty	Both - △	Both - △	Both - △
Equipment demonstration	✓	✓	✓

☒ Urology not available as standard, however two customer specific programmable buttons are part of this table

⌘ Specialist shoulder version now available in the beach chair position; all dimensions are the same. Maximum load of 135kg with longitudinal displacement. * Width not supplied △ Information not provided by supplier

Table 13. Europa Medical Services / Merivaara Oy – operating table specifications (continued)

Table model	Rapido	OP1700	OP1650
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	General
Tabletop design			
Tabletop sections	Up to 5	Up to 5	Up to 5
Non-detachable	2	3	2
Base			
Mobile / Fixed (width mm)	Mobile (693)	Mobile (620)	Mobile (620)
Tabletop dimensions (mm)			
Width (with side rails)	654	555	555
Width(no side rails)x Length	600 x 2050	500 x 1950	500 x 1950
Weight (kg)			
Patient (maximum) / Table	135 / 125	135 / 145	135 / 135
Table adjustments			
Height (mm)	650-1020	730-1040	730-1040
Trendelenburg	-25° / 18°	-25° / 25°	-25° / 25°
Lateral tilt	15° / 15°	15° / 15°	15° / 15°
Longitudinal slide (mm)	✕	✕	✕
Flexion / Extension	110° / ✕	110° / 195°	90° / 195°
Back section	-4° / +70°	-15° / +70°	-15° / +90°
Leg section	-90° / +4°	-90° / +0°	-90° / +0°
Split leg section	✓	✓	✓
Body elevator	✕	✕	✕
Headrest	-40° / +25°	-45° / +30°	-40° / +30°
Chair position	✓	✕	✓
Tabletop rotation	Fixed non-traversing	Non-traversing	
Manual handling / Manoeuvrability			
Wheel design / Braking / Integral track stabilisation	150mm Ø antistatic twin castors, central braking & track stabilisation	75mm Ø twin castors, 2 support feet for braking	
Mattress (mm)			
Pressure-redistributing / depth	PU covering / 70	Integral PU / 50	
Type / Tabletop fixing	Moulded IS or VEF / Velcro tapes	Antistatic / Edges	
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	✕	✕	✕
Imaging capabilities (mm)			
Imaging coverage	Table length		
Tabletop construction	X-ray permeable high-pressure laminate		
Controls			
Corded hand control	✕	✕	✕
Back up column control	✕	✕	✕
Serial interface port	✕	✕	✕
Purchasing			
Buy/Rent/Both - Warranty	Both - △	Both - △	Both - △
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier

Lab-Med Ltd

Figure 7. Images of operating tables supplied by Lab-Med Ltd




Model	
Opmaster 506	
Opmaster 531	
Opmaster 508	

Table 14. Lab-Med Ltd – operating table specifications

Table model	Opmaster 506	Opmaster 531	Opmaster 508
Surgery type			
All specialities / Laparoscopic	Ophthalmic	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	4	4	4
Detachable / Powered	0 / 4	2 / 0	2 / 0
Base			
Mobile / Fixed (width mm)	Mobile*	Mobile*	Mobile*
Tabletop dimensions (mm)			
Width (over mattress)	600	600	797
Width(no side rails)x Length	454 / 750 x 1990	500 x 1925	600 x 1960
Weight (kg)			
Patient (maximum) / Table	225 / 160	225 / 170	225 / 175
Table adjustments			
Height (top of mattress (mm))	578-978	726-926	660-1110
Trendelenburg	+20° / -5°	+35° / -15°	+25° / -15°
Lateral tilt	x	15° / 15°	15° / 15°
Longitudinal slide (mm)	x	x	x
Flexion / Extension	x	x	x
Back section	60°	85°	85°
Leg section	87°	100% down (foot)	100° (foot section)
Split leg section	x	x	x
Body / kidney elevator	x	x	x
Headrest	+36 / -36°	30% up/down	+30 / -30°
Chair position	60°	x	60°
Tabletop rotation	△	△	△
Manual handling / Manoeuvrability			
Wheel design / Braking	Easy roll castors / manual braking	Anti-static twin castors / manual braking	Easy roll castors / manual braking
Mattress (mm)			
Pressure-redistributing / depth	△ / 75	△ / 50	△ / 75
Type / Tabletop fixing	Moulded rubber, anti-static, easy clean		
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	x	x	x
Imaging capabilities (mm)			
Imaging Coverage	x	Full length of table	Full length of table
Tabletop construction	n/a	Translucent top	Translucent top
Controls			
Corded hand control	✓	x	x
Back up column control	x	x	x
Serial interface port	x	x	x
Purchasing			
Buy/Rent/Both - Warranty	To be agreed	To be agreed	To be agreed
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier * Width not supplied

MAQUET Ltd

Figure 8. Images of operating tables supplied by MAQUET Ltd

Model		Model	
Magnus (System)		Betaclassic (as Alphaclassic but manually operated)	
Alphamaquet (System)		Deltaclassic	
Alphamaxx		Orthostar	
Alphastar		Betastar	
Alphaclassic			

Table 15. MAQUET Ltd – operating table specifications

Table model	Magnus (System)	Alphamaquet (System)	Alphamaxx
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	Up to 7	Up to 6	Up to 6
Detachable / Powered	5 / Upper and lower	5 / Upper and lower	5 / Upper and lower
Base			
Mobile / Fixed (width mm)	Both*	Both*	Mobile*
Tabletop dimensions (mm)			
Width (to side rails)	580	540	570
Width(no side rails)x Length	540 x 1952	500-540 x 2075	530 x 2075
Weight (kg)			
Patient (maximum) / Table	250 (Patient)	360 (Patient)	450 / 312
Table adjustments			
Height (mm)	(Mobile) 625 -1345 (Fixed) 595 -1315	725 -1215	594 -1056
Trendelenburg	80° / -80°	40° / -40°	30° / -30°
Lateral tilt	45° / -45°	25° / -25°	20° / -20°
Longitudinal slide (mm)	460	320	230
Flexion / Extension	Up to 60° / ✕	Up to 60° / ✕	Up to 40° / ✕
Back section	+90° / -60°	+70° / -60°	+80° / -40°
Leg section	+90° / -90°	+90° / -90°	+10° / -90°
Split leg section	Optional	Optional	Optional
Body / kidney elevator	Attachable	Attachable	Attachable
Headrest	+45° / -45°	+45° / -45°	+45° / -45°
Chair position	+90°/ -90°	+70°/ -90°	+80°/ -90°
Tabletop rotation	△	△	△
Manual handling / Manoeuvrability			
Wheel design / Braking	4 manual castors, braking at base (lock / unlock)		4 tandem castors, braking at base
Mattress (mm)			
Pressure-redistributing / depth	✓ / 80	✓ / 80	✓ / 80
Type / Tabletop fixing	SFC**, multi-layer / Grooved fixation	SFC**, multi-layer / Velcro or studs	
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	All	All	All
Imaging capabilities (mm)			
Imaging coverage	✓	✓	730 - 1640
Tabletop construction	Various	Various	Carbon fibre / steel
Controls			
Corded hand control	✓	✓	✓
Back up column control	✓	✓	✓
Serial interface port	✓	✓	✓
Purchasing			
Buy/Rent/Both - Warranty	Both - 1-2 years	Both - 1-2 years	Both - 1-2 years
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier * Width not supplied ** Special Foam Core

Table 15. MAQUET Ltd – operating table specifications (continued)

Table model	Alphastar	Alphaclassic	Betaclassic
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✕	✓ / ✕
Tabletop design			
Tabletop sections	Up to 6	5	5
Detachable / Powered	5 / Upper and lower	Up to 3 / 1	Up to 3 / 0
Base			
Mobile / Fixed (width mm)	Mobile*	Mobile*	Mobile*
Tabletop dimensions (mm)			
Width (to side rails)	570	550	550
Width(no side rails)x Length	580 x 2075	510 x 2075	510 x 2075
Weight (kg)			
Patient (maximum) / Table	270 (Patient)	135 / 165	135 / 156
Table adjustments			
Height (mm)	685 -1125	600-950	600-950
Trendelenburg	✕	25° / -25°	25° / -25°
Lateral tilt	✕	15° / 15°	15° / 15°
Longitudinal slide (mm)	Reverse orientation	290	290
Flexion / Extension	Up to 40° / ✕	✕ / +70°/-50°	✕ / +70°/-50°
Back section	+80° / -40°	+60° / -50°	+60° / -50°
Leg section	+80° / 105°	+0° / -95°	+0° / -95°
Split leg section	Optional	✕	✕
Body / kidney elevator	Attachable	100mm	100mm
Headrest	+45° / -45°	+45° / -45°	+45° / -45°
Chair position	+65°/ -105°	70° / 50°	70° / 50°
Tabletop rotation	△	△	△
Manual handling / Manoeuvrability			
Wheel design / Braking	4 tandem castors, base braking (lock/unlock)	4 external 100mm Ø castors, manual braking	
Mattress (mm)			
Pressure-redistributing / depth	✓ / 80	✓ / 80	✓ / 80
Type / Tabletop fixing	SFC**, multi-layer / Velcro or studs	SFC**, multi-layer / Velcro	
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	All	Level	✕
Imaging capabilities (mm)			
Imaging coverage	✓	✓	✓
Tabletop construction	Carbon fibre / steel	Steel / Polyresin	Steel / Polyresin
Controls			
Corded hand control	✓	✓or infrared	✕
Back up column control	✓	✓	✕
Serial interface port	✓	✓	✓
Purchasing			
Buy/Rent/Both – Warranty	Both – 1-2 years	Both - △	Both - △
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier * Width not supplied ** Special Foam Core

Table 15. MAQUET Ltd – operating table specifications (continued)

Table model	Deltaclassic	Orthostar	Betastar
Surgery type			
All specialities / Laparoscopic	✓ / ✗	Orthopaedic, trauma / ✗	✓ / ✗
Tabletop design			
Tabletop sections	5	8	6
Detachable / Powered	0	5 / Back plate	Up to 4 / Upper & lower
Base			
Mobile / Fixed (width mm)	Mobile*	Mobile*	Mobile*
Tabletop dimensions (mm)			
Width (to side rails)	605	550	590
Width(no side rails)x Length	540 x 2075	510 x 2075	540 x 2075
Weight (kg)			
Patient (maximum) / Table	135 / 156	180 / 280	225 / 260
Table adjustments			
Height (mm)	730-980	810-1175	600-950
Trendelenburg	28° / -35°	25° / -30°	30° / -30°
Lateral tilt	20° / 20°	20° / 20°	20° / 20°
Longitudinal slide (mm)	✗	✗	✗
Flexion / Extension	✗ / +70°/-50°	✗	40°/20° / +70°/-30°
Back section	+70° / -40°	+60° / -60°	+70° / -40°
Leg section	+25 / -90°	✗	✗
Split leg section	✗	✗	✗
Body / kidney elevator	Attachable	✗	Attachable
Headrest	+45° / -45°	+45° / -45°	+45° / -45°
Chair position	70° / 50°	✗	70° / 50°
Tabletop rotation	△	△	△
Manual handling / Manoeuvrability			
Wheel design / Braking	4 x 100mm Ø castors, manual braking	3 castors & directional pedal, manual braking	Castors, manual braking
Mattress (mm)			
Pressure-redistributing / depth	✓ / 80	✓ / 80	✓ / 80
Type / Tabletop fixing		SFC**, multi-layer / Velcro	
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	✗	Level	All
Imaging capabilities (mm)			
Imaging coverage	✓	✓	✓
Tabletop construction	Steel / Polyresin	Steel / Polyresin	Steel / Polyresin
Controls			
Corded hand control	✗	✓	✓or infrared
Back up column control	✗	✗	✓
Serial interface port	✓	✓	✓
Purchasing			
Buy/Rent/Both – Warranty	Both - △	Both - △	Both - △
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier * Width not supplied ** Special Foam Core

Melyd Medical Ltd

Figure 9. Images of operating tables supplied by Melyd Medical Ltd

Model	
<p>Schaerer Mayfield Arcus</p>	
<p>Schaerer Mayfield Axis 400/600</p>	
<p>Schaerer Mayfield Axis 500/700</p>	

Table 16. Melyd Medical Ltd – operating table specifications

Table model	Schaerer Mayfield Arcus	Schaerer Mayfield Axis 400/600	Schaerer Mayfield Axis 500/700
Surgery type			
All specialities / Laparoscopic	✓ / ✓	✓ / ✓	Orthopaedic / ✓
Tabletop design			
Tabletop sections	4 to 7	4 to 7	4 to 7
Detachable / Powered	3 / 3	3 / 3	3 / 3
Base			
Mobile / Fixed (width mm)	Mobile (480)	Mobile (300)	Mobile (300)
Tabletop dimensions (mm)			
Width(no side rails)x Length	520 x 2090	515 x 2000	515 x 2000
Width extenders	100 x 2	100 x 2	100 x 2
Weight (kg)			
Patient (maximum) / Table	360 / 290	230 / 298	230 / 298
Table adjustments			
Height (mm)	595-1200	740-1150	740-1150
Trendelenburg	+ 30° / -30°	+ 28° / -28°	+ 28° / -28°
Lateral tilt	20°	18°	18°
Longitudinal slide (mm)	x	x	x
Flexion / Extension	✓	✓	✓
Back section	+70°	+85°	+85°
Leg section	-90°/ +20°	-95°/ +15°	-95°/ +15°
Split leg section	-90°/ +20°	-95°/ +15°	-95°/ +15°
Body / kidney elevator	x	x	x
Headrest	40°	30°	30°
Chair position	✓	✓	✓
Tabletop rotation	△	△	△
Manual handling / Manoeuvrability			
Wheel design / Braking	4 x double swivel, powered braking 4 x rams		
Mattress (mm)			
Pressure-redistributing / depth	✓ / 65	✓ / 65	✓ / 65
Type / Tabletop fixing	Visco / Pins	Visco / Pins	Visco / Pins
X-ray translucent	△	△	△
Preset positions			
Flex/Urology//Chair/Level	Flex / Level	Flex / Level	Flex / Level
Imaging capabilities (mm)			
Imaging coverage	1280	1800	1800
Tabletop construction	Alloy	Stainless steel	Stainless steel
Controls			
Corded hand control	✓	✓	✓
Back up column control	✓	✓	✓
Serial interface port	x	x	x
Purchasing			
Buy/Rent/Both - Warranty	Both – 12 months		
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier

STERIS Ltd

Figure 10. Images of operating tables supplied by STERIS Ltd

Model		Model	
Cmax Transfer™		Himax	
Cmax S		Amsco® 3085 SPTM	
Surgimax		SurgiGraphic® 6000 Image Guided	

Table 17. STERIS Ltd – operating table specifications

Table model	Cmax Transfer™	Cmax S	Surgimax
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	3	3	3
Detachable / Powered	Various / Back & seat	Various / Back & seat	Various / Back & leg
Base			
Mobile / Fixed (length x width (mm))	Mobile*	Mobile*	Mobile (1015 x 560)
Tabletop dimensions (mm)			
Width (with side rails)	547	547	560
Width(no side rails)x Length	510 x 2010	510 x 2010	520 x 2024
Weight (kg)			
Patient (maximum)	500 when table centred on central column, 260 in all other positions		
Table	350	270	215
Table adjustments			
Height (mm)	702-1163	671-1132	600-900
Trendelenburg	30° / -30°	30° / -30°	40°/-20° (normal orientation)
Lateral tilt	20° / 20°	20° / 20°	20° / 20°
Longitudinal slide (mm)	454	454	x
Flexion / Extension	✓	✓	x / ✓
Back section upper - lower	-40° / +90°	40° / 55° - 75° / 15°	90° / -90°
Leg section	-105° / 0°	0° / -90°	80° / -90°
Split leg section	Available as an accessory		
Body / kidney elevator	Standard via motorised table break		x
Headrest	-90° / +50°	-90° / +50°	-90° / +50°
Chair position	✓	✓	✓
Tabletop rotation	x	x	x
Manual handling / Manoeuvrability			
Wheel design / Braking	Large Ø swivel castors (C-Max Transfer also has 5 th wheel for easy steering) self compensating floor locks adjust automatically for uneven surfaces, handset braking (motorised transfer handle for Transfer table)		
Mattress (mm)			
Pressure-redistributing / depth	✓ / 50		
Type / Tabletop fixing	Welded seam or Memoline / Velcro in centre strip on mattress		
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	All	All	All
Imaging capabilities (mm)			
Imaging coverage	+ 227 / -227 = 454 mm		x
Tabletop construction	Phenolic laminate		
Controls			
Corded hand control	✓	✓	✓
Back up column control	✓	✓	✓
Serial interface port	RS232 on column		
Purchasing			
Buy/Rent/Both - Warranty	△ - 24 months	△ - 24 months	△ - 24 months
Equipment demonstration	x	x	x

△ Information not provided by supplier * Width not supplied

Table 17. STERIS Ltd – operating table specifications (continued)

Table model	Himax	Amsco® 3085 SPTM	SurgiGraphic® 6000
Surgery type			
All specialties / Laparoscopic	✓ / ✓	✓ / ✓	Vascular & Imaging
Tabletop design			
Tabletop sections	3	4	△
Detachable / Powered	Various / Back and leg	2 / 3	1 / 0
Base			
Mobile / Fixed (length x width (mm))	Mobile (1015 x 560)	Mobile*	Mobile*
Tabletop dimensions (mm)			
Width (with side rails)	560	558	n/a
Width(no side rails)x Length	520 x 2024	508 x 1930	530 x 2340
Weight (kg)			
Patient (maximum) / Table	500 (column centred) 260 (all other) / 200	454 (normal) 227(reverse) / 334	227 / 449
Table adjustments			
Height (mm)	720-1114	690-1120	810-1070
Trendelenburg	30° / 30°(normal & reverse)	25° / 25°	16° / 16°
Lateral tilt	20° / 20°	18° / 18°	16° / 16°
Longitudinal slide (mm)	x	x	410 (+ 200 lateral)
Flexion / Extension	✓	20° / 30°	x
Back section	90° / -90°	55° / -25°	x
Leg section	x	80° / -105°	x
Split leg section	Available as an accessory		x
Body / kidney elevator	x	101mm	x
Headrest	-90° / +50°	80°/-105° (15° increments)	x
Chair position	✓	✓	x
Tabletop rotation	x	x	x
Manual handling / Manoeuvrability			
Wheel design / Braking	Same as Cmax and Surgimax.	Easy Glide Castor. Braking – floor lock control via handset	6 inch manual locking casters, uneven floor self compensating.
Mattress (mm)			
Pressure-redistributing / depth	✓ / 50	✓ / 50	✓ / 50
Type / Tabletop fixing	Welded seam or Memoline/ Velcro on centre strip on mattress		Conductive tri-layer technology / Velcro
X-ray translucent	✓	✓	✓
Preset positions			
Flex/Urology/Chair/Level	All	All	x
Imaging capabilities (mm)			
Imaging coverage	n/a	711 upper / 838 lower	1800 & extension 2110
Tabletop construction	Phenolic laminate	Radiolucent material	Carbon fibre
Controls			
Corded hand control	✓	Yes lightweight	Yes & foot pedal
Back up column control	✓	x	Located at foot of table
Serial interface port	RS232 on column	x	x
Purchasing			
Buy/Rent/Both - Warranty	△ - 24 months	Both - 12 months	Both - 12 months
Equipment demonstration	x	✓	✓

△ Information not provided by supplier * Width not supplied

TRUMPF Medical Systems

Figure 11. Images of operating tables supplied by TRUMPF Medical Systems

Model		Model	
TruSystem 7500		MARS 2.XX	
JUPITER System		MARS Enduro	
SATURN System		SATURN Select	
TITAN		MERKUR	
JUPITER Universal Carbon X-tra		JUPITER Universal	

Table 18. TRUMPF Medical Systems – operating table specifications

Table model	TruSystem 7500	JUPITER System	SATURN System
Surgery type			
All specialities / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	(basic) 1-2 (max) 7	(basic) 1-2 (max) 7	(basic) 1-3 (max) 7
Detachable / Powered	2-3 Powered	1-2 Powered	△
Base			
Mobile / Fixed (length x width x height (mm))	Fixed (900 x 408 x 25)	Fixed (900 x 445 x 22)	Fixed (900 x 445 x 22)
Tabletop dimensions (mm)			
Width (with side rails)	600	580	580
Width(no side rails)x Length	550 x 2220	530 x 2240	530 x 2240
Weight (kg)			
Patient (maximum) / Table	360 / 300	360 / 300	225 / 250
Table adjustments			
Height (without pads (mm))	616-1166 (mobile) 596-1146 (fixed)	660-1160 (mobile) 640-1140 (fixed column) 672-1172 (floor column)	420
Trendelenburg	45° / -45°	40° / -40°	30° / -30°
Lateral tilt	30° / 30°	25° / 25°	25° / 25°
Longitudinal slide (mm)	350	300	250
Flexion / Extension	✓	✓	✓
Back section upper – lower	85° / -55° - 90° / -88°	70° / -45° - 90° / -60°	85° / -40° - 90° / -60°
Leg section	90° / -90°	90 / -90°	90° / -90°
Split leg section	90° / -90°	90° / -90°	90° / -90°
Headrest	60° / -60°	60° / -60°	60° / -60°
Chair position	✓	✓	✓
Column rotation Tabletop	360°	345°	x
Manual handling / Manoeuvrability			
Wheel design / Braking	No wheels, fixed column, electrical brake	No wheels, fixed & floor column, manual brake	n/a
Mattress (mm)			
Pressure-redistributing / depth	PU / 50 or 90		Standard / 50
Type / Tabletop fixing	Standard PU (50) & FoamLine medifoam PU (90) / Mushroom or Velcro		PU
X-ray translucent	△	△	△
Preset positions			
Flex/Urology/Chair/Level	All	All	All
Imaging capabilities (mm)			
Imaging coverage	Yes between struts		
Tabletop construction	Stainless steel		
Controls			
Corded hand control	✓	✓	✓
Back up column control	✓	✓	✓
Serial interface port	✓	✓	✓
Purchasing			
Buy/Rent/Both - Warranty	△	△	△
Equipment demonstration	✓	✓	✓

△ Information not provided by supplier

Table 18. TRUMPF Medical Systems – operating table specifications (continued)

Table model	TITAN	JUPITER Universal Carbon X-tra	MARS 2.XX
Surgery type			
All specialities / Laparoscopic	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design			
Tabletop sections	(basic) 2 (max) 7	(basic) 1 (max) 2	(basic) 2 (max) 7
Detachable / Powered	2 Powered	0 Powered	2 Powered
Base			
Mobile / Fixed (length x width x height (mm))	Mobile (120 x 570 x 210)	Mobile (115 x 6010 x 225)	Mobile (1130 x 570 x 214)
Tabletop dimensions (mm)			
Width (with side rails)	600	560	580
Width(no side rails)x Length	550 x 2240	530 x 2085	535 x 2260
Weight (kg)			
Patient (maximum) / Table	450 / 275	180 / 280	360 / 200
Table adjustments			
Height (without pads (mm))	630-1130	730-1130	700-1120 & 600-950
Trendelenburg	40° / -40°	40° / -40°	30° / -35° & 25° / -35°
Lateral tilt	40° / -25°	25° / -25°	25° / -25°
Longitudinal slide (mm)	300	460	270
Flexion / kidney elevator	✓	✗	✓
Back section upper - lower	85° / -45° - 90° / -55°	✗	80° / -40° - 90° / -60°
Leg section	90° / -90°	✗	90° / -90°
Split leg section	90° / -90°	✗	90° / -90°
Headrest	60° / -60°	✗	60° / -60°
Chair position	✓	✗	✓
Tabletop rotation	△	△	△
Manual handling / Manoeuvrability			
Wheel design / Braking / Integral track stabilisation	4 electrically conductive double swivel castors –150mm Ø (Titan also has one lowering electromotive drive wheel). Brakes: Stamps - release via foot pedal (Mars has remote control release also). Free wheel and directional running.		
Mattress (mm)			
Pressure-redistributing / depth	PU / 50 or 90		
Type / Tabletop fixing	Standard PU (50) & FoamLine medifoam PU (90) / Mushroom or Velcro		
X-ray translucent	△	△	△
Preset positions			
Flex/Urology/Chair/Level	All	Level	All
Imaging capabilities (mm)			
Imaging coverage	Yes between struts	Yes	Yes between struts
Tabletop construction	Stainless steel	Stainless steel & carbon	Stainless steel
Controls			
Corded hand control	✓	✓	✓
Back up column control	✓	✓	✓
Serial interface port	✓	✓	✓
Purchasing			
Buy/Rent/Both - Warranty	△	△	△
Equipment demonstration	✓	✓	✓





△ Information not provided by supplier

Table 18. TRUMPF Medical Systems – operating table specifications (continued)

Table model	MARS Enduro	SATURN Select	MERKUR	JUPITER Universal
Surgery type				
All specialities / Laparoscopic	Urology, Gynaecology	✓ / ✓	✓ / ✓	✓ / ✓
Tabletop design				
Tabletop sections	(basic)1 (max) 4	(basic) 2 (max) 7	(basic) 2 (max) 6	(basic) 2 (max) 7
Powered sections	0	0	0	2
Base				
Mobile / Fixed (length x width x height (mm))	Mobile (1425 x 630/485 x 180/260)	Mobile (1120 x 590/420 x 210)	Mobile (1100 x 600 x 220)	Mobile (1115 x 600 x 225)
Tabletop dimensions (mm)				
Width (with side rails)	680	580	580	580
Width(no side rails)x Length	630 x 2265	530 x 2230	525 x 2100	530 x 2240
Weight (kg)				
Patient (maximum) / Table	225 / 220	225 / 180	135 / 155	225 / 315
Table adjustments				
Height (without pads (mm))	770-1150	710-1100	740-1040	710-210
Trendelenburg	30° / -30°	30° / -30°	25° / -25°	40° / -40°
Lateral tilt	25° / -25°	25° / -25°	20° / -20°	25° / -25°
Longitudinal Slide (mm)	500	250	x	300
Flexion / kidney elevator	x	120mm	120mm	✓
Back section lower - upper	x	85° / -45°	75° / -40°	70° / -45° - 90° / -60°
Leg section	90° / -60°	90° / -90°	20° / -85°	90° / -90°
Split leg section	45° / -45°	90° / -90°	90° / -90°	90° / -90°
Headrest	x	60° / -60°	45° / -45°	60° / -60°
Chair position	x	✓	✓	✓
Tabletop rotation	△	△	△	△
Manual handling / Manoeuvrability				
Wheel design / Braking / Integral track stabilisation	4 electrically conductive double swivel castors, 150mm Ø (Mars -2 swivel and two fixed castors). Brakes: Stamps - release via foot pedal. Free wheel and directional running (for all except Mars Enduro)			
Mattress (mm)				
Pressure-redistributing / depth	As MARS 2.XX	PU / 50		
Type / Tabletop fixing	As MARS 2.XX	Standard PU / Mushroom		
X-ray translucent	△	△	△	△
Preset positions				
Flex/Urology/Chair/Level	Urology / Chair	All	All	All
Imaging capabilities (mm)				
Imaging coverage	Yes between struts			
Tabletop construction	Stainless steel			
Controls				
Corded hand control	✓	✓	x	✓
Back up column control	✓	✓	x	✓
Serial interface port	x	x	x	✓
Purchasing				
Buy/Rent/Both - Warranty	△	△	△	△
Equipment demonstration	✓	✓	✓	✓

△ Information not provided by supplier

Table 19. Static (low-technology) operating table mattresses & overlays – mixed foam, gel & air

	Pro-op	Pressurease	RIK® Pads	Tempur-Med® Pads
				
Manufacturer/ supplier	Meditec Medical Ltd	Sareo Healthcare Ltd	KCI Medical Ltd	Sumed International (UK) Ltd
Risk category				
Low / Medium / High / Very high	△	High	Medium / High	△
Types				
Standard / Bespoke	Both	Both	Standard	Both
Bariatric / Paediatric	Both	Paediatric	×	Both
Mattress size (single)				
Depth x width x length (mm)	150 x 800 x 1980	100 x 560 x 1980	Various 5 piece construction	Various sizes available
Weight (kg)				
Patient (max)	308	150	135	114
Mattress	△	12	27.3	△
Infection control				
Cover material	Staffcheck	100% polyester polyurethane coated fabric. Anti-slip	Top: Brookwood Softex® Bottom: vinyl coated nylon	Stretch polyurethane
Removable covers	✓	✓	×	✓
Non-slip covers	✓	✓	n/a	n/a
Infill material	Air	Visco-elastic polyether foam laminated to polyether foam base	MicroFlow viscous fluid and polyethylene foam	Foam
Covered zips	✓	✓	✓	✓
Stitched / Welded seams	Welded	Both	Stitched	△
Purchasing				
Buy / Rent / Both	Both	Both	Buy	On request
Warranty (months)	12	24	△	△
Demonstration of equipment				
	✓	✓	✓	✓
X-ray translucent				
	△	△	△	△

△ Information not provided by supplier

Ergonomic assessment and modelling

Introduction

In order to provide context to the specification data an ergonomics usability analysis was undertaken to appraise the level of adjustability provided by the operating tables.

The primary focus was on the ability of users to adjust each table such that they could achieve an optimal posture when undertaking generalised operating procedures. The value of this element of the assessment is reinforced by an appreciation of the occupational risks faced by theatre staff as well as the task effectiveness when interacting with equipment.

The activities undertaken by surgeons require a range of upper limb motions which support precision movements at the hand and fingers. These may be undertaken for considerable periods of time, often under pressure and without breaks and predominantly with a low margin of error. These are all occupational risk factors that are readily identified using upper limb disorder assessment practices. Because of these stringent demands, equipment which can adequately adjust to the physiology is imperative. Provision of such equipment will help limit occupational risk whilst enhancing effectiveness through increased comfort and vigilance and reduced stress.

The considerations for operating theatre tables are made complex by the diversity of staff that interact with the equipment. During the operation itself numerous staff may have to singly or collaboratively undertake critical tasks on or around the table. These staff will inevitably have widely differing physiology and it is unlikely that this could be accommodated by a single piece of adjustable equipment such as an operating table. The operating theatre should be viewed as a system in which users and equipment should, as far as possible, be harmonised.

There is a range of additional users, traditionally designated as secondary and tertiary, who also interact with such equipment and who range from the patient, through maintenance and cleaning personnel and on to end-of-life management and implementation. These further usability demands can often conflict with those of the primary user group.

However, for the purposes of this buyers' guide, we have focused on the pivotal user, identified as the principal surgeon. Ensuring that the needs of the principal surgeon can be adequately met is a significant first step in assessing overall performance.

Methodology

The methodology employed in this assessment utilises conventional ergonomics practice and is based on static anthropometry. By identifying a suitably representative population of users and then using the more extreme of these to

challenge the equipment, it is possible to discriminate between the provisions of adjustment made by the tables. The process involved a number of logical stages which are outlined below.

Stage 1 – identification of the surgical population

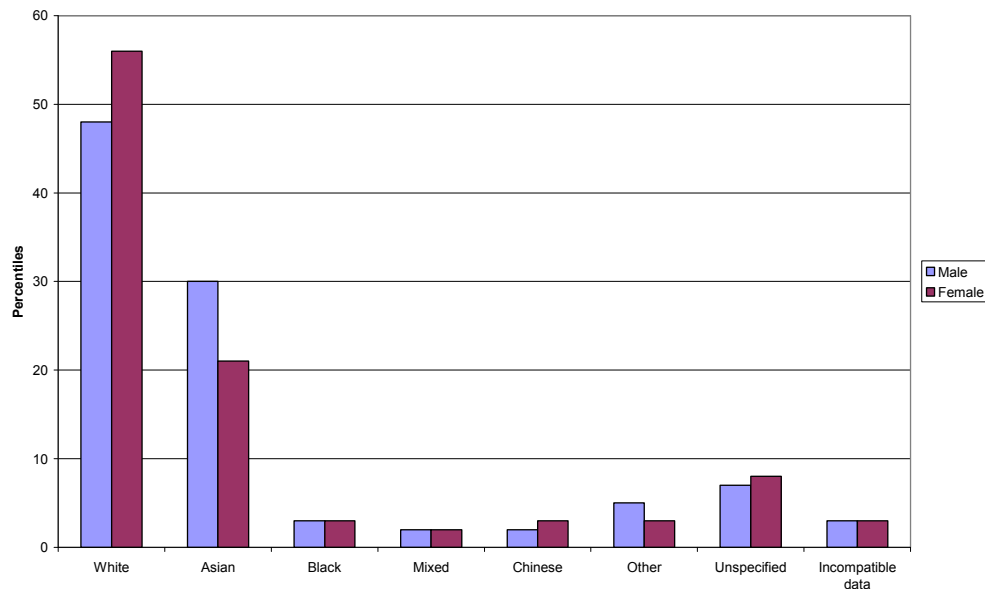
In order to determine anthropometric dimensions of the intended user group it was essential to establish the ethnic make up of the surgical population. This is because ethnicity is a defining element of the physical structures of the human form.

A request was made of the Royal College of Surgeons of England for details of the self-determined ethnicity of the surgical staff of their members. This provided an accurate representation of the surgical population and is presented in table 20 and figure 12.

Table 20. Ethnicity of surgical staff

Ethnic group	Male	Female
White	7192 (48%)	2401 (56%)
Asian	4584 (30%)	918 (21%)
Black	428 (3%)	129 (3%)
Mixed	297 (2%)	106 (2%)
Chinese	281 (2%)	129 (3%)
Other	794 (5%)	127 (3%)
Unspecified	1081 (7%)	329 (8%)
Incompatible data	453 (3%)	149 (3%)
Total	15110 (78%)	4288 (22%)

Figure 12. Ethnicity of surgical staff



From these data it can be clearly seen that the dominant ethnic groups are White and Asian (including Asian British), with these two groups making up approximately 80% of all surgical staff.

Stage 2 – selecting appropriate data sets

Data from established anthropometric sources were searched for appropriate populations to reflect the identified ethnic groups. In order for these to be most onerous it was necessary to pick representative population groups with the greatest range within the required dimensions. Since the assessment would be examining stature and stature-related arm height, the tallest and shortest users were chosen. These were identified as:

- Sri Lankan 5th percentile adult female users (smallest Asian user group)
- Dutch 95th percentile adult male users (largest White user group)

These user groups accurately reflect the most demanding UK surgeon population but also add international relevance to the buyers' guide since these user groups also represent the most onerous throughout most of the developed world.

In addition a second population group was selected to represent a less onerous range of users, typified by the UK population. The inclusion of this group offers a less demanding assessment for readers who might need a lower level of provision. Because of the reduced dimensional range, this allows a higher degree of discrimination between different tables. The population chosen comprised UK mixed

gender adults aged 18 to 64 years. This will, due to the multi-racial nature of the UK population, include a variety of ethnic groups albeit to a greatly reduced degree.

The stature data were sourced from an ergonomics tool called *Peoplesize* [47], which allows interpretation of numerous data sets using predefined variable definitions. The appropriate stature data generated in this way for the two chosen population groups are shown in table 21.

Table 21. Stature data for the selected user populations

	Asian female	Dutch male	British adults
Mean	1523mm	1792mm	1684mm
5th percentile	1426mm	1672mm	1538mm
95th percentile	1617mm	1913mm	1845mm

It should be noted that a 5th to 95th percentile range (which eliminates 10% of the population) is considered the normal design guidelines [48] for non safety-critical devices, although good practice would seek a wider range. In the case of a mixed gender population, such as the UK adults, only 5% of the total population are excluded since all the smallest individuals are female and all the largest individuals male (i.e. 2.5% of the population is excluded at the lower end and 2.5% at the upper margin). This further increases the robustness of the demands placed by this user group.

Additional data were required for the elbow height of the population in order to calculate the optimum hand position. This is obtained directly from published data sets (Dutch males and UK adults) or calculated in a conventional fashion (Asian females) for a normally distributed attribute from the formula [48]:

$$x_p = m + sd(z)$$

Where:

x_p = the percentile value to be calculated

m = the mean

sd = the standard deviation

z = the standard deviate score

Best practice guidelines recommend that fine grip tasks are undertaken at a height between +25mm and -125mm of the standing elbow height, with an optimum being 50mm below this point. In addition, stature needs to be corrected for footwear, which is given a nominal height of 30mm for males and females. This results in the optimum working heights for the chosen populations given in table 22.

Table 22. Optimum working heights for chosen populations

	5 th %ile Asian female	95 th %ile Dutch male	5 th %ile UK adults	95 th %ile UK adults
Elbow height	873mm	1200mm	937mm	1156mm
Grip adjustment	-50mm	-50mm	-50mm	-50mm
Shoe adjustment	+30mm	+30mm	+30mm	+30mm
Total	853mm	1180mm	917mm	1136mm

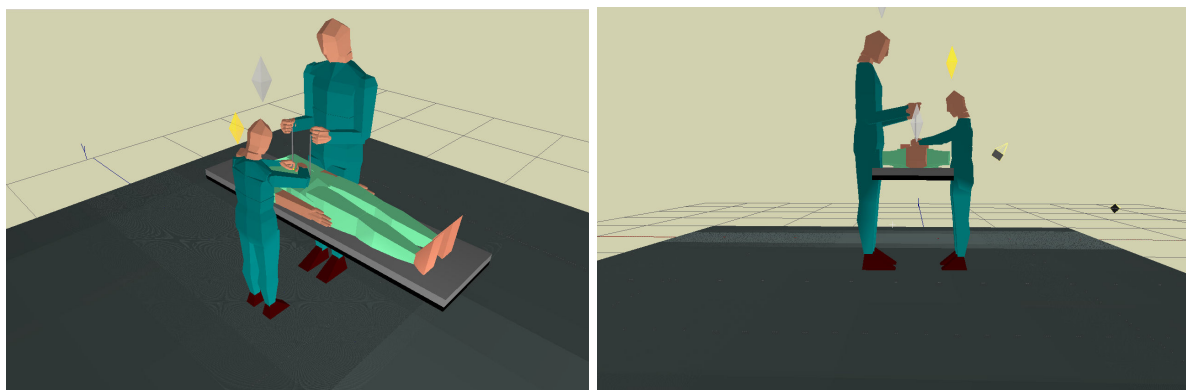
Stage 4 – modelling procedure

Each of the seventy theatre table combinations (55 tables, some with multiple widths) was modelled in an ergonomics modelling package. The model consisted of the table in its lowest and highest positions matched to the tallest and shortest user both with and without laparoscopic tools. This process was used to validate the anthropometric analysis and generated a series of CAD files which are retained for examination by technically interested stakeholders.

The package used to undertake the modelling is SAMMIE, a computer-based 3D human modelling tool developed by SAMMIE CAD Ltd [49]. It takes the form of a simple CAD package into which are integrated complex anthropometric tools and ergonomics features.

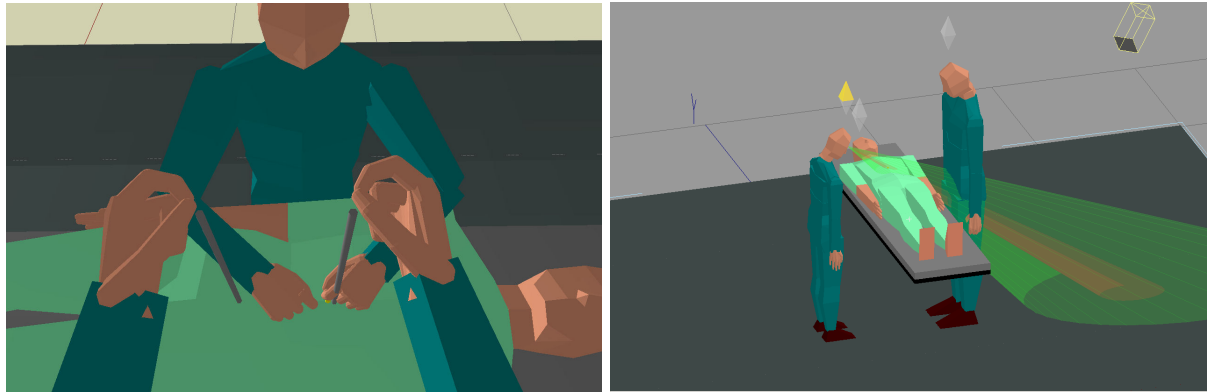
The output from SAMMIE is graphical, allowing rapid assimilation of a range of design criteria. Projections can be 2D or 3D depending on requirements and can assist in the assessment of fit, posture and reach. Individual dimensions can also be evaluated to determine specific reach ranges, with the facility to establish reach shortfalls as absolute values. For instance, it will show by how much one individual will be unable to reach a given point or object, compared with another sized individual at the same point of origin. An example of SAMMIE output, containing representative images of the tallest and shortest users, is shown in figure 13.

Figure 13. Example of output from SAMMIE showing tallest and shortest user [49]



SAMMIE can also provide insight into vision and the effects of mirrors. Scenarios can be viewed through the model's eyes to investigate fields of view and potential obscurity. Mirrors can be modelled to demonstrate reflected fields of view. An example of this SAMMIE output is shown in figure 14.

Figure 14. Example of user's eye view output from SAMMIE [49]



Stage 5 – assumptions

A number of assumptions, stated below, had to be made within the modelling process. These are generally based on depicting a worst case scenario.

- For a tall user the most demanding scenario would be for a patient with a shallow torso and the surgeon working within the body cavity. However, the surgeon would have to reach over the wound margin at the upper margin of the patient's torso. This would therefore require a value of 193mm to be added to the working height.
- For a short user the most demanding scenario would be for a patient with a deep torso and the surgeon working near the surface of the body. This would require a value of 344mm to be added to the working height.
- Laparoscopic tools are generalised at 300mm in length and a worst case would have them being used vertically at the upper margin of the patient. This would require a value of 300mm to be added to the working height.
- The somatotype (body shape) of the surgeons and patient is assumed to be neutral and depicted as mesomorphic.
- The patient is assumed to compress the mattress by 50%. Where multiple mattress depths are offered the thinnest mattress is used to model the tall user and the thickest mattress used to model the short user. This represents a worst case.

- Where laparoscopic tools are being used, a pinch grip is assumed to be employed which is suitable for fine actions.
- An acceptable joint deflection is restricted to 15 degrees for the neck region, as recommended in Health and Safety Executive (HSE) publication HSG60 [50].
- A deflection of 90 degrees is used for the elbow, offering the most neutral stance and comfortable reach.
- It is acknowledged that operating tables are highly adjustable devices and as such cannot be fully appraised within the scope of a buyers' guide. Additionally they are often provided with an extensive range of accessories to facilitate use in specialist practice. However, all the tables assessed are classified as suitable for general surgery and have been appraised with this in mind. The limiting factor to the performance will be the adjustment range of the central section of the table, around which the other sections can be manipulated. It is also probable that many operating procedures will be located around the central point, given that this covers the thorax to lower abdomen. Accordingly, in order to inform the procurement process the match of the table adjustment at this point to the intended users is a useful and valid assessment.

Stage 6 – anthropometric comparison

In order to develop a discriminating scale of effective adjustment a series of comparisons were made between the intended user groups and the range of adjustment provided for each table.

The corrected table heights (corrected for patient and mattress) are paired with each user group in turn, each of which is corrected for footwear and optimised hand position. The absolute values for table height are expressed as the respective percentiles of the population groups. The ranges of possible scores were then banded into 20 percentile groups as depicted in table 23.

Table 23. User percentile groupings and nominated star ratings

	95 th percentile/tall user	5 th percentile/small user
5 star	80.1 to >99	<1 to 20
4 star	60.1 to 80	20.1 to 40
3 star	40.1 to 60	40.1 to 60
2 star	20.1 to 40	60.1 to 80
1 star	<1 to 20	80.1 to >99

Stage 7 – assessment of visual angle

An additional variable that may be considered is the ability to achieve a safe and comfortable height for observation of activities at the site of the operation. Guidance published by the UK Health and Safety Executive (HSG60) [50] identifies that a forward neck angle (flexion) of greater than 15 degrees from the vertical is a risk factor of musculoskeletal disorders. This is amplified by duration, infrequent breaks and increasing angle. These additional factors are routine conditions within an operating theatre. It will be seen that there is a necessary compromise between comfortable working height for the upper limbs and appropriate height for neck comfort, although some activities may require greater emphasis on one or other of these.

Accordingly, it is important that appropriate members of the surgical team can adjust the operating table such that they are able to view the site of the operation without exceeding a neck flexion greater than 15 degrees.

In order to assess this capability a visual cone facility within SAMMIE was utilised. This is a projection of the sight line of the individual, restricted by human capabilities. For the purposes of this evaluation conventional dimensions were used, consisting of an inner cone constrained by a 4 degree angle (representing the area of most acute visual ability) and an outer cone constrained by a 13 degree angle (representing the less acute but sub-peripheral image area). In task analysis this larger area would be considered an optimal zone for task activity. However, given the critical nature of surgical operations and the required focus, the cone was centred on a target point located mid way across the patient's torso.

The population utilised for the visual modelling was restricted to UK adults aged 18 to 64 years. This is supported by a good quality anthropometric data set [48]. A 5th percentile female was used for the smaller stature dimension (1515mm) and a 95th percentile male for the larger individual (1870mm). The UK population contains a proportion of ethnic variation so these dimensions will partially accommodate minorities. It is also the case that by using the UK population split by gender the extremes are somewhat greater than for EU citizens, thereby ensuring that a larger proportion of those individuals are included.

Each table was evaluated for the taller and shorter user. For the tall user the best performance was from tables which offered adjustment to the greatest height since this would allow the tallest user to adopt the least neck flexion. Accordingly, a five star score indicates that the table will adjust to a height that is required for a maximum of 15 degree flexion. Stars were withheld for adjustment heights below this level in bands of 15 degrees, which approximate to poorer grades of visual performance.

For short users it was necessary for the table to be adjusted to a level where they can also obtain a 15 degree neck flexion or less. All tables were comfortably able to provide this level of adjustment, so each table has been allocated five stars in this variable.

Since laparoscopic surgery is normally undertaken utilising display screens, the visual performance evaluation is not appropriate for this application. Accordingly, only non-laparoscopic data are presented.

Limitations

This ergonomics evaluation is intended to quantify basic fit between surgeons and the operating table. It is beyond the scope of the buyers' guide to present a full usability assessment. Consequently the main parameter of height adjustment has been selected as an indicator of the accommodation of a range of typical users.

It is appreciated that physical interventions are utilised in the operating theatre environment, such as plinths and steps. However, these are viewed as poor practice and should not replace good design of equipment. Where multiple users of differing physical stature are simultaneously using the table there will be inevitable conflict in addressing their needs. In these circumstances the solution lies in more elaborate design solutions applied to the equipment rather than the built environment. Such conflicts are unlikely to be addressed in the short term and so the focus of this assessment is on the primary user alone.

Results

The results of the appraisal are expressed in tables 24 to 50 by supplier and by operating table model. Where a particular table is available in multiple variants, typically in different table widths, these are nominated as version (a), (b) etc.

BERCHTOLD UK Ltd

Table 24. Rating of systems for most onerous population use (BERCHTOLD)

Rating variable	Operon B710	Operon B712	Operon B810	Operon D850
Non-laparoscopic work				
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work				
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation				

Table 25. Rating of systems for UK population use (BERCHTOLD)

Rating variable	Operon B710	Operon B712	Operon B810	Operon D850
Non-laparoscopic work				
Small user	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work				
Small user	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation				

Table 26. Rating of systems for visual performance (BERCHTOLD)

Vision rating variable	Operon B710	Operon B712	Operon B810	Operon D850
Non-laparoscopic work				
Small user	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation				

Eschmann Equipment Ltd

Table 27. Rating of systems for most onerous population use (Eschmann)

Rating variable	T30 a ⁺ /m ⁺ base (a)	T30 a ⁺ /m ⁺ base (b)	T20 m ⁺	T20 a ⁺	T10 m
Non-laparoscopic work					
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work					
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	T10e	T50	MR	Specialist Stille (a)	Specialist Stille (b)
Non-laparoscopic work					
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work					
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation					

Table 28. Rating of systems for UK population use (Eschmann)

Rating variable	T30 a ⁺ /m ⁺ base (a)	T30 a ⁺ /m ⁺ base (b)	T20 m ⁺	T20 a ⁺	T10 m
Non-laparoscopic work					
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work					
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	T10e	T50	MR	Specialist Stille (a)	Specialist Stille (b)
Non-laparoscopic work					
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work					
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation					

Table 29. Rating of systems for visual performance (Eschmann)

Vision rating variable	T30 a ⁺ /m ⁺ base (a)	T30 a ⁺ /m ⁺ base (b)	T20 m ⁺	T20 a ⁺	T10 m
Non-laparoscopic work					
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	T10e	T50	MR	Specialist Stille (a)	Specialist Stille (b)
Non-laparoscopic work					
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation			★★★★★ = >15 degree accommodation		

Essentialink Ltd

Table 30. Rating of systems for most onerous population use (Essentialink)

Rating variable	Bicakcilar 2000R	Bicakcilar 550s	Bicakcilar 550se	Bicakcilar Mobiline 660	Bicakcilar 650 (a)	Bicakcilar 650 (b)
Non-laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 31.: Rating of systems for UK population use (Essentialink)

Rating variable	Bicakcilar 2000R	Bicakcilar 550s	Bicakcilar 550se	Bicakcilar Mobiline 660	Bicakcilar 650 (a)	Bicakcilar 650 (b)
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 32. Rating of systems for visual performance (Essentialink)

Vision rating variable	Bicakcilar 2000R	Bicakcilar 550s	Bicakcilar 550se	Bicakcilar Mobiline 660	Bicakcilar 650 (a)	Bicakcilar 650 (b)
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation						

Europa Medical Services / Merivaara Oy

Table 33. Rating of systems for most onerous population use (Europa/Merivaara Oy)

Rating variable	Practico 1 20010/20	Practico 1 20010/20 (split leg)	Practico 1 20030	Practico 1 20030 (split leg)	Practico 2 30020	Practico 2 30030
Non-laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	Promerix	Promerix B3	Rapido	OP1700	OP1650	
Non-laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 34. Rating of systems for UK population use (Europa/Merivaara Oy)

Rating variable	Practico 1 20010/20	Practico 1 20010/20 (split leg)	Practico 1 20030	Practico 1 20030 (split leg)	Practico 2 30020	Practico 2 30030
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	Promerix	Promerix B3	Rapido	OP1700	OP1650	
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 35. Rating of systems for visual performance (Europa/Merivaara Oy)

Vision rating variable	Practico 1 20010/20	Practico 1 20010/20 (split leg)	Practico 1 20030	Practico 1 20030 (split leg)	Practico 2 30020	Practico 2 30030
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Vision rating variable	Promerix	Promerix B3	Rapido	OP1700	OP1650	
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation						

Lab-Med Ltd

Table 36. Rating of systems for most onerous population use (Lab-Med)

Rating variable	Opmaster 506 (a)	Opmaster 506 (b)	Opmaster 531	Opmaster 508
Non-laparoscopic work				
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work				
5 th Percentile	★★★★★	★★★★★	★★★★★	★★★★★
95 th Percentile	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation				

Table 37. Rating of systems for UK population use (Lab-Med)

Rating variable	Opmaster 506 (a)	Opmaster 506 (b)	Opmaster 531	Opmaster 508
Non-laparoscopic work				
Small user	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work				
Small user	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation				

Table 38. Rating of systems for visual performance (Lab-Med)

Vision rating variable	Opmaster 506 (a)	Opmaster 506 (b)	Opmaster 531	Opmaster 508
Non-laparoscopic work				
Small user	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation				

MAQUET Ltd

Table 39. Rating of systems for most onerous population use (MAQUET)

Rating variable	Magnus (mobile base)	Magnus (fixed base)	Alpha- maquet (a)	Alpha- maquet (b)	Alphamax	Alphastar
Non-laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	Alpha- classic	Beta- classic	Delta- classic	Orthostar	Betastar	
Non-laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 40. Rating of systems for UK population use (MAQUET)

Rating variable	Magnus mobile base	Magnus fixed base	Alpha- maquet (a)	Alpha- maquet (b)	Alphamax	Alphastar
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	Alpha- classic	Beta- classic	Delta- classic	Orthostar	Betastar	
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 41. Rating of systems for visual performance (MAQUET)

Vision rating variable	Magnus mobile base	Magnus fixed base	Alpha-maquet (a)	Alpha-maquet (b)	Alphamax	Alphastar
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Vision rating variable	Alpha-classic	Beta-classic	Delta-classic	Orthostar	Betastar	
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation						

Melyd Medical Ltd

Table 42. Rating of systems for most onerous population use (Melyd)

Rating variable	Schaerer Mayfield Arcus	Schaerer Mayfield Axis 400/600	Schaerer Mayfield Axis 500/700
Non-laparoscopic work			
5 th percentile	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★
Laparoscopic work			
5 th percentile	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation			

Table 43. Rating of systems for UK population use (Melyd)

Rating variable	Schaerer Mayfield Arcus	Schaerer Mayfield Axis 400/600	Schaerer Mayfield Axis 500/700
Non-laparoscopic work			
Small user	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★
Laparoscopic work			
Small user	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation			

Table 44. Rating of systems by for performance (Melyd)

Vision rating variable	Schaerer Mayfield Arcus	Schaerer Mayfield Axis 400/600	Schaerer Mayfield Axis 500/700
Non-laparoscopic work			
Small user	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation			

STERIS Ltd

Table 45. Rating of systems for most onerous population use (STERIS)

Rating variable	Cmax Transfer™	Cmax S	Surgimax	Himax	Amsco® 3085 SPTM	Surgi-Graphic® 6000 Image Guided
Non-laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 46. Rating of systems for UK population use (STERIS)

Rating variable	Cmax Transfer™	Cmax S	Surgimax	Himax	Amsco® 3085 SPTM	Surgi-Graphic® 6000 Image Guided
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation						

Table 47. Rating of systems for visual performance (STERIS)

Vision rating variable	Cmax Transfer™	Cmax S	Surgimax	Himax	Amsco® 3085 SPTM	Surgi-Graphic® 6000 Image Guided
Non-laparoscopic work						
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation ★★★★★ = >15 degree accommodation						

TRUMPF Medical Systems

Table 48. Rating of systems for most onerous population use (TRUMPF)

Rating variable	TruSystem 7500 mobile base	TruSystem 7500 fixed base	JUPITER System - mobile base	JUPITER System - fixed base	JUPITER System - floor base	SATURN System	TITAN
Non-laparoscopic work							
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work							
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	JUPITER Universal Carbon	MARS 2.XX (a)	MARS 2.XX (b)	MARS Enduro	SATURN Select	MERKUR	JUPITER Universal
Non-laparoscopic work							
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work							
5 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
95 th percentile	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★

★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation

Table 49. Rating of systems for UK population use (TRUMPF)

Rating variable	TruSystem 7500 mobile base	TruSystem 7500 fixed base	JUPITER System - mobile base	JUPITER System - fixed base	JUPITER System - floor base	SATURN System	TITAN
Non-laparoscopic work							
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work							
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Rating variable	JUPITER Universal Carbon	MARS 2.XX (a)	MARS 2.XX (b)	MARS Enduro	SATURN Select	MERKUR	JUPITER Universal
Non-laparoscopic work							
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Laparoscopic work							
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★

★★★★★ = <20% accommodation ★★★★★ = >80.1% plus accommodation

Table 50. Rating of systems for visual performance (TRUMPF)

Vision rating variable	TruSystem 7500 mobile base	TruSystem 7500 fixed base	JUPITER System - mobile base	JUPITER System - fixed base	JUPITER System - floor base	SATURN System	TITAN
Non-laparoscopic work							
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Vision Rating variable	JUPITER Universal Carbon	MARS 2.XX (a)	MARS 2.XX (b)	MARS Enduro	SATURN Select	MERKUR	JUPITER Universal
Non-laparoscopic work							
Small user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Large user	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
★★★★★ = <60.1 degree accommodation				★★★★★ = >15 degree accommodation			

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Manufacturers and suppliers listed in appendix 1.

Term	Meaning
Abduction	Abduction, in functional anatomy, is a movement which draws a limb away from the median (Sagittal) plane of the body. It is thus opposed to adduction.
Alternating pressure mattress	Electrically powered (pump) devices where the distribution of internal pressure across the support surface is periodically altered. These are usually air filled devices which have sequentially inflating and deflating air filled pockets to remove pressure at selected anatomical sites.
Axial skeleton	The axial skeleton consists of the 80 bones in the head and trunk of the human body. It is composed of five parts; the human skull, the ossicles of the inner ear, the hyoid bone of the throat, the chest, and the vertebral column.
C-arm	Imaging machines.
Continuous low pressure system	These conform to the body, maximising the weight-bearing surface area. Two common high-technology types are low-air-loss and air-fluidised.
Cost effectiveness	Form of economic analysis that compares the relative expenditure (costs) and outcomes (effects) of two or more courses of action.
Diathermy	This is a high frequency electric current that produces heat, used to cut tissue.
Electromyography (EMG)	The technique for evaluating and recording the activation signal of muscles. EMG is performed using an instrument called an electromyograph, to produce a record called an electromyogram by detecting the electrical potential generated by muscle cells when these cells contract and also when the cells are at rest.
Haemodynamic	Medical term for the dynamic regulation of the blood flow in the brain.
Haemoglobin	The iron-containing oxygen-transport metalloprotein in the red blood cells.
Interface pressure	Describes the physical interaction between the body and a surface.
Intraoperative	During surgery.
Laparoscopy	This is a 'key-hole' procedure specifically to look inside the abdomen or pelvic regions. A laparoscope is used.
Sacrum	The sacrum is a large, triangular bone at the base of the spine and at the upper and back part of the pelvic cavity
Serum albumin	The most abundant plasma protein in humans. Albumin is essential for maintaining the osmotic pressure needed for proper distribution of body fluids between intravascular compartments and body tissues.
Static muscle loading	Refers to physical exertion in which the same posture or position is held throughout the exertion. These types of exertions put increased load or forces on the muscles and tendons, which contributes to fatigue. This occurs because not moving impedes the flow of blood that is needed to bring nutrients to the muscles and to carry away the waste products of muscle metabolism. Examples of static postures include gripping tools that cannot be put down (i.e. surgical tools), holding the arms out or up to perform tasks, or standing in one place for prolonged periods.

Term	Meaning
Surgical operations	Surgery is a medical specialty that uses operative manual and instrumental techniques on a patient to investigate or treat a disease or injury. The act of performing surgery may be called a surgical procedure, operation or simply surgery.
Ulnar deviation	Ulnar deviation is a physiological movement of the wrist, where the hand including the fingers moves towards the ulna. Ulnar deviation is a disorder in which flexion by ulnar nerve innervated muscles is intact while flexion on the median nerve side is not.
Vascularised	To make or become vascular.
Wrist / joint excursions	Also know as deflection, it is a movement from and back to a mean position or axis in an oscillating or alternating motion.
X-ray cassette	Light-proof housing for x-ray film, containing front and back intensifying screens, between which the film is placed and held during exposure.

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Operating table suppliers

Company	Telephone / Fax	Website
BERCHTOLD UK Ltd		
First Floor The Barn Enbourne Gate Newbury Berkshire RG14 6 AL	Tel: 01635 521541 Fax: 01635 44002	www.berchtold.de
Eschmann Equipment		
Eschmann House Peter Road Lancing West Sussex BN15 8TJ	Tel: 01903 753322 Fax: 01903 875789	www.eschmann.co.uk
Essentialink Ltd		
112 Morden Road Merton London SW19 3BP	Tel: 020 8543 5425 Fax: 020 8543 9955	www.essentialinklimited.com
Europa Medical Services Ltd		
Golds House Catts Hill Mark Cross Crowborough East Sussex TN6 3NH	Tel: 0845 6584328 Fax: 0845 6584329	www.europamedical.co.uk
Lab-Med Ltd		
Unit 4 Brunel Business Court Brunel Way Thetford Norfolk IP24 1HP	Tel: 01842 762513 Fax: 01842 762513	www.lab-med.co.uk

Company	Telephone / Fax	Website
MAQUET Ltd		
14 – 15 Burford Way Bolden Business Park Sunderland Tyne & Wear NE35 9PZ	Tel: 0191 519 6200	www.maquet.co.uk
Melyd Medical Ltd		
Unit 8 Bretton Hall Farm Offices Chester Road Bretton Chester Cheshire CH4 0DF	Tel: 01244 660954 Fax: 01244 661581	www.melydmedical.com
Merivaara Oy		
Puustellintie 2 FIN-15150 Lahti Finland	Tel: + 358 3 3394 611 Fax: + 358 3 3394 6144	http://www.merivaara.com
STERIS Ltd		
STERIS House Jays Close Viables Basingstoke Hampshire RG22 4AX	Tel: 01256 840400 Fax: 01256 866502	www.steris.com
TRUMPF Medical Systems Ltd		
Systems Ltd President Way Airport Executive Park Luton Bedfordshire LU2 9NL	Tel: 01582 399281 Fax: 01582 399260	www.uk.trumpf-med.com

Mattress suppliers

Company	Telephone / Fax	Website
KCI Medical Ltd		
KCI House Langford Business Park Langford Locks Kidlington Oxfordshire OX5 1GF	Tel: 0800 9808880 Fax: 01865 840626	http://www.kci-medical.com/kci/unitedkingdom
Meditec Medical Ltd		
Unit 9 Chells Enterprise Centre, The Glebe Chells Way Stevenage Hertfordshire SG2 0LZ	Tel: 01438 317600	http://www.meditecmedical.co.uk www.meditecmedical.ie
Sareo Healthcare Ltd		
55 Comet Way, Southend-on-Sea, Essex SS2 6UW	Tel: 01702 527401 Fax: 01702 420240	http://www.sareo.co.uk
Sumed Int. Ltd		
Integrity House Graphite Way Hadfield Glossop Derbyshire SK13 1QH	Tel: 01457 890980 Fax: 01457 890990	http://www.sumed.co.uk

EU procurement procedure

Lease options

National frameworks are in place for operating leases to help the NHS procure leases more cost efficiently and effectively. The framework came into place on 1st April 2007 and runs for two years. Further details are available from the PASA website [51].

EU procedures

The Public Sector Directive (2004/18/EC) has been transposed into UK law. This has been achieved by means of the following statutory instruments:

- the Public Contracts Regulations SI 2006 No.5 (the regulations)
- the Utilities Contracts Regulations SI 2006 No. 6 (not relevant to this guide).

The regulations apply to contracts worth more than £90,319 (from January 1st 2008) [44] over their whole life, and specify the procedures to be followed for public sector contracting, including adherence to strict timetables, requirements for advertising, invitation to tender and the award of contract. Organisations undertaking a procurement exercise covered by the regulations must give all suppliers an equal opportunity to express an interest in tendering for the contract by placing a contract notice in the Official Journal of the European Union (OJEU).

At all stages of the procurement process, the purchaser must be demonstrably fair, as any decision made can be challenged by the unsuccessful suppliers.

Establishing a procurement strategy

To achieve a successful outcome, decisions need to be made on:

- whether an existing contract/agreement can be used
- the need to consider sustainable development issues
- whether EU directives apply
- the type and form of contract
- sourcing potential suppliers
- duration of contract and opportunity to review/extend
- payment schedules
- how to minimise any risks with the chosen strategy, including supplier appraisal and evaluation/clarification of suppliers' bids.

Preparing a business case

A business case should be drafted and approved before conducting any procurement exercise. Further guidance on preparing business cases is available from the Office

of Government Commerce [52] and an illustrative example is provided in the NHS PASA Operational Purchasing Procedures Manual, Procedure 1-01 [43].

The EU tendering exercise

EU procurements usually take between 4 and 6 months to complete. This needs to be taken into account in the planning stages. The length of the exercise depends on the chosen procedure (open or restricted). Further information is available from the Department of Health [53].

The procurement panel

A multidisciplinary team should be selected to guide the purchase. Representatives from clinical, user, technical, estates and financial areas should be considered.

Identifying potential suppliers

Criteria for supplier selection must be established. A pre-qualification questionnaire, seeking background information (e.g. on the skills and experience of the service engineers) may be employed as an initial screen to exclude unsuitable suppliers.

Evaluation criteria

Performance specifications should be derived from local operational requirements, and agreed by the procurement panel. They will form the basis for assessing the adequacy of suppliers' technical specifications, provided in response to the technical specification questionnaire.

It is important to have agreed on the performance specifications of the product as they will be used in the adjudication against company specifications.

Requests for features, which are supplier-specific, are not permitted under the regulations. Very specific features that are not supported by operational requirements are also not allowed.

Award of contract

Following award of the contract to the successful supplier; unsuccessful suppliers may need to be debriefed. This is at the supplier's request.

Buyers must be aware of the 'Alcatel' procedure (see the Trust Operational Purchasing Procedures Manual [43], Procedure No.T-08, section 6 - 'Mandatory Standstill Period').

For more information on procurement please refer to the Department of Health Website [53].

This appendix summarises identified published studies on the ergonomics of operating tables and surgical pressure ulcers. It also includes a table describing the intrinsic and extrinsic risk factors of developing a pressure ulcer during or after a surgical procedure.

Ergonomics

Open and laparoscopic surgery

Open surgery requires the surgeon to be in close proximity to the patient. However, laparoscopic surgery has changed the way that surgeons interact with their operative environments. These procedures involve using surgical instruments that are up to 300mm in length. This changes the relationship between the height of the surgeon's hands and the desirable height of the operating table [54]. Laparoscopic surgery also requires monitors, cameras and light sources to be used and trolleys on which these instruments are placed which can restrict the ergonomic configuration of the operating theatre [9].

A surgeon is often in a static posture for long periods of time when completing a surgical procedure. Static positioning or posture is well recognised as being associated with increased muscular fatigue. This is an issue for both open and laparoscopic procedures [50]. See table 51 for an evidence review of ergonomics and open and laparoscopic surgical procedures.

Table 51. Comparison and impact of open and laparoscopic surgical procedures

Study	Comparison	Conclusions
Berguer <i>et al</i> 1996 [55] A comparison of surgeons' posture during laparoscopic and open surgical procedures.	Determines the differences in the movement of the surgeons' axial skeleton between laparoscopic and open surgery.	<ul style="list-style-type: none"> ▪ The surgeons head and back positions were often straighter in laparoscopic procedures and more bent in open surgery. ▪ The numbers of changes of back position were significantly decreased in laparoscopic procedures. ▪ Overall the laparoscopic surgeons have decreased mobility of the head and back and have decreased weight shifting despite a more upright posture. This could lead to increased fatigue by limiting natural changes in posture.
Matern & Waller 1999 [56] Instruments for minimally invasive surgery: Principles of ergonomic handles.	Investigates the long laparoscopic instruments and the shape of the handles to assess their potential to cause discomfort.	<ul style="list-style-type: none"> ▪ Pressure areas and persisting nerve lesions have been described as a problem. ▪ The handles of the long laparoscopic instruments can cause excessive wrist flexion and ulna deviation of the surgeon's wrists and abduction of the shoulders during manipulation, particularly if the operating table cannot be sufficiently lowered.

Study	Comparison	Conclusions
<p>Nguyen et al 2002 [57]</p> <p>An ergonomic evaluation of surgeons' axial skeletal and upper extremity movements during laparoscopic and open surgery.</p>	<p>Evaluates the differences in surgeons' axial skeletal and upper extremity movements during laparoscopic and open operations.</p>	<ul style="list-style-type: none"> ▪ Laparoscopic surgery involves a more static posture of the neck and head. ▪ Laparoscopic surgery has more frequent awkward movements of the upper extremities than open surgery. ▪ Ergonomic changes in instrument design could ease the physical stress of surgeons. ▪ The optimal height for operating tables is lower for laparoscopic surgery than for open surgery. The lower table height reduces the tension and stress on the surgeon's shoulder.
<p>van Veelen et al 2004 [58]</p> <p>Improved physical ergonomics of laparoscopic surgery.</p>	<p>Examines the surgeons' non-neutral posture that is associated with laparoscopic surgery and leads to complaints by surgeons of fatigue and discomfort.</p>	<p>Five main issues are associated with this poor posture:</p> <ul style="list-style-type: none"> ▪ the hand held instrument design (extreme wrist excursions) ▪ the position of the monitor (too much head flexion) ▪ the use of foot pedals to control diathermy (no vision so a foot can be permanently hovering over the right pedal) ▪ the poorly adjusted operating table height ▪ static body posture (causes physical fatigue).
<p>Wauben et al 2006 [59]</p> <p>Application of ergonomic guidelines during minimally invasive surgery: a questionnaire survey of 284 surgeons.</p>	<p>Analysis of the results from this questionnaire survey entitled 'Are ergonomic guidelines applied in the operating room and what are the consequences?'</p>	<ul style="list-style-type: none"> ▪ Almost 80% reported experiencing discomfort in the neck, shoulders and back when performing MIS. ▪ 89% were unaware of ergonomic guidelines. ▪ 100% stated that they find ergonomics important. ▪ 45% found the height range of their operating table inadequate. ▪ 70% wanted a table that could be lowered more, 4% wanted a table to be raised more and 26% wanted both.

Operating table height adjustability

Industrial ergonomic design recommends a working height of 50mm below elbow height for light precision work but has an acceptable range of 125mm below to 25mm above. This recommendation is adhered to in surgical practice by placing the operating table just below elbow height (of the surgeon) for open surgery [54]. This may cause conflict if more than one person is performing or assisting with the operation and they are different heights.

Due to the longer handles of the laparoscopic instruments, guidelines for table height during surgery should be different. The surgeon's arms are extended in length by 300mm and a table should adjust in height sufficient to accommodate this extension to prevent potential medical problems for the surgeon due to bad posture.

Comparing the height of a person with the range of adjustability of the table is important. If a surgeon is very tall, for example, but the operating table used has insufficient height adjustability to allow safe working practices to be maintained, then this may cause static muscle loading and fatigue [55]. The position of the patient can

also influence the safe working height of an operating table. For example, the height of a patient is higher in a lateral position than in a supine position. This would mean the operating table needs to have lower adjustment so that the surgeon is not reaching over the patient. Table 52 has a summary of published ergonomic studies on operating table height.

Table 52. Studies regarding operating table height adjustability for laparoscopic surgery

Study	Comparison	Conclusions
<p>Matern <i>et al</i> 2001 [60]</p> <p>Ergonomics: requirements for adjusting the height of laparoscopic operating tables.</p>	<p>Established the most ergonomic table height for a particular physique of the surgeon. In a simulated model, two different statures (50th and 95th percentile) used laparoscopic instruments with different handle designs. Four different handles were used and each one was tested at four different angles of use.</p>	<ul style="list-style-type: none"> ▪ The lowest required operating table height was 300mm and the highest 600.5 mm. ▪ When performing laparoscopic surgery with long shafted instruments and patients with pneumoperitoneum (air within peritoneal cavity), the current theatre tabletops are too high for 95% of all surgeons. ▪ As skin incision and wound suture are often performed using conventional open surgical technique, the operating tabletop must be adjustable from the lower heights up to the height of 1220mm. ▪ The use of differently designed handles is an issue because each handle design requires different working heights – for one surgeon the difference in optimal table height when using two different handles (one rod and one axial) was 270mm.
<p>Berquer <i>et al</i> 2002 [54]</p> <p>An ergonomic study of the optimum operating table height for laparoscopic surgery.</p>	<p>Tested the hypothesis that the optimum table height for laparoscopic surgery places the laparoscopic instrument handles at surgeons' elbows height and hence lower table heights relative to the surgeon for open surgery.</p>	<ul style="list-style-type: none"> ▪ Surgeon's subjective ratings of discomfort were lowest when laparoscopic instrument handles were positioned at elbow height, with decreased Electromyography (EMG) signal and decreased arm elevation when performing tasks in this position. ▪ The optimum table height for laparoscopic surgery is lower than that for open surgery - instrument handles should be at either elbow height or 100mm below elbow height to minimise both discomfort and upper arm and shoulder muscle work. ▪ Recommend that table height should be 640 to 770mm above floor level (dependant on the height of the surgeon).
<p>van Veelen <i>et al</i> 2002 [61]</p> <p>Assessment of ergonomically optimal operating surface height for laparoscopic surgery.</p>	<p>Determined the ergonomically optimal operating surface height in order to reduce discomfort in the upper extremities of the surgeons and their assistants.</p>	<ul style="list-style-type: none"> ▪ In order to prevent upper limb excursions, the optimal operating surface height must be between a factor 0.7 and 0.8 of the surgeon's elbow height. ▪ At this height, the joint excursions stay in the neutral zone for more than 90% of the total manipulation time, with less activity within the biceps muscle (15% of maximum muscle activation). ▪ The operating surface height influences the upper joint excursions of the surgeon. ▪ The optimal table height range for laparoscopic surgery is lower than is currently available.

Study	Comparison	Conclusions
Manasnayakorn 2008 [62]		
Ergonomic assessment of optimum operating table height for hand assisted laparoscopic surgery.	Investigated the influence of the working surface height on task performance and muscle workload in laparoscopic surgery.	<ul style="list-style-type: none"> Working above elbow height was associated with the longest execution time and increased muscular workload of the upper limb and upper trunk. The working surface of the instrument handle should be at, or 50mm above, the elbow level of the surgeon for the optimal operating surface height.

Pressure ulcers and surgical procedures

Risk factors for developing pressure ulcers

Pressure ulcers can give rise to serious complications where deeper layers of tissue, muscle or bone become damaged. Infection can lead to blood poisoning or disseminated infections of the bone [8].

Factors that increase the risk of developing pressure ulcers may be intrinsic or extrinsic [63]. Intrinsic factors relate to the patient's tolerance to pressure, whereas extrinsic risk factors concern the intensity and duration of pressure [64]. See tables 53 and 54 for the surgical risk factors.

Table 53. Surgical patients' extrinsic pressure ulcer risk factors

Extrinsic risk factors	
Pressure	<p>The intensity and duration of pressure, particularly over bony prominences, are major risk factors [65].</p> <p>A person is unable to move when undergoing an operation so there are long periods of high pressure on certain body areas. There is an inverse relationship between time and pressure. A large amount of pressure during a short period of time or a low amount of pressure over a long period of time is unlikely to cause pressure ulcers [8]. High pressure over a long period of time could cause pressure ulcers.</p>
Shear / friction	<p>Friction between the skin and the support surface can generate shear forces which increase the risk of pressure ulcer development.</p> <p>Skin shearing and friction may occur when positioning the patient.</p>
Moist skin	Moist skin (due to pooled moisture from prep solutions) is more susceptible to damage [63].
Time	<p>Pressure ulcers can develop quickly, sometimes in less than one hour [13]. Collins 2003 [12] stated that pressure ulcers are associated with prolonged lying in the same position without adequate provision of a pressure redistributing surface.</p> <p>A rate of 8.5% of patients developed pressure ulcers after undergoing an operation that lasted more than three hours [66].</p>

Table 54. Surgical patients' intrinsic pressure ulcer risk factors

Intrinsic risk factors	
Position	<p>Prolonged pressure on bony prominences may lead to the formation of pressure ulcers.</p> <p>Patients may be placed in unnatural positions for several hours during surgery. Positioning devices and accessories may hold a surgical patient in the correct position to operate on but they increase the pressure on the bony prominences [66].</p>
Age	<p>Age increases the risk of pressure ulcer development in the operating theatre [67].</p> <p>Older patients are more likely to develop pressure ulcers. The aging process causes thinning of the dermis and the reduction of tensile strength, reduction in tissue perfusion and lessening of sensation [10].</p> <p>Overall prevalence of pressure ulcer development in hospitals in the UK is about 9%, this figure increases with age and ill-health [68]. A study on elderly patients [68] (published 1985) showed there was an incidence of 32% overall who had/developed pressure ulcers when admitted to hospital for hip surgery. 16% of people in the study developed a sore on the day of the operation, indicating this to be a critical period.</p> <p>Patients ages 20 to 40 have a 9.3% incidence of pressure ulcer development when admitted for a surgical procedure, suggesting that all surgical patients are at high risk not just older patients [66].</p>
Length of operation	<p>The patient will not be aware of pressure in a particular area of the body and is not able to reposition to avoid discomfort.</p> <p>A rate of 8.5% of patients developed pressure ulcers after undergoing an operation that lasted more than three hours [66].</p> <p>Pressure ulcers can develop quickly, sometimes in less than one hour [13]. Collins 2003 [12] stated that pressure ulcers are associated with prolonged lying in the same position without adequate provision of a pressure-redistributing surface.</p>
Anaesthesia	<p>Anaesthetised patients potentially have prolonged pressure on particular areas of the body. The effects of anaesthesia ensures a person is unable to perceive the discomfort that prolonged pressure on one area of the body will cause, thus this constant pressure against the skin reduces the blood supply to that area and the tissue eventually dies [69].</p> <p>Anaesthetic agents can also reduce a person's blood pressure and alter tissue perfusion which can contribute to tissue damage [8].</p>
Disease pathologies	<p>Certain pathologies increase the risk of developing pressure ulcers. The risk for diabetic patients, for example, is approximately three times that for non-diabetic patients [70].</p> <p>Diabetic patients have approximately three times more potential for pressure ulcer development than non diabetic patients [71].</p>
Temperature	<p>Skin cell function is impaired if the skin becomes too hot or too cold.</p>
Decreased nutrition and circulation	<p>Low body fat and low muscle bulk reduce padding on bony prominences. High body fat patients have more padding but the tissue is poorly vascularised.</p> <p>Dehydration is a major risk factor [10]. This may be due to nil by mouth before an operation takes place.</p> <p>Preoperative factors that affect pressure ulcer development include low preoperative haemoglobin and a serum albumin level lower than 3g per dL [8].</p> <p>Intraoperative hypotension and altered haemodynamic and circulatory status relating to the patients position and blood loss may occur [8].</p>

Operating table pressure-redistributing mattresses

Table 55 provides a summary of the studies that compare various different operating table mattresses.

Table 55. Published studies on operating table pressure-redistributing mattresses

Study	Comparisons	Conclusions
Clinch 1996 [72] Pressure area care in one operating theatre.	Compares a pressure-redistributing operating table mattress and a non-pressure-redistributing operating table mattress. Post-operative notes for 120 patients were analysed and the study found that pressure area care notes were up to date on the medical records of the majority of these patients. The literature of pressure problems in surgical procedures was then examined.	<ul style="list-style-type: none"> ▪ The longer the surgery, the greater the risk of skin damage, pressure should be relieved after two hours if possible. Prolonged low pressure causes more damage than short term high pressure and some surgery increases specific direct pressure in particular skin areas. Sores can appear up to nine days after surgery. ▪ Shearing forces should be avoided by careful lifting and moving. ▪ Heating blankets may result in tissue damage. ▪ The pressure needs to be 32mmHg or lower to prevent a problem occurring.
Baker <i>et al</i> 2003 [73] Pressure-relieving properties of a intra-operative warming device.	Compares four different operating table surface combinations: standard operating table mattress; the mattress plus a pressure-relieving gel pad; the mattress plus an under patient warming device set at 38°C; the mattress plus the warming device switched off but left on the table.	<ul style="list-style-type: none"> ▪ In a supine position the mattress plus gel pad demonstrated significantly higher average sacral interface pressures. ▪ The mattress plus warming pad showed lower average pressure for heel interface pressures. ▪ Both average and maximum pressures were lower when the warming device was switched off (potentially due to property changes of the warming device when switched on).
Defloor <i>et al</i> 2000 [74] Preventing pressure ulcers: an evaluation of four operating table mattresses.	Investigated four different operating table mattresses against the standard mattress (foam, gel, visco-elastic polyether and a visco-elastic polyurethane mattress) to identify any differences between them.	<ul style="list-style-type: none"> ▪ The foam mattress and gel mattress had little or no pressure reducing qualities compared to a standard operating table mattress. ▪ The visco-elastic polyether and polyurethane mattresses that were tested did reduce pressure in surgical patients. ▪ None of the mattresses that were tested reduced pressure enough to prevent the occurrence of pressure ulcers.
Keller <i>et al</i> 2006 [75] Interface pressure measurement during surgery: a comparison of four operating table surfaces.	Compared a standard operating table mattress (overlay fibre filled pad), a viscoelastic polyetherane foam mattress, an inflatable air filled cell mattress and a fluid mattress.	<ul style="list-style-type: none"> ▪ Extremely high pressures (over 120mmHg) were reached on three of the mattresses. The fluid mattress was the only mattress that reduced interface pressure to an acceptable level.

Buyers' guide: Operating tables

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