# final report


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## Review of mark three and development of mark four cattle restraining box


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# Abstract

This project was initially undertaken to technically review the design of the Mark 3 cattle restraining box before building and testing the Mark 3 prototype. The review of Mark 3 design, and subsequent assessment of functioning restraining boxes in Indonesia, indicated that either further design modifications were required or a new design concept undertaken. Following consultation a decision was made to design, build and test a new Mark 4 restraining box. The Mark 4 design allows cattle to be squeezed and rotated 90 degrees onto their side. This reduces excessive handling of cattle prior to slaughter and slaughter times. It also improves animal welfare outcomes as cattle do not fall to a lying position. The Mark 4 restraining box design allows for easy conversion between manual and automatic versions. Both versions use a scissor frame squeeze and rollover crush. The manual version uses a load binder strap system to squeeze the animal onto the side of the restraining table and a hydraulic hand pump jack system to roll the animal onto its side. The automatic version uses an external power source and hydraulics to operate both the squeeze and rollover. Both the manual and automatic version use a load binder strap system to secure the animals neck to the rollover table.

# Executive summary

This project was initially undertaken to technically review the design of the Mark 3 cattle restraining box before building and testing the Mark 3 prototype. The review of Mark 3 design, and subsequent assessment of functioning restraining boxes in Indonesia, indicated that either further design modifications were required or a new design concept undertaken. Following consultation a decision was made to design, build and test a new Mark 4 restraining box. The Mark 4 design allows cattle to be squeezed and rotated 90 degrees onto their side. This reduces excessive handling of cattle prior to slaughter and slaughter times. It also improves animal welfare outcomes as cattle do not fall to a lying position. The Mark 4 restraining box design allows for easy conversion between manual and automatic versions. Both versions use a scissor frame squeeze and rollover crush. The manual version uses a load binder strap system to squeeze the animal onto the side of the restraining table and a hydraulic hand pump jack system to roll the animal onto its side. The automatic version uses an external power source and hydraulics to operate both the squeeze and rollover.

A version of the manual Mark 4 slaughter box has been installed and tested in an Indonesian abattoir. Feedback on its operation has led to some minor amendments to the design. These have been incorporated in the drawings submitted in this report. It is envisaged that further testing and modifications to the Mark 4 design may be necessary as the Mark 4 design is rolled out in both SE Asian and Middle East destinations.

# Contents

# 1 Background

Since 1998, the Australian industry has funded the development of cattle restraining boxes, mainly for implementation in SE Asia for halal slaughter of cattle. These designs have relied on the use of springs and levers, as opposed to pneumatics, hydraulics or electricity.

As markets evolve there is a need to develop a more sophisticated restraining box that incorporates automation. The Mark 3 cattle restraining box has been designed with the following considerations:

· It is automated;
· Incorporates simplicity of operation;
· Robustly designed;
· Maximises animal welfare outcomes; and
· It is comparatively inexpensive to build, install and operate.

The purpose of this Project is to technically review the design of the Mark 3 cattle restraining box. Following this review and in consultation with MLA build two prototype cattle restraining boxes.

# 2 Project objectives

The following were identified as objectives for the project:

1. Produced a technical review of the Mark 3 cattle restraining box and;
2. Subject to the technical review, design and build:
    a. A manual cattle restraining box and;
    b. An automated restraining box

Objective 1

MLA will provide full working diagrams and plans of the Mark 3 restraining box design along with the contact details of the contracted designer of the restraining box. At a minimum, the review will consider the following;

· Whether the design will function according to plan
· Human occupation health and safety
· Impact on animal welfare
· Modifications that would improve intended function

Completion of objective one will be a stop/go point for the project. MLA will review the project at this point and subject to the review may or may not proceed to objective two.

Objective 2

Stage 1: Manual restraining box

Following completion of objective 1 and in consultation with MLA, a manually operated prototype should be built to the specifications as determined from the technical review (objective one) and

outcomes of the W.LMW.1001 Restraining box development final report. The prototype manual cattle restraining box will meet the following design capabilities:

- Restrain cattle from 300 – 600 kg liveweight
- Require minimal adjustments to any mechanically functioning parts such as a counterweight mechanism
- Meet OIE standards
- Be easily and readily adapted to incorporate the use of stunning
- Require minimal stockman training or operator skill
- Is quick and efficient
- Not require the use of electrical or other power sources

The completed prototype will be viewed and tested by MLA representatives at the Stark Engineering facilities before progression to stage two.

Stage 2: Installation of manual restraining box and prototype Automated restraining box

After successful testing of the prototype manual restraining box at the Stark Engineering facilities, the Consultant will travel to Indonesia to install and test the box. MLA will be responsible for transportation of box to Indonesia and identifying suitable location for installation.

Following successful trialling of stage one and in consultation with MLA, design and build a hydraulically operated cattle restraining box prototype which will meet the following design capabilities:

- Restrain cattle from 300 – 600 kg liveweight
- Require minimal adjustments to any mechanically functioning parts such as a counterweight mechanism
- Meet OIE standards
- Be easily and readily adapted to incorporate the use of stunning
- Require minimal stockman training or operator skill
- Avoid the use of tie downs and other moving parts which may require replacement and operator training
- Is quick and efficient

The prototypes need only be sand blasted and painted and the following will be required on completion of stage 2;

- Video footage of them functioning
- A written review of their operating capabilities with suggested modifications to improve design and function
- CAD drawings of both designs. These will include full size working model dimensional details.

The completed prototypes and design drawings will remain the property of MLA.

# 3 Methodology

## 3.1 Review of the Mark 3 restraining box

A technical review of the Mark 3 restraining box design was undertaken and results are presented below.

## 3.2 Mark 4 restraining box

Following the technical review of the Mark 3 designs and subsequent visit to Indonesia to assess functioning Mark 1 and 2 restraining boxes, the original contract was amended to reflect the concerns that were raised with the Mark 3 design. The amended contract removed the requirement to build a Mark 3 prototype box and included the building and testing of both a manual and automatic Mark 4 restraining box. Detailed explanations and drawings of the Mark 4 design are presented below.

# 4 Results and discussion

## 4.1 Review of the Mark 3 design

### 4.1.1 Review of design function

1. The functionality of the unit appears to be in line with drawings supplied.
2. The pivot of the restraint box will work keeping in mind we could not, in our investigations, allow for the changes in the centre of gravity of the unit with and without a beast.
3. The longitudinal stability of the crush during the raising from “park” i.e. the position where the beast is brought into the crush, to the “roll over point” 250mm vertically above the park position. There could be a tendency for the crush not to lift evenly. This could lead to jamming and uncontrolled or unexpected movement of the crush. Once the crush is at the apex of its vertical movement, the bottom rollers would contact the top of the roller slots in the track frame and restabilise the unit.
4. The dimension for the length of the crush of 2075mm should be adequate to accommodate cattle up to 450kg live weight. Cattle over this size might be too long to fit readily into the crush.

### 4.1.2 Review of occupational health and safety

1. The design appears to provide good restraint of the beast thereby ensuring the safety of the operators. The WLL (Working Load Limit) of the specified hoist of 2000kg, if built to

Australian Standards will have a sufficient safety factor to ensure it does not fail during lifting procedures causing harm to the operators or beast.

2. At the point of roll over the crush could move in an unexpected way if the operators are not paying attention to the situation at hand catching them off guard, causing injury. Sections 4.2 and 4.4 below seek to address this issue. Training of staff in the correct use of the restraining box will also help overcome this potential problem.
3. A chain hoist might be preferable to a cable hoist in regard to the number of cycles, cable wear, cable damage and the danger a frayed cable would bring to the operators.
4. A chain hoist would be easier to clean.
5. The counter balance of the vertical sliding gate could prove dangerous to operators through cable wear/failure, hand pinch points and the counter weight striking an operator.

### 4.1.3 Review of Animal Welfare

1. The animal welfare issue may be outside the scope of our expertise other than to say the perceived process seems to hold the beast firmly and if the unit is operated as envisaged and lowered to the lay over point without jarring. If this occurs satisfactorily, then the whole restraint and movement of the beast would seem to be good.

### 4.1.4 Suggested modifications to improve design

1. The vertical sliding gate the entrance to the crush could be replaced with a horizontal sliding gate of a proven design that we manufacture already and have had “in the field” for many years without any problems. This would eliminate the need for costly superstructure and cable with counterbalances to operate the gate. Refer also to 2.4 above. Consideration to layout and operating procedures would need to be addressed.
2. The position of chain hoist along the gantry beam may need to be locked momentarily during the “roll over point” (refer to 1.3 above) to ensure that the crush continues its lay down process without the need for operators to manually drag it past it point of roll. This would become evident on testing of the assembled unit or analysing of the centre of gravity properties through full 3D CAD modelling.
3. The superstructure for the chain hoist should be integral to the restraint box. This would ensure correct alignment of the hoist to crush and maintain direction of forces of the lifting mechanism (refer to section 4.2 above). It would also address the subject of mechanical strength of the gantry beam and remove any reliance on the customer to build a suitable mounting for the gantry beam.
4. Consideration could also be given to the use of a hydraulic power to operate the restraint box as well as the sliding gate unit. This hydraulic power unit could be one of our standard units fitted with an electric motor to suit the local electric power grid or a Honda powered unit. The inclusion of hydraulics would remove the concerns mentioned in 1.2, 1.3, 2.2, 2.4, and 4.2 and 4.3. The ongoing maintenance of the hydraulic unit would need to be addressed. The layout and positioning of the hydraulic mounts, pivot points and sequencing would need to be looked into.

### 4.1.5 Outcomes of Indonesia visit

After consultation with MLA and the live export program management, Gary Stark visited Indonesia to review the functioning cattle restraining boxes in Market. This review process and subsequent report highlighted concerns with the Mark 3 design. Several Government abattoirs were viewed and the following observations and conclusions were made:

1. An excessive amount of work is required to install Mark I and Mark II boxes on site including the concrete raised platforms. This currently requiring four to five days in total.
2. Safety and Animal Welfare: Animals are leaving the box, falling down hard onto a 45 degree concrete slab and in isolated instances breaking jaws.

Recommendation:

It is my opinion the efficient economical installation of units be initiated bearing in mind the necessity for humane animal friendly equipment.

Stark Engineering & Warwick Cattle Crush Co have designed a more easily installed animal friendly restraining box – the Mark 4 cattle restraining box (see below). Installation of the Mark 4 restraining box requires a maximum of 2 hours.

## 4.2 Mark 4 restraining box

Manual and automatic Mark 4 restraining boxes have been designed and tested. The Mark 4 design allows cattle to be squeezed and rotated 90 degrees onto their side. This reduces excessive handling of cattle prior to slaughter and slaughter times. It also improves animal welfare outcomes as cattle do not fall to a lying position. The Mark 4 restraining box design allows easy conversion between manual and automatic versions. Both versions use a scissor frame squeeze and rollover crush. The manual version uses a load binder strap system to squeeze that animal onto the side of the restraining table and a hydraulic hand pump jack system rolls the animal onto its side. The automatic version uses an external power source and hydraulics to operate both the squeeze and rollover. Both versions have a load binder strap system to secure the neck of the animal to the rollover crush.

The hydraulic components (including manufacturer, make and model) for the Mark 4 restraining box are outlined below.

| | | |
|---|---|---|
| Hydraulic Unit: | Bucher Hydraulics | UP100 |
| Squeeze Cylinder: | NORDON | NA20A04R12 |
| Roll Cylinder: | NORDON | NA30A12R15 |
| Two Lever Control Valve: | OIL PATH | OP11-D-D-2000 |
| Change Over Valve: | OIL PATH | OP80 7/8" UNF 6 Port C/O Valve |

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|---|---|---|
| Power source (automatic version): | TECO Australia | Monarch single phase squirrel cage induction motor |
| Hand pump (manual version): | HPTD Double acting hand pump | |
| Neck Restraint Ratchet & Strap: | HEAVY DUTY TRUCK LOAD BINDER WINCH | |

A complete set of Computer Aided Design drawings of the Mark 4 restraining box are detailed in Appendices 1 -5.

The Mark 4 design has been tested at both the Stark Engineering facility (Figures 1 to 4) and in Indonesia (Figures 5 and 6).

Figure 1 – Completed manual Mark 4 restraining box

Figure 2 – Testing hydraulic Mark 4 restraining box at Start Engineering

Figure 3 – Testing hydraulic Mark 4 restraining box at Stark Engineering


Figure 4 – Extra heavy duty truck side rail mounting

Figure 5 – Installing prototype manual Mark 4 restraining box (Lampung, Indonesia)

Figure 6 – Testing manual restraining box in Indonesian abattoir (Lampung)

# 5 Success in achieving objectives

All objectives have been successfully achieved and both the automatic and manual versions of the Mark 4 slaughter box will be installed by the LEP in suitable locations throughout SE Asia and the Middle East.

# 6 Impact on meat and livestock industry – now and in five years time

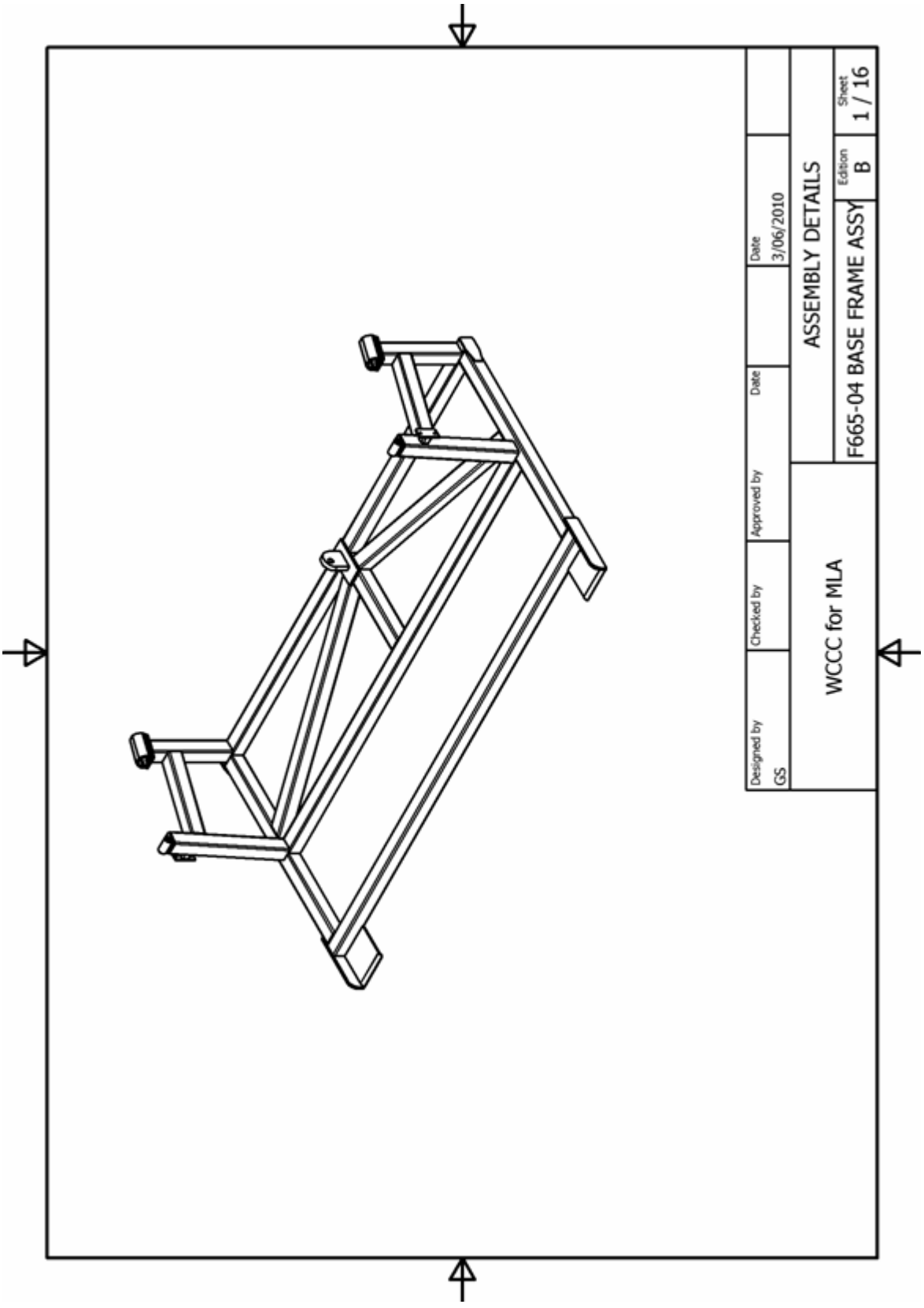
The use of the Mark 4 restraining box will further improve the animal welfare of Australian cattle at the point of slaughter.

# 7 Conclusions and recommendations

It is recommended that both the manual and automatic Mark 4 restraining boxes be installed in suitably identified abattoirs and slaughter houses where Australian cattle are slaughtered. Functioning restraining boxes should be assessed and monitored and any feedback or suggested modifications be submitted to Stark Engineering for assessment. Testing of minor modifications or improvements can be conducted on the restraining box that is owned by MLA but residing at Stark Engineering in Queensland.

# 8 Appendices

## 8.1 Appendix 1 – Base frame assembly details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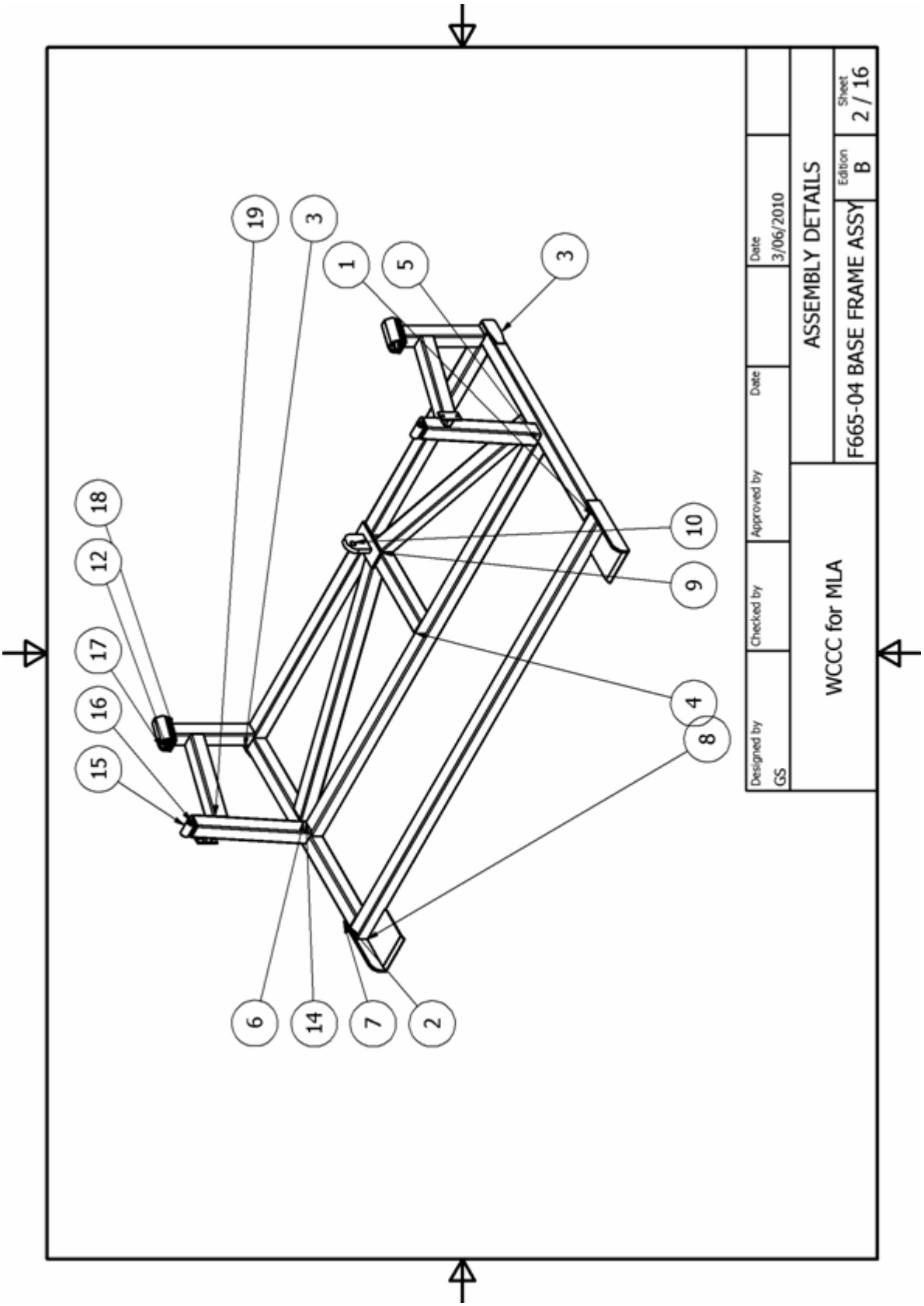
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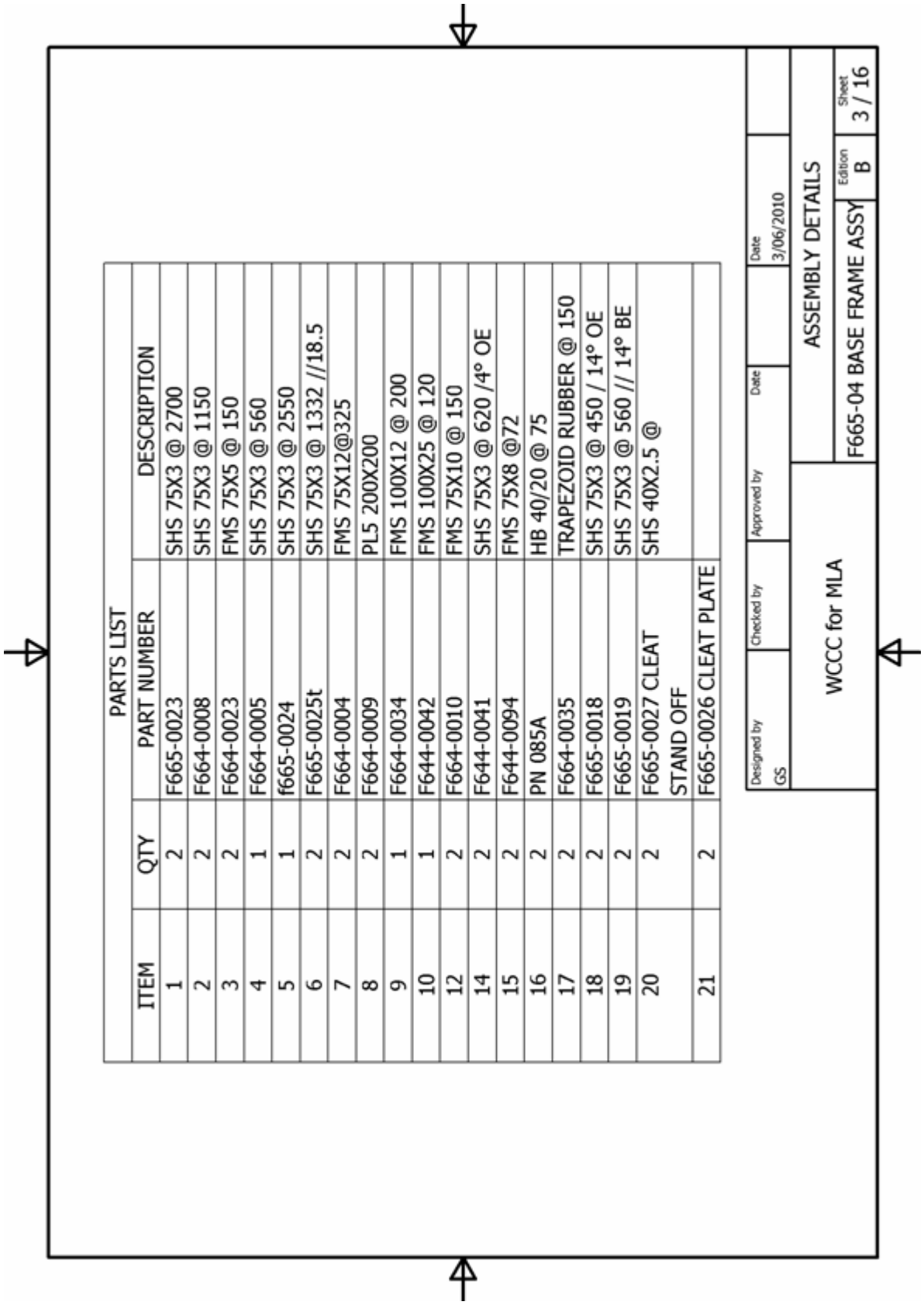

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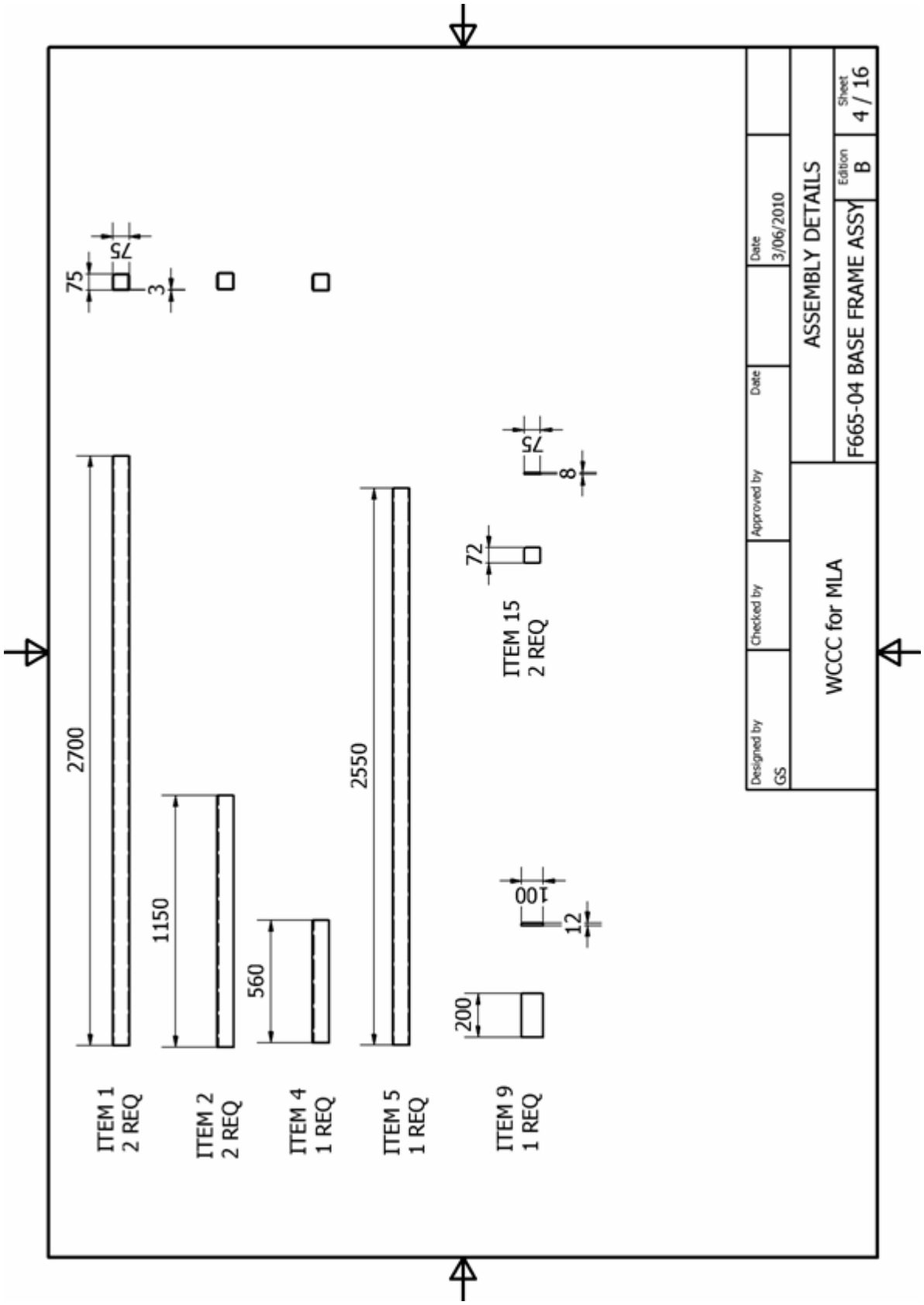
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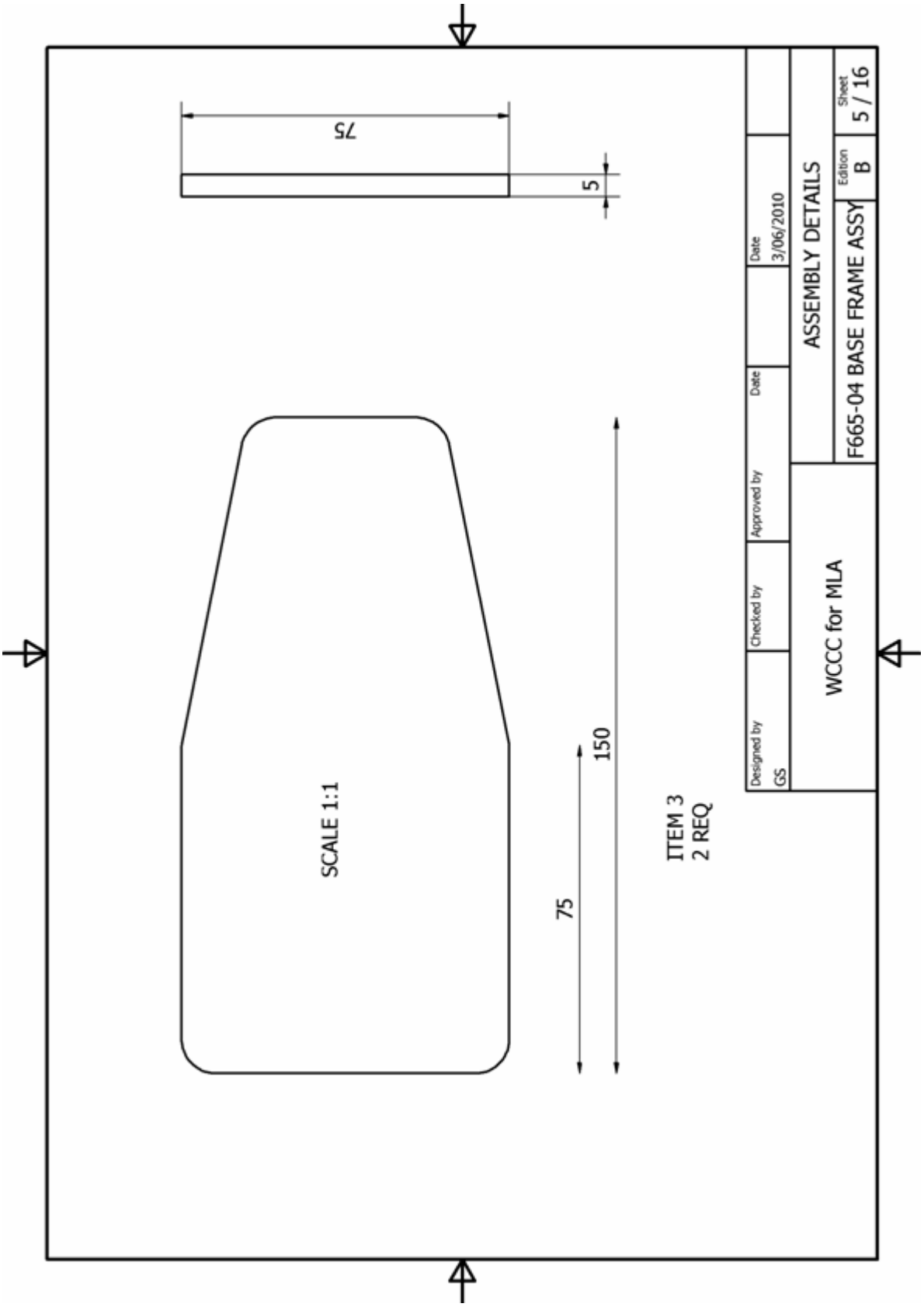
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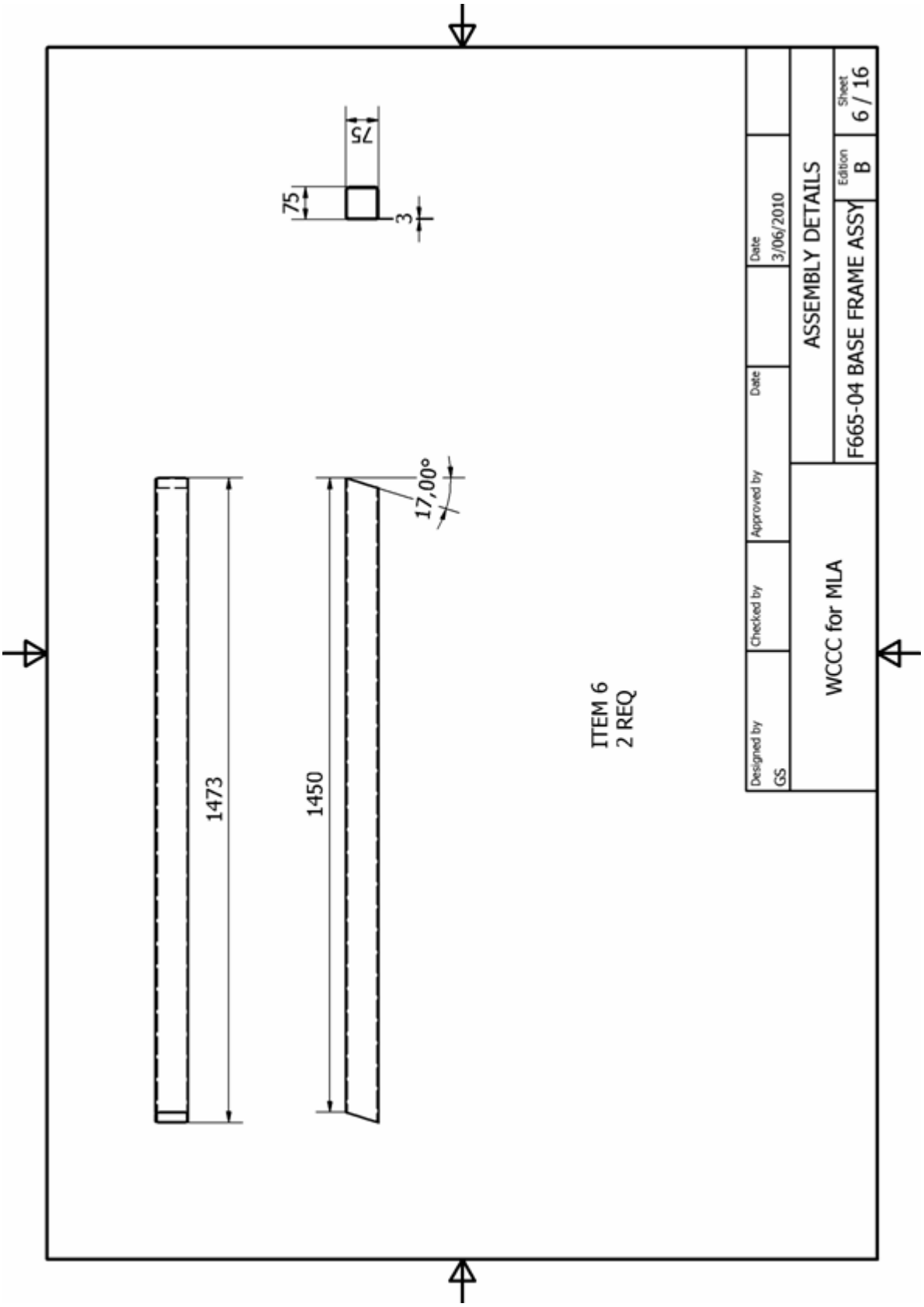
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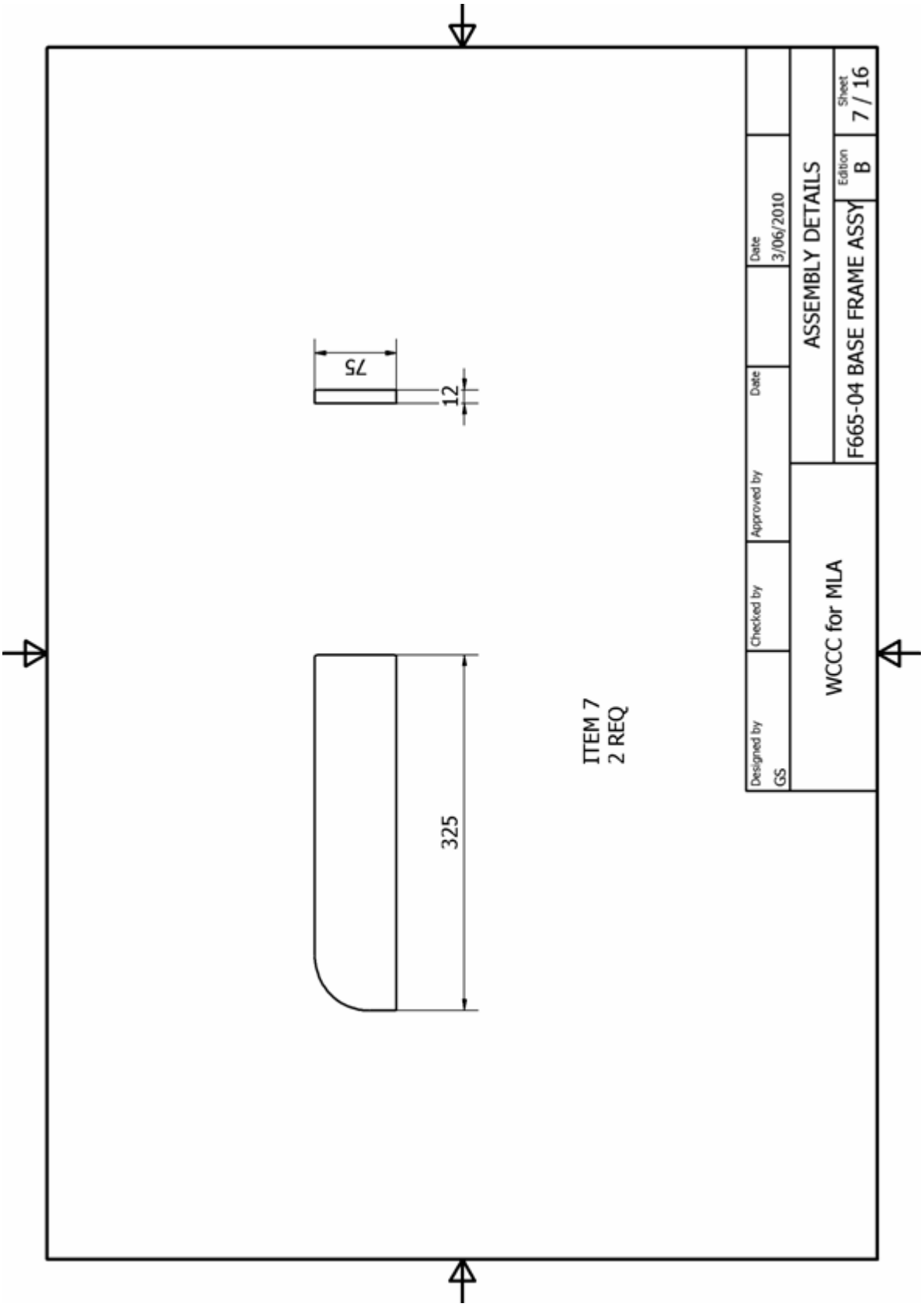
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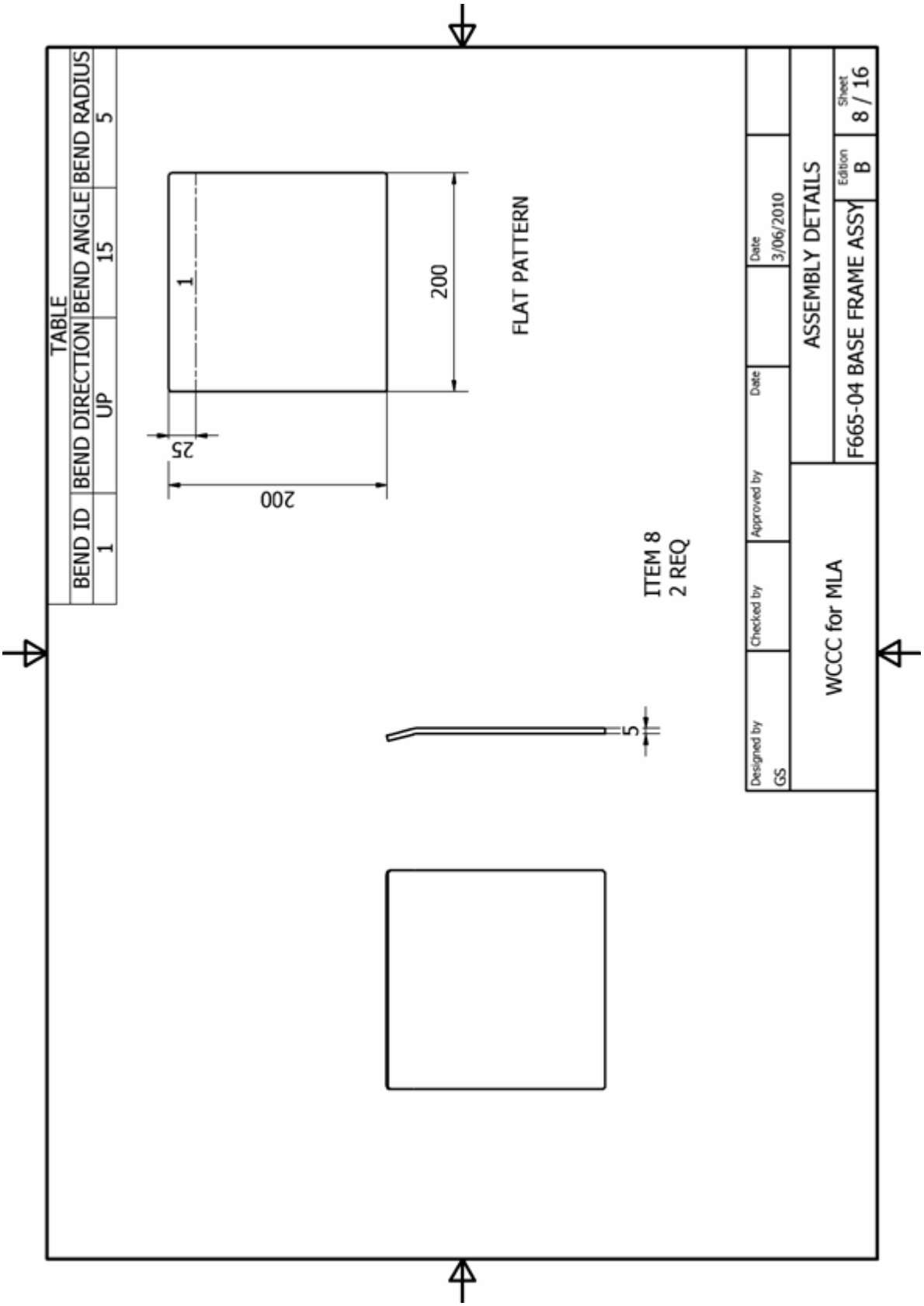
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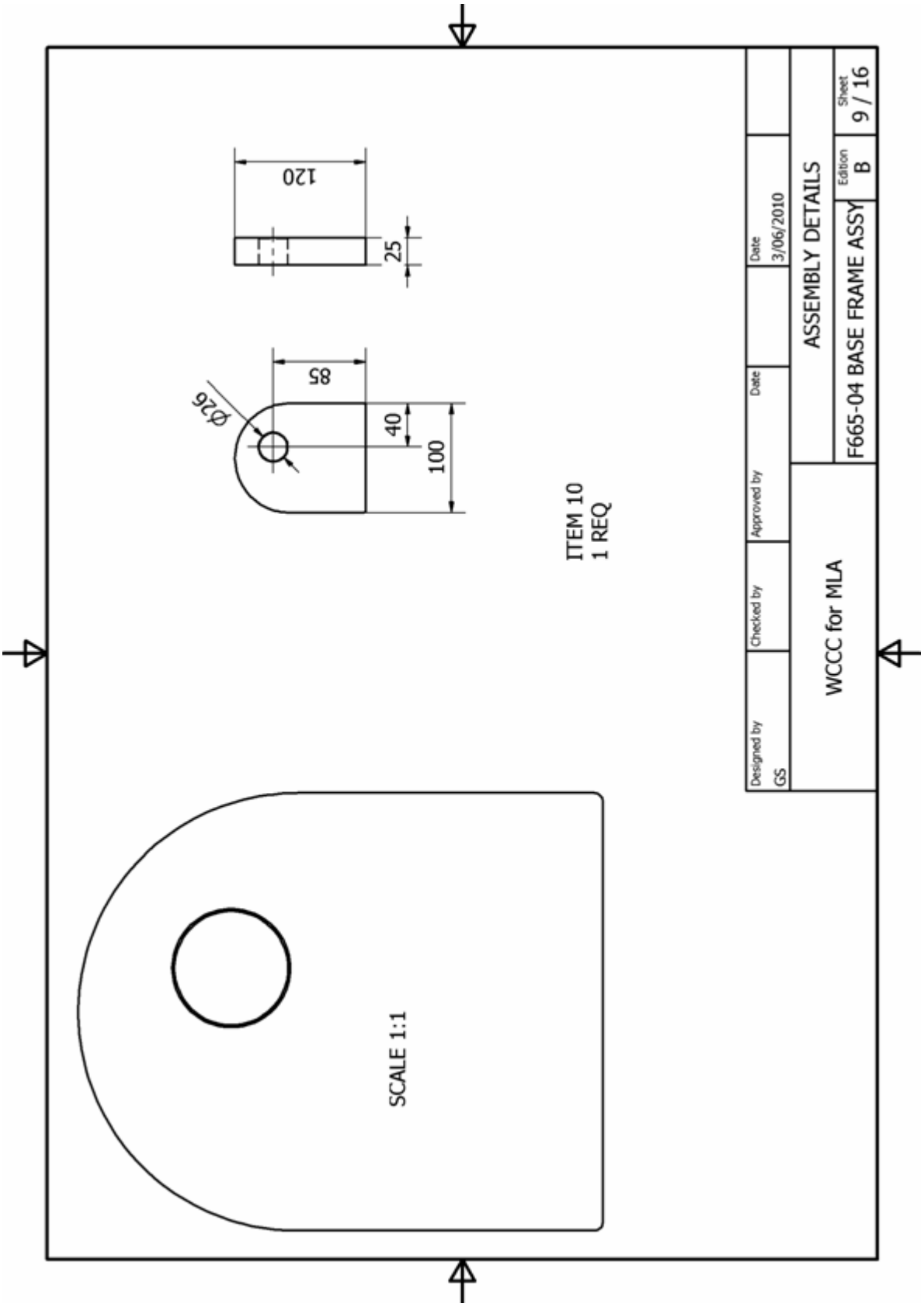
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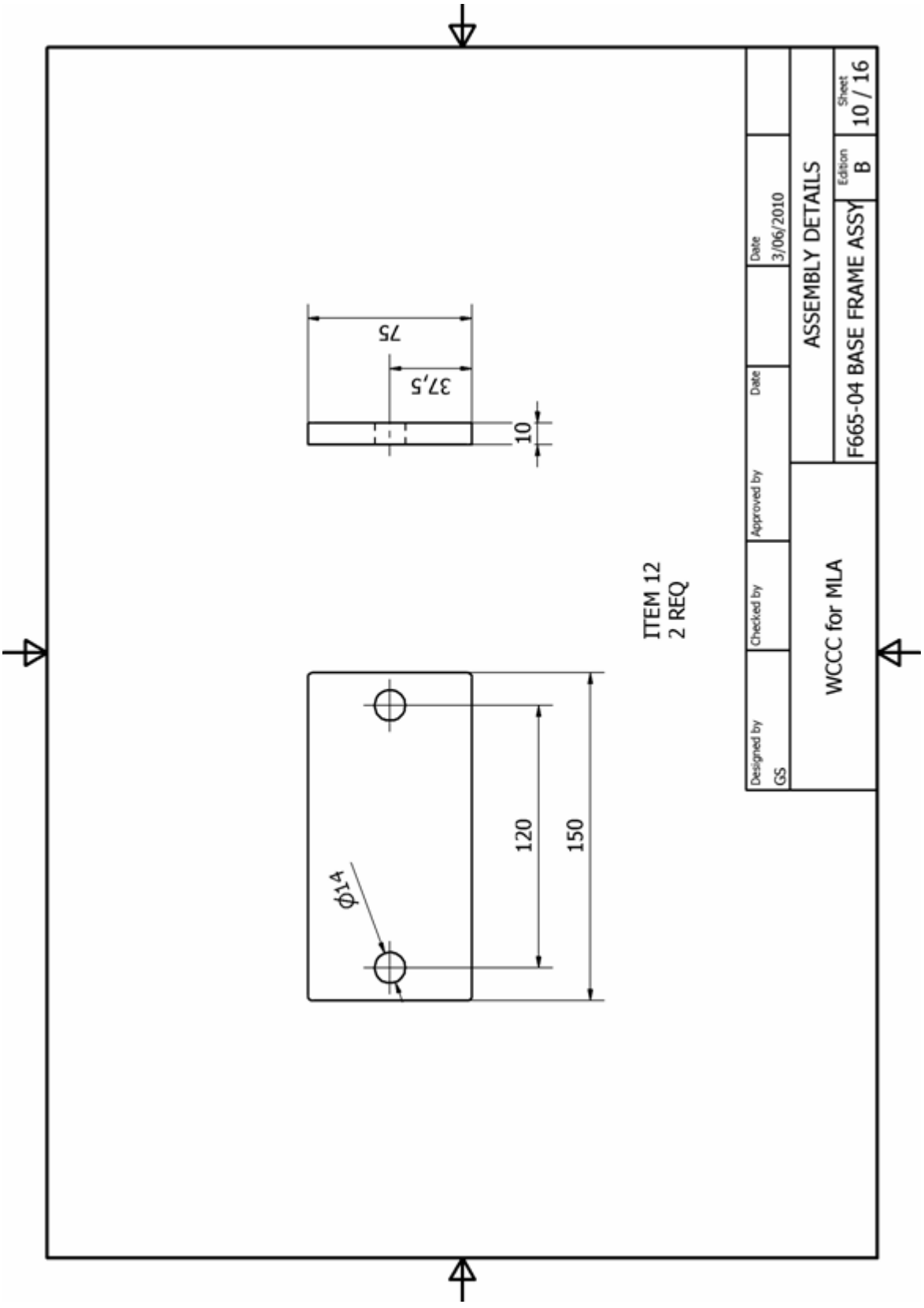
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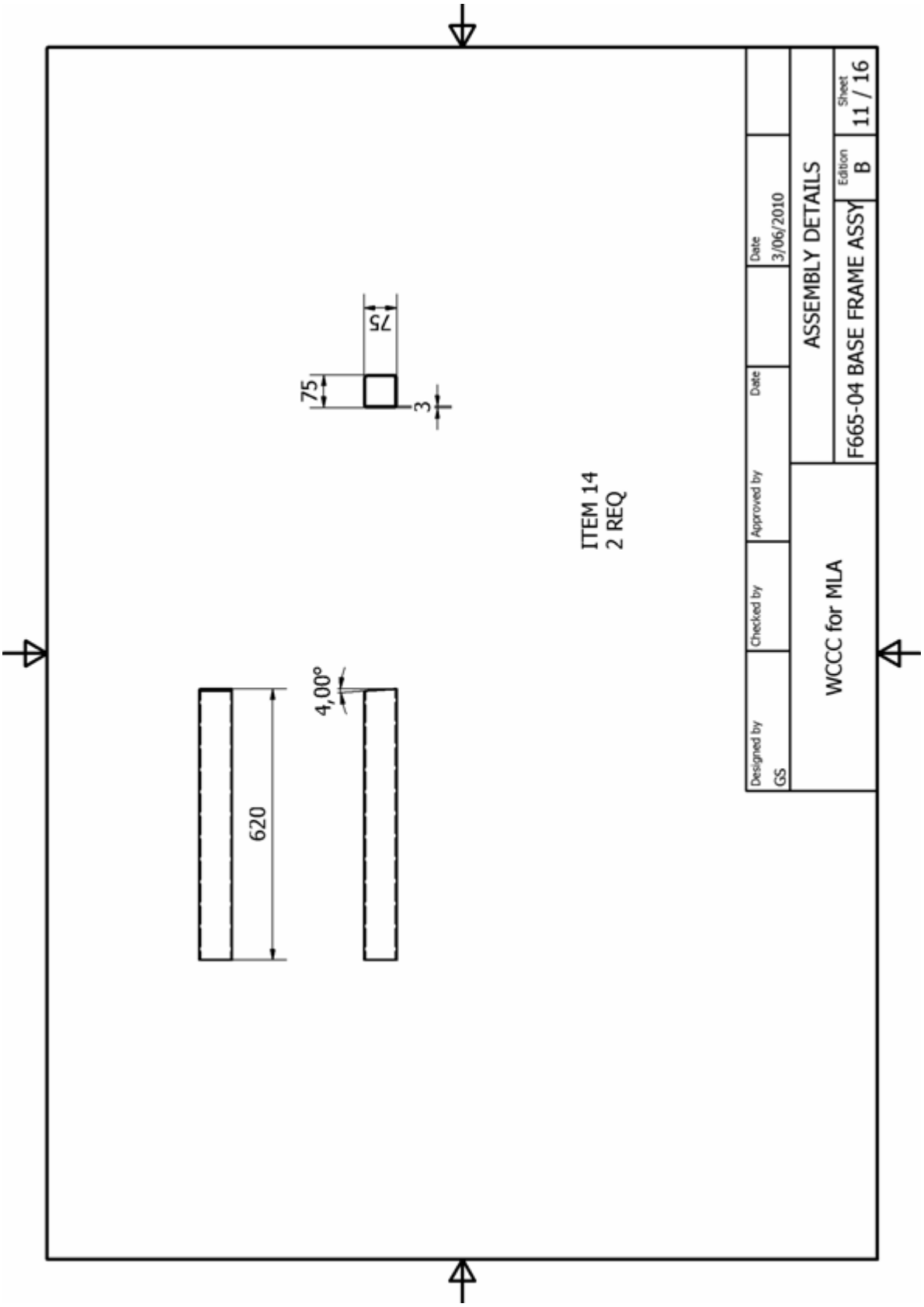
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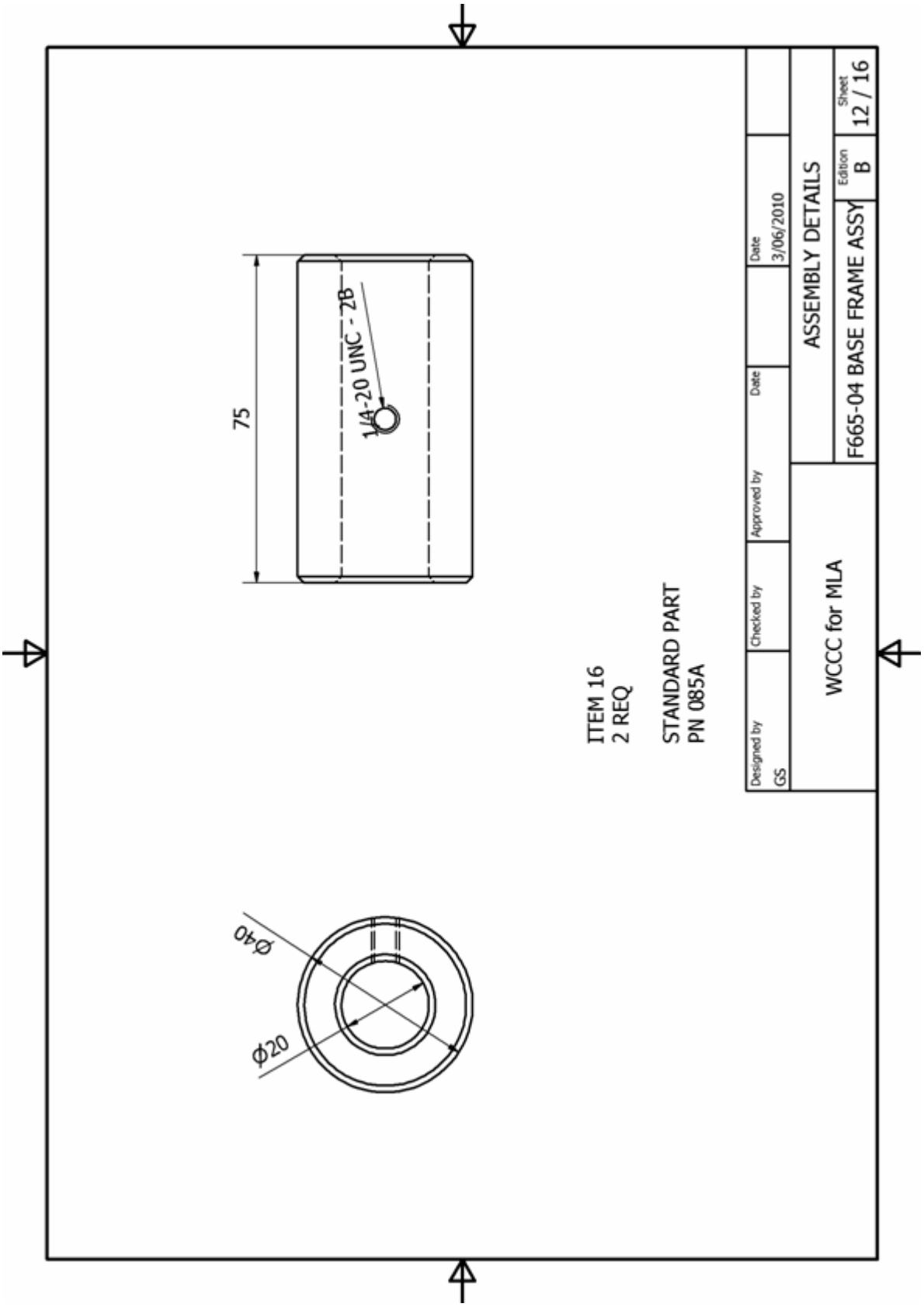
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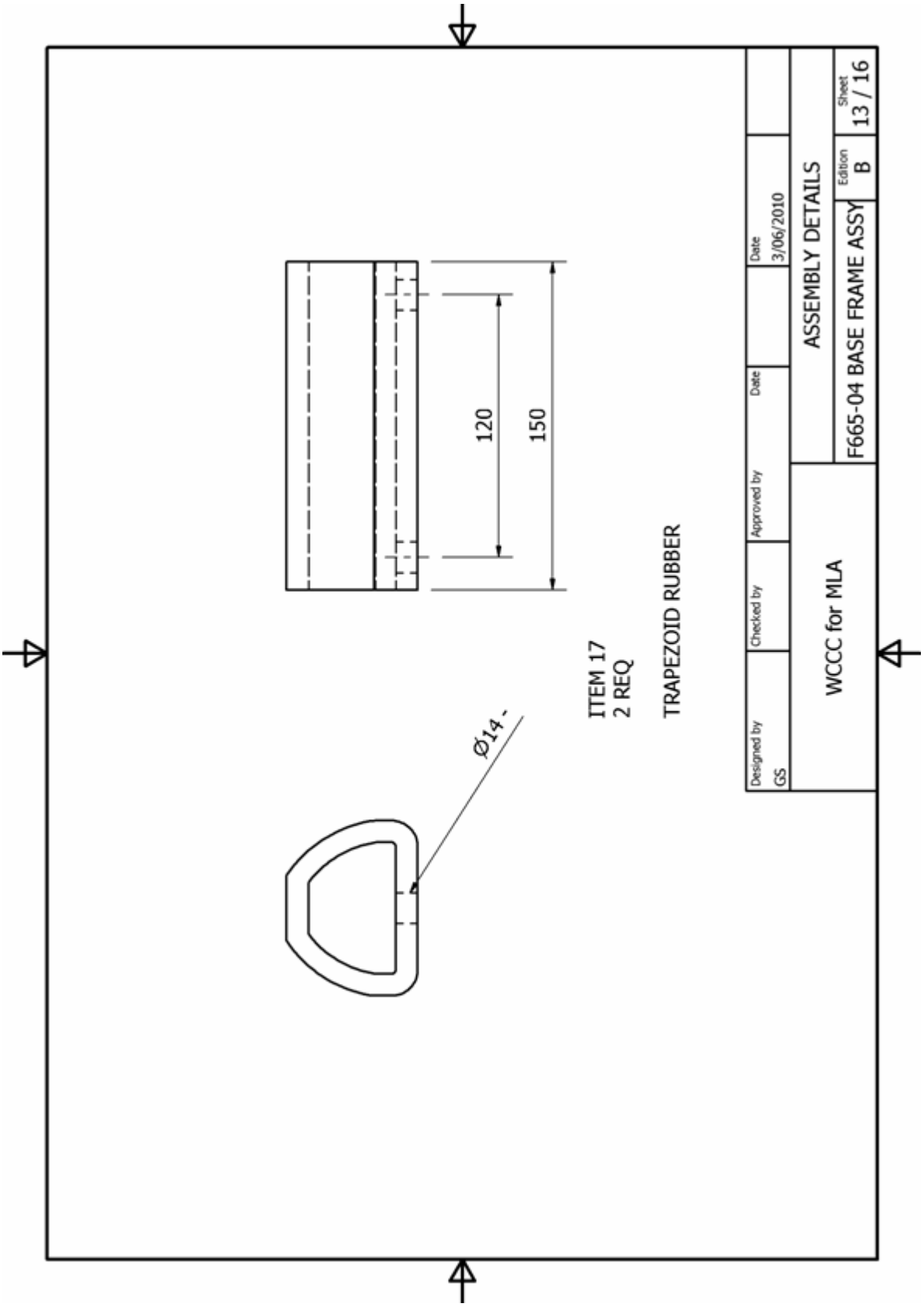
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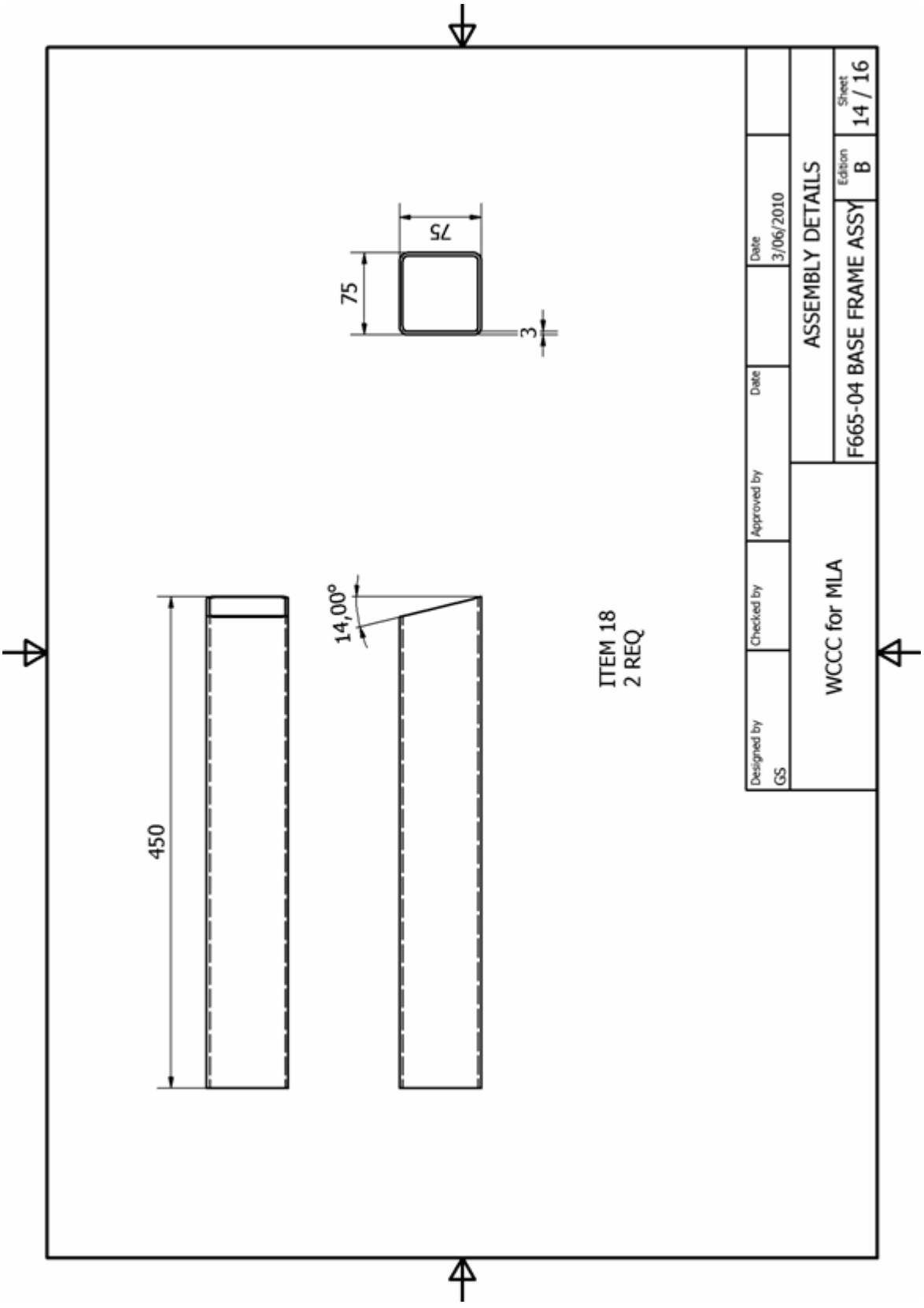
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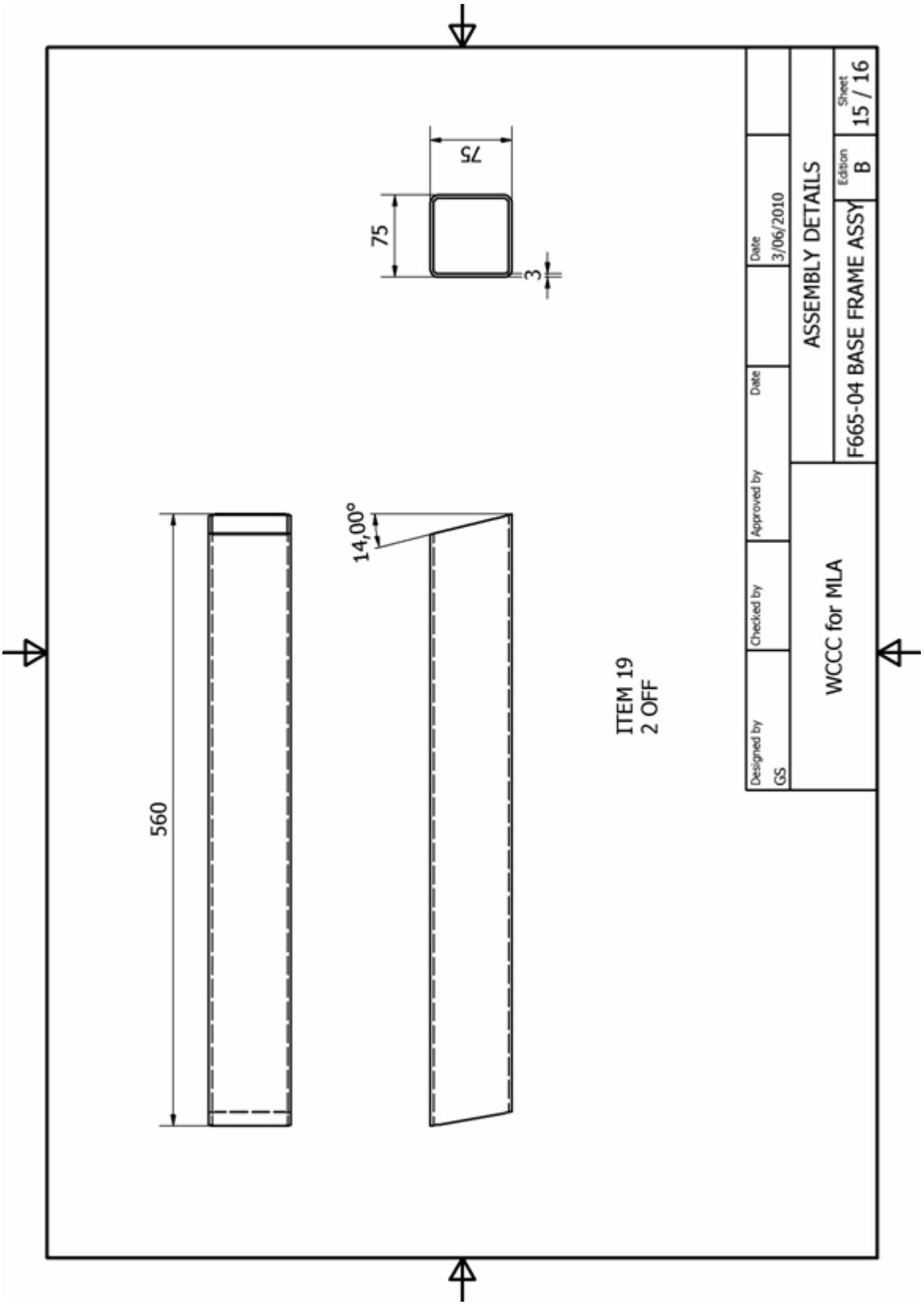
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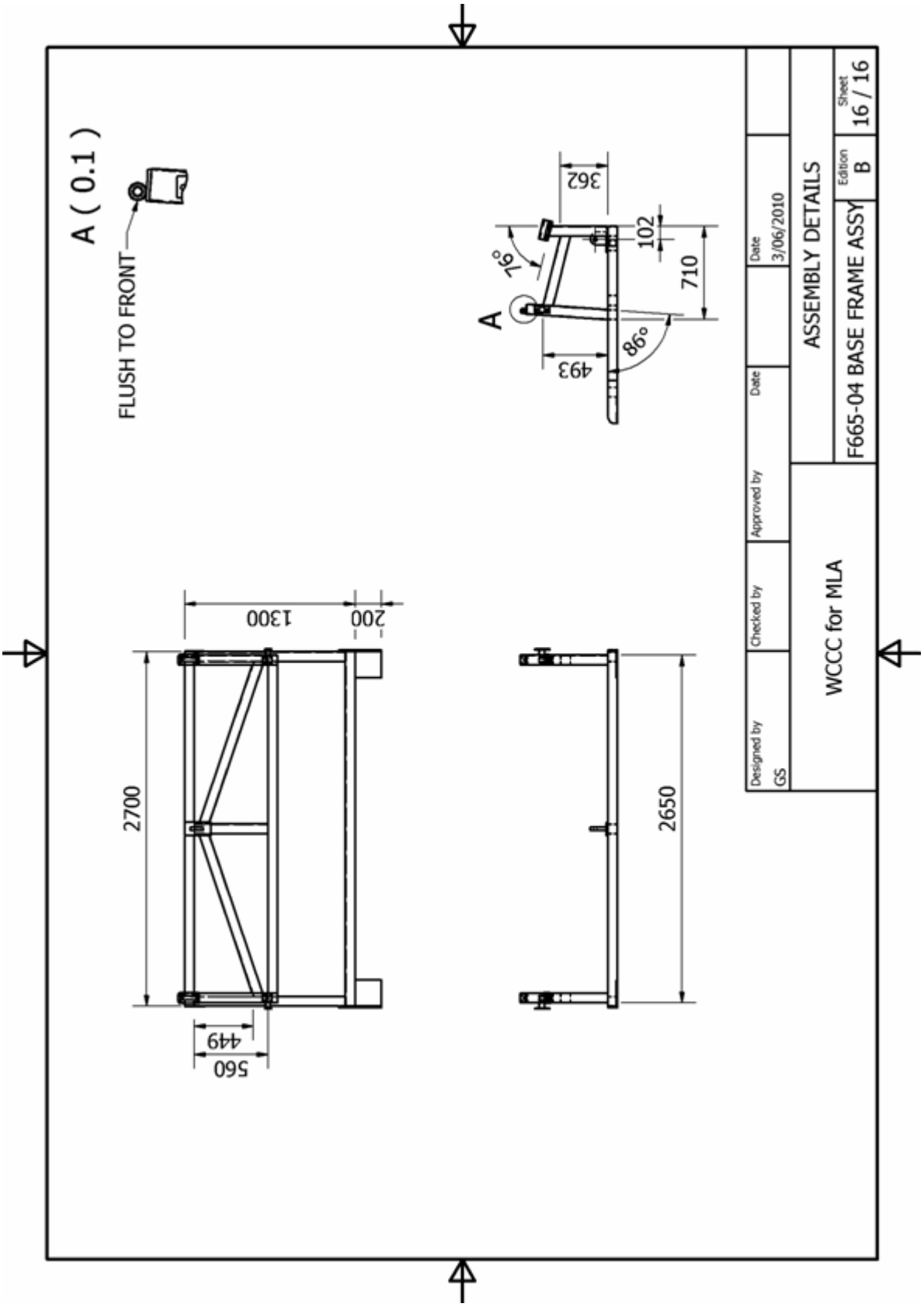
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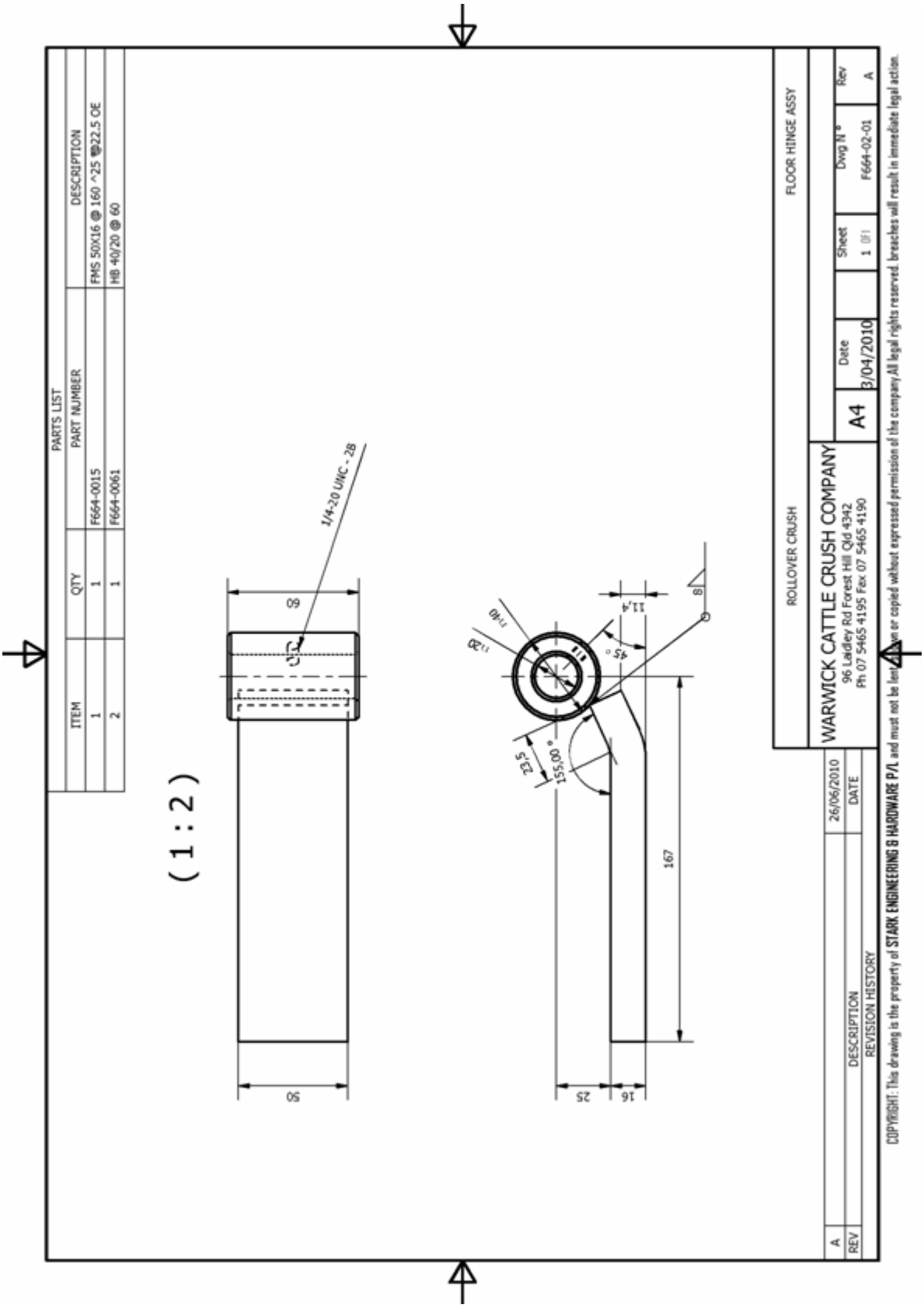
## 8.2 Appendix 2 – Floor hinge assembly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WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
A4
Date 3/04/2010
Sheet 1 of 1
Dwg N° F664-02-01
Rev A
A 26/06/2010
REV DESCRIPTION DATE
REVISION HISTORY
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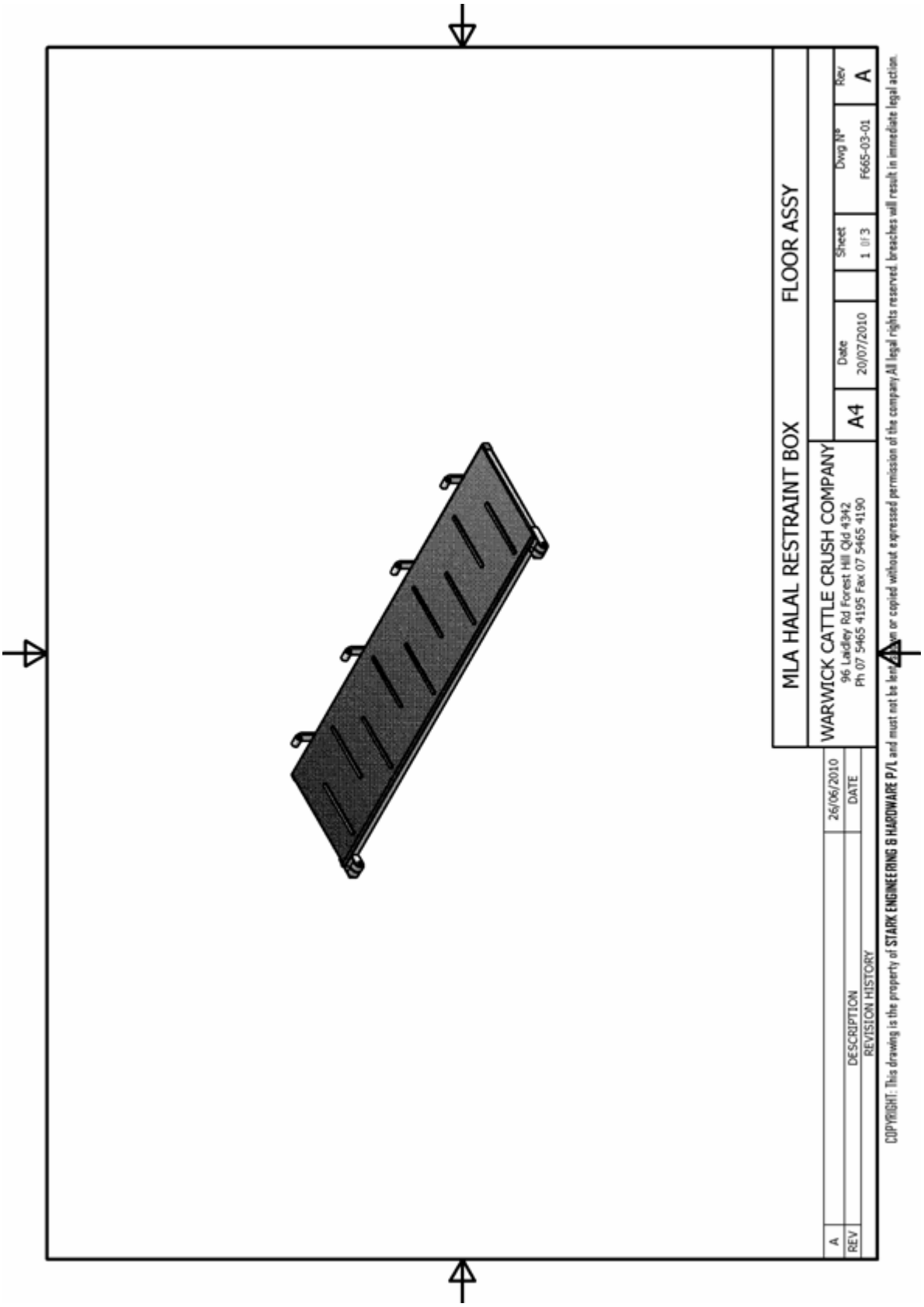
## 8.3 Appendix 3 – Floor assembly drawings


MLA HALAL RESTRAINT BOX
FLOOR ASSY
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
A4
Date
20/07/2010
Sheet
1 of 3
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F665-03-01
Rev
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DESCRIPTION
DATE
A
REVISION HISTORY
26/06/2010
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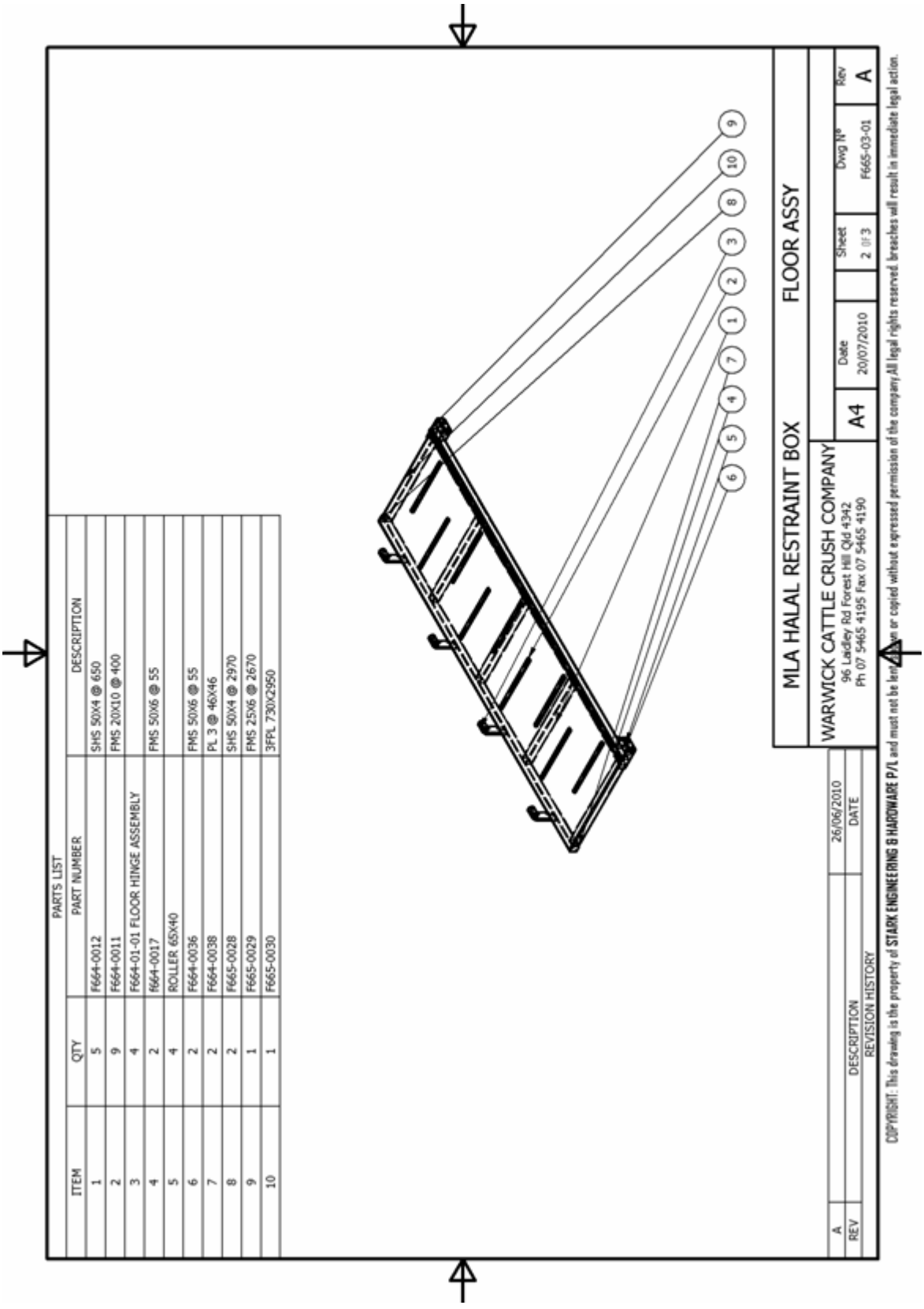
PARTS LIST
ITEM | QTY | PART NUMBER | DESCRIPTION
1 | 5 | F664-0012 | SHS 50X4 @ 650
2 | 9 | F664-0011 | FMS 20X10 @ 400
3 | 4 | F664-01-01 FLOOR HINGE ASSEMBLY |
4 | 2 | f664-0017 | FMS 50X6 @ 55
5 | 4 | ROLLER 65X40 |
6 | 2 | F664-0036 | FMS 50X6 @ 55
7 | 2 | F664-0038 | PL 3 @ 46X46
8 | 2 | f665-0028 | SHS 50X4 @ 2970
9 | 1 | F665-0029 | FMS 25X6 @ 2670
10 | 1 | F665-0030 | 3FPL 730X2950
A | 26/06/2010
REV | DESCRIPTION | DATE
REVISION HISTORY
MLA HALAL RESTRAINT BOX
FLOOR ASSY
WARWICK CATTLE CRUSH COMPANY
96 Ladley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
A4
Date 20/07/2010
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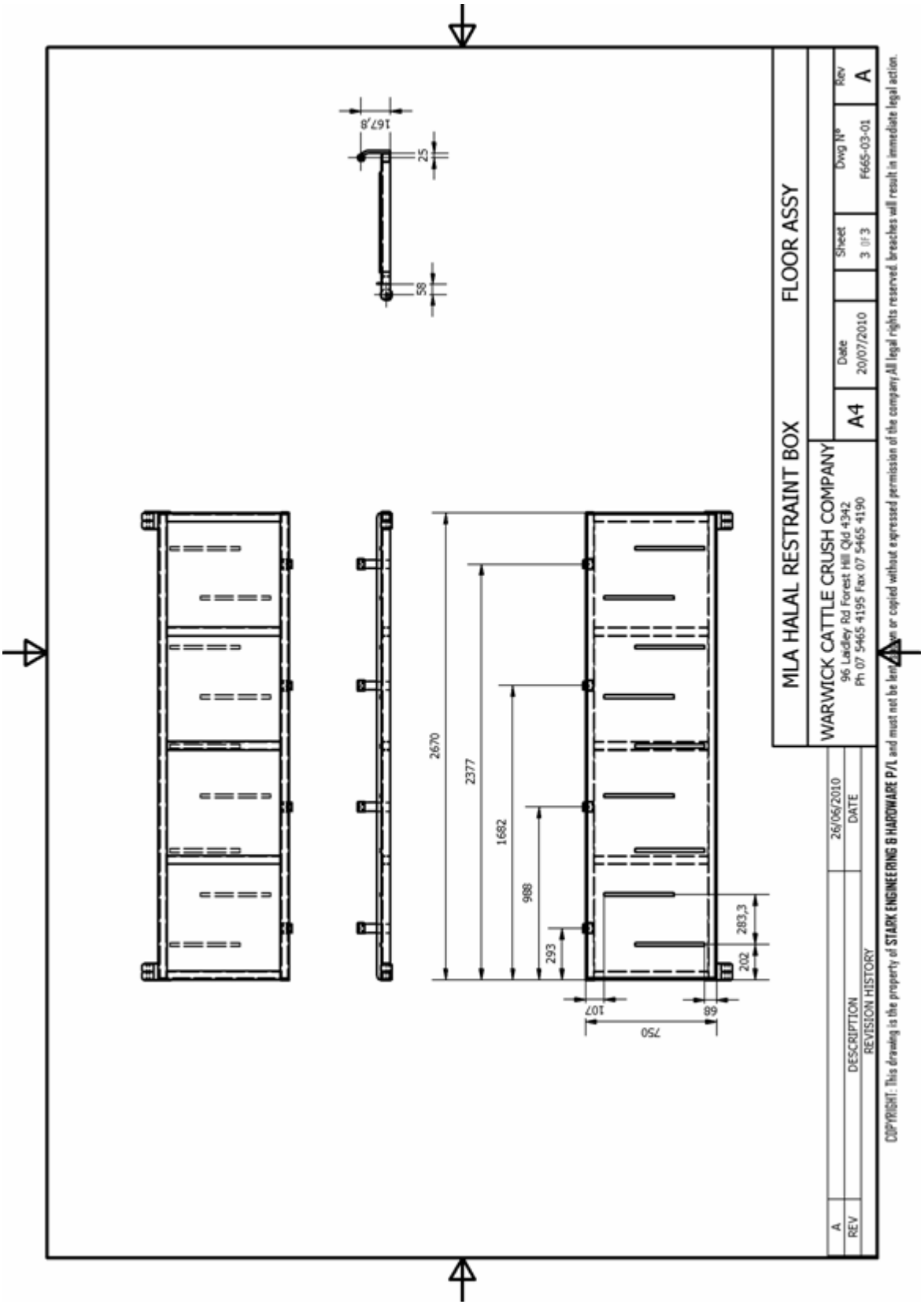
MLA HALAL RESTRAINT BOX
FLOOR ASSY
WARWICK CATTLE CRUSH COMPANY
96 Ladley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
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Date 20/07/2010
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167,8
25
58
2670
2377
1682
988
293
283,3
202
107
68
750
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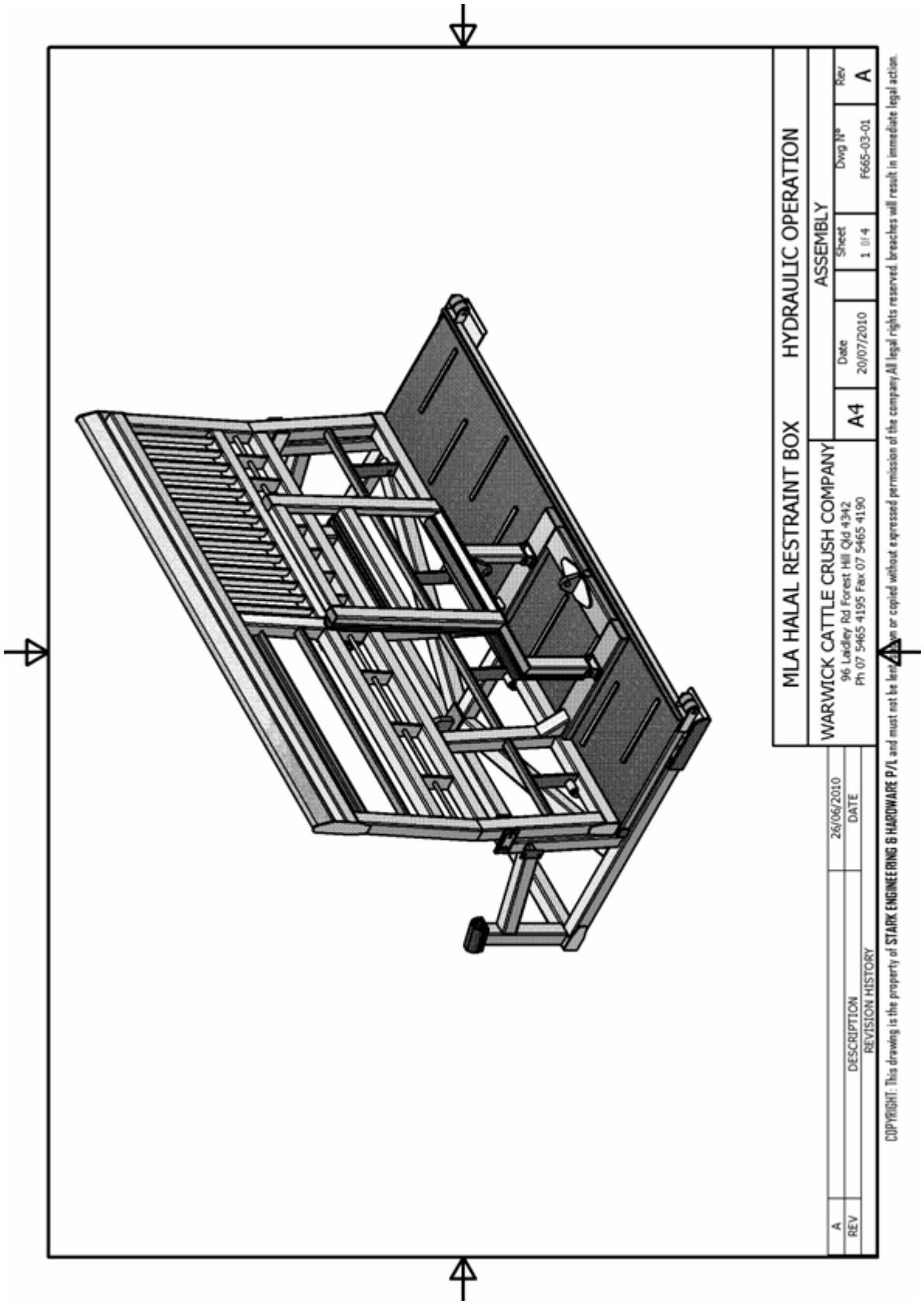
## 8.4 Appendix 4 – Hydraulic operation drawings


MLA HALAL RESTRAINT BOX
HYDRAULIC OPERATION
ASSEMBLY
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
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20/07/2010
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1 of 4
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DESCRIPTION
DATE
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REVISION HISTORY
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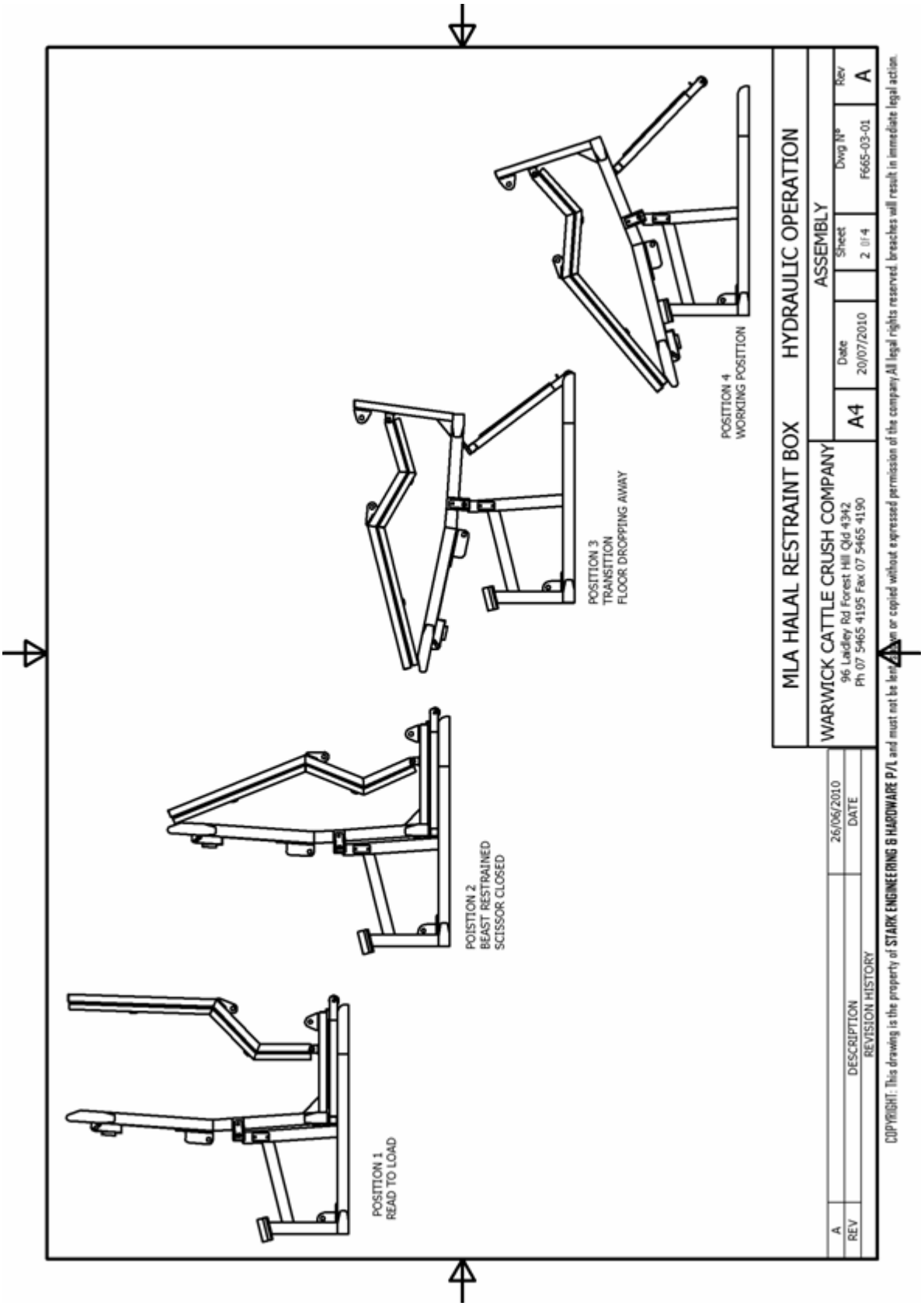
POSITION 1
READ TO LOAD
POISTION 2
BEAST RESTRAINED
SCISSOR CLOSED
POSITION 3
TRANSITION
FLOOR DROPPING AWAY
POSITION 4
WORKING POSITION
MLA HALAL RESTRAINT BOX
HYDRAULIC OPERATION
ASSEMBLY
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
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A4
Date
20/07/2010
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2 of 4
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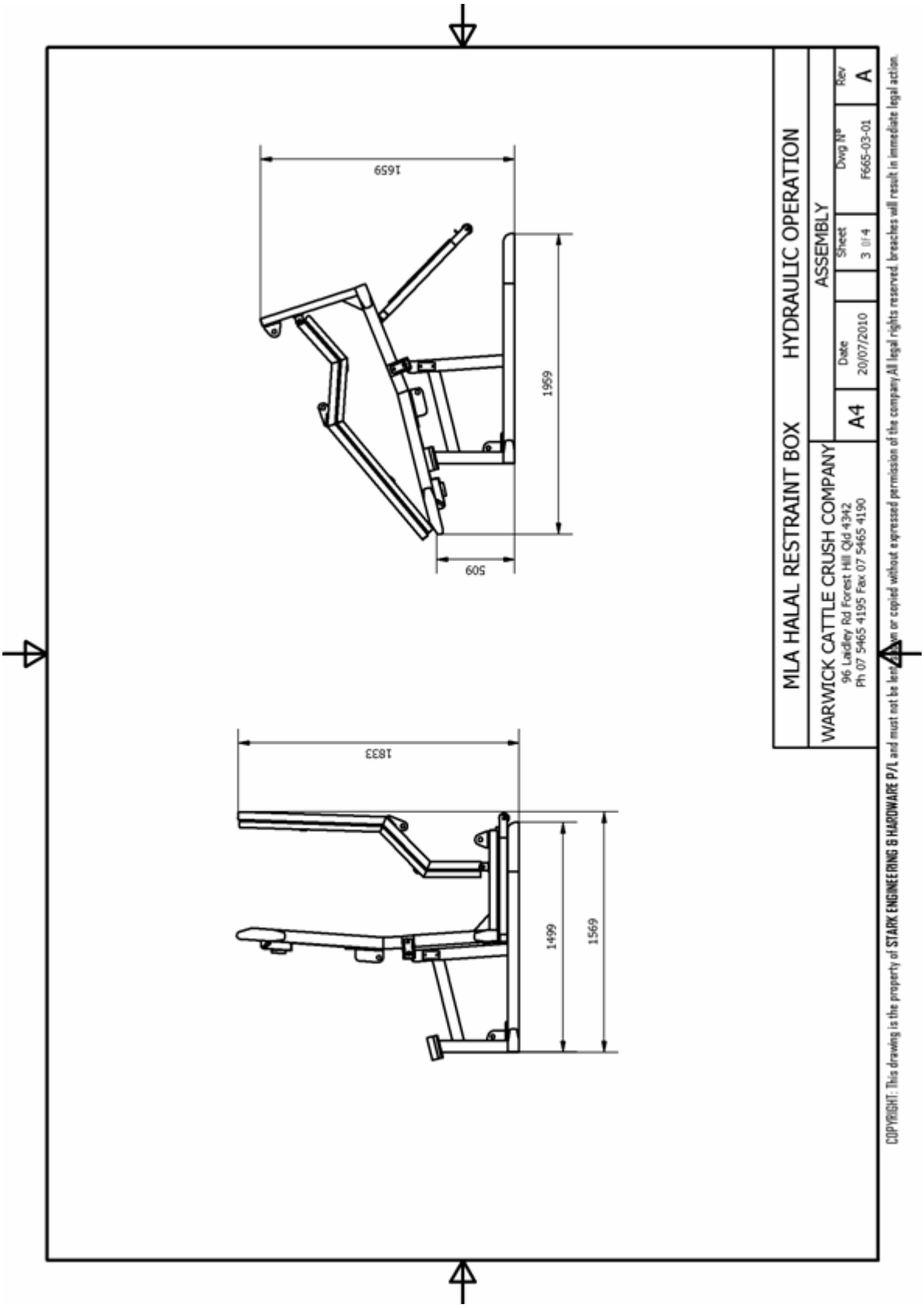
1659
1959
509
1833
1499
1569
MLA HALAL RESTRAINT BOX
HYDRAULIC OPERATION
ASSEMBLY
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
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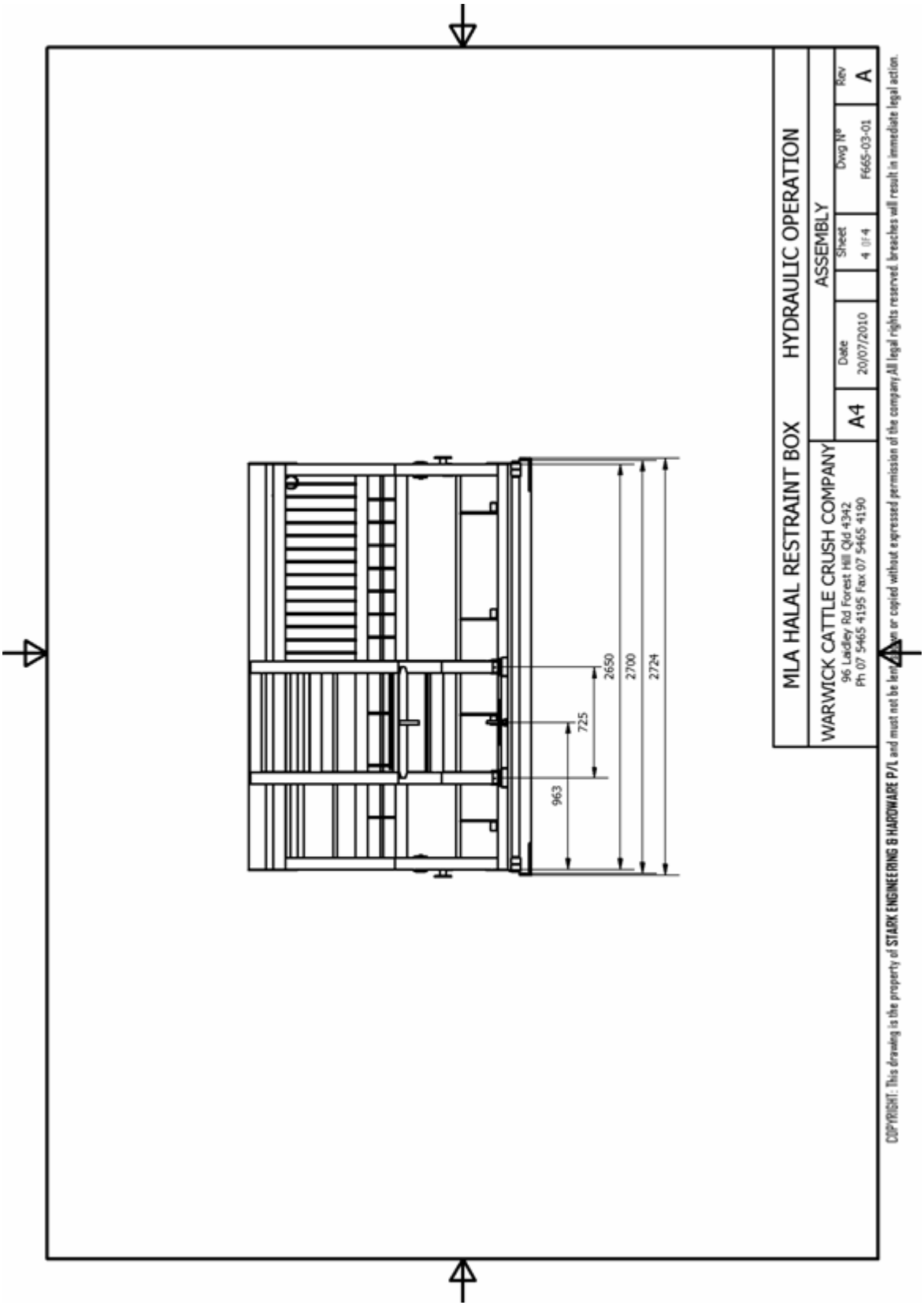
MLA HALAL RESTRAINT BOX
HYDRAULIC OPERATION
ASSEMBLY
WARWICK CATTLE CRUSH COMPANY
96 Ladley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
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2650
2700
2724
725
963
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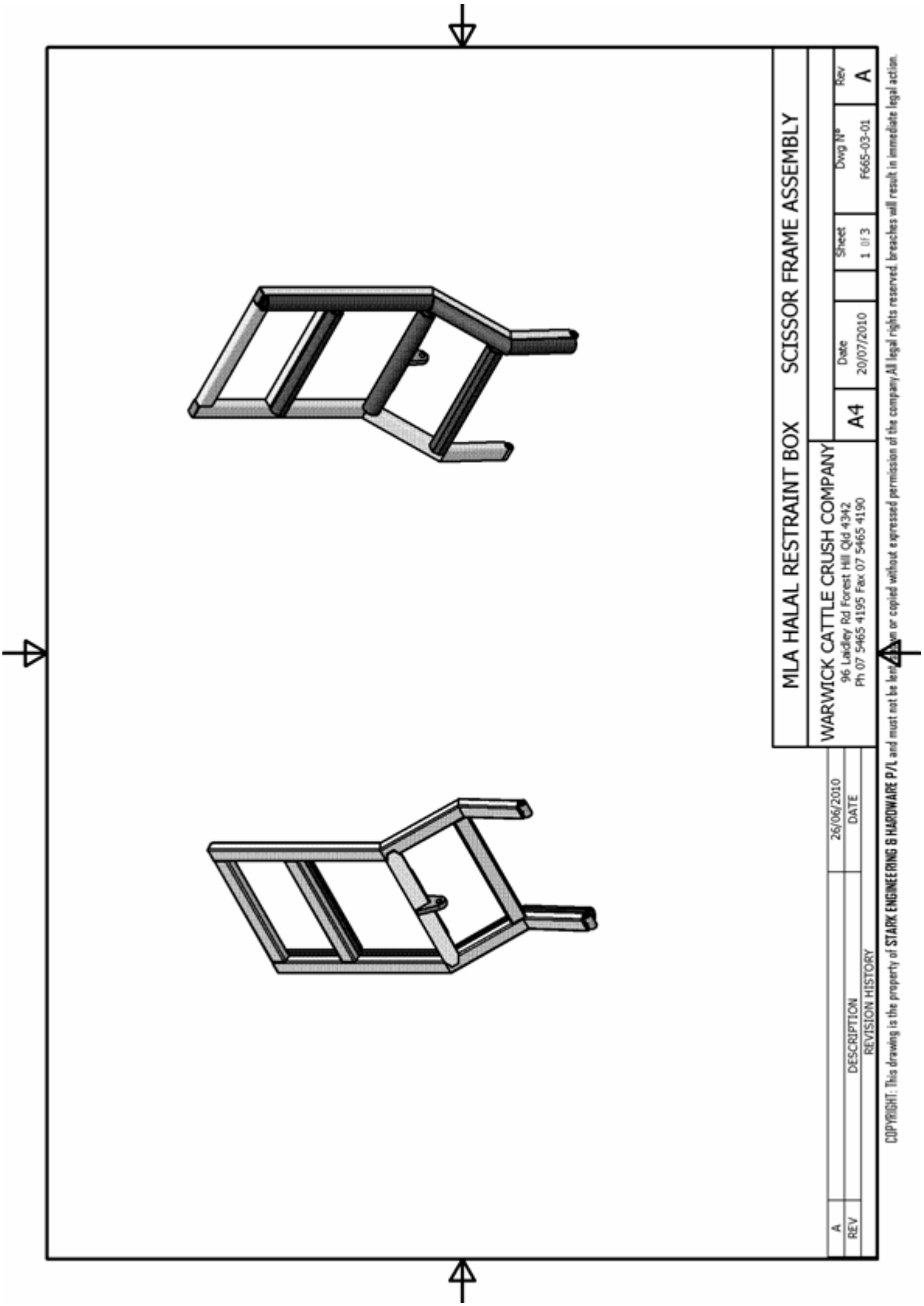
## 8.5 Appendix 5 – Scissor frame assembly


MLA HALAL RESTRAINT BOX
SCISSOR FRAME ASSEMBLY
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
A4
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20/07/2010
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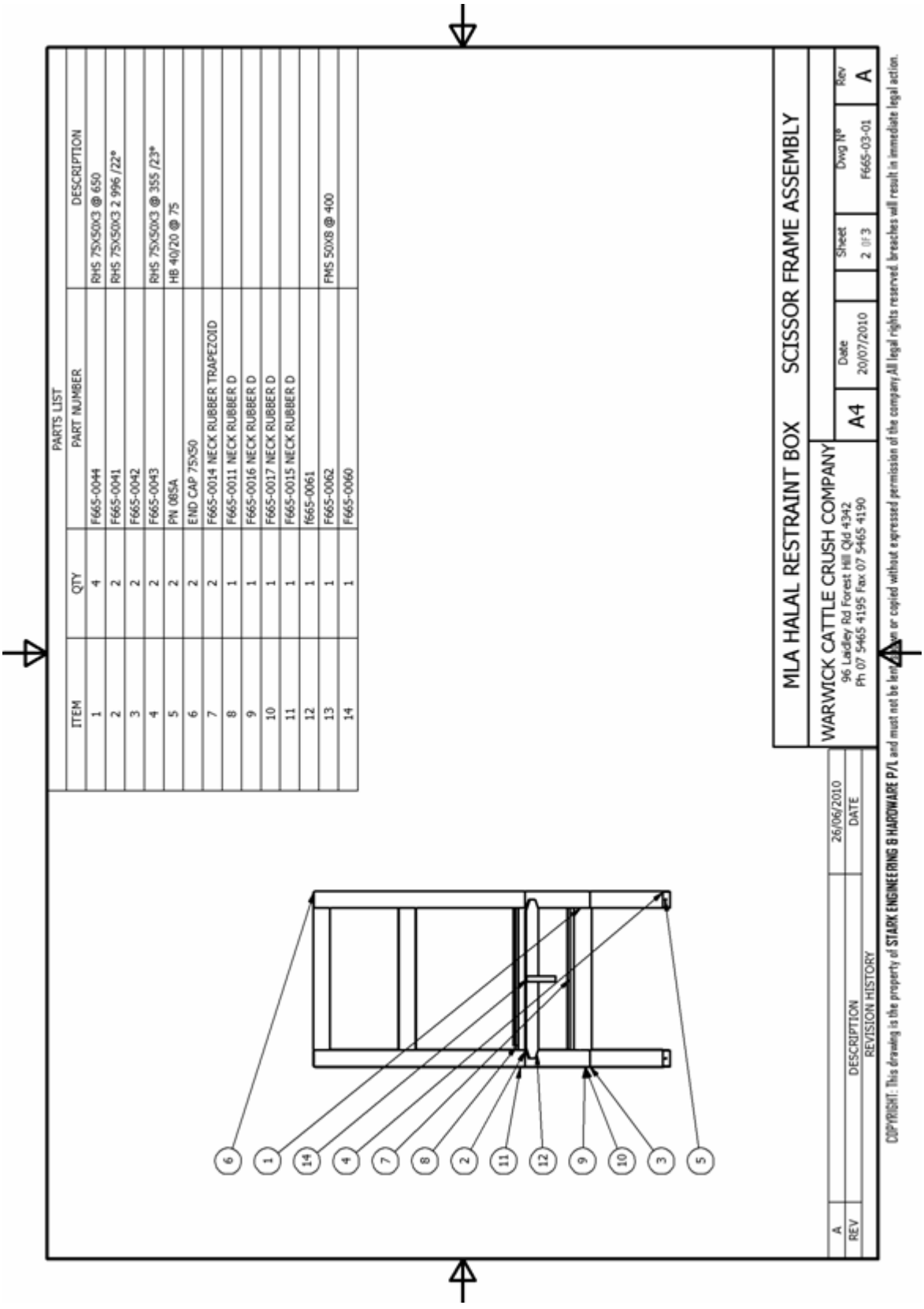

PARTS LIST

| ITEM | QTY | PART NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 4 | F665-0044 | RHS 75X50x3 @ 650 |
| 2 | 2 | F665-0041 | RHS 75X50x3 2 996 /22° |
| 3 | 2 | F665-0042 | |
| 4 | 2 | F665-0043 | RHS 75X50x3 @ 355 /23° |
| 5 | 2 | PN 085A | HB 40/20 @ 75 |
| 6 | 2 | END CAP 75X50 | |
| 7 | 2 | F665-0014 NECK RUBBER TRAPEZOID | |
| 8 | 1 | F665-0011 NECK RUBBER D | |
| 9 | 1 | F665-0016 NECK RUBBER D | |
| 10 | 1 | F665-0017 NECK RUBBER D | |
| 11 | 1 | F665-0015 NECK RUBBER D | |
| 12 | 1 | f665-0061 | |
| 13 | 1 | F665-0062 | FMS 50X8 @ 400 |
| 14 | 1 | F665-0060 | |

MLA HALAL RESTRAINT BOX SCISSOR FRAME ASSEMBLY

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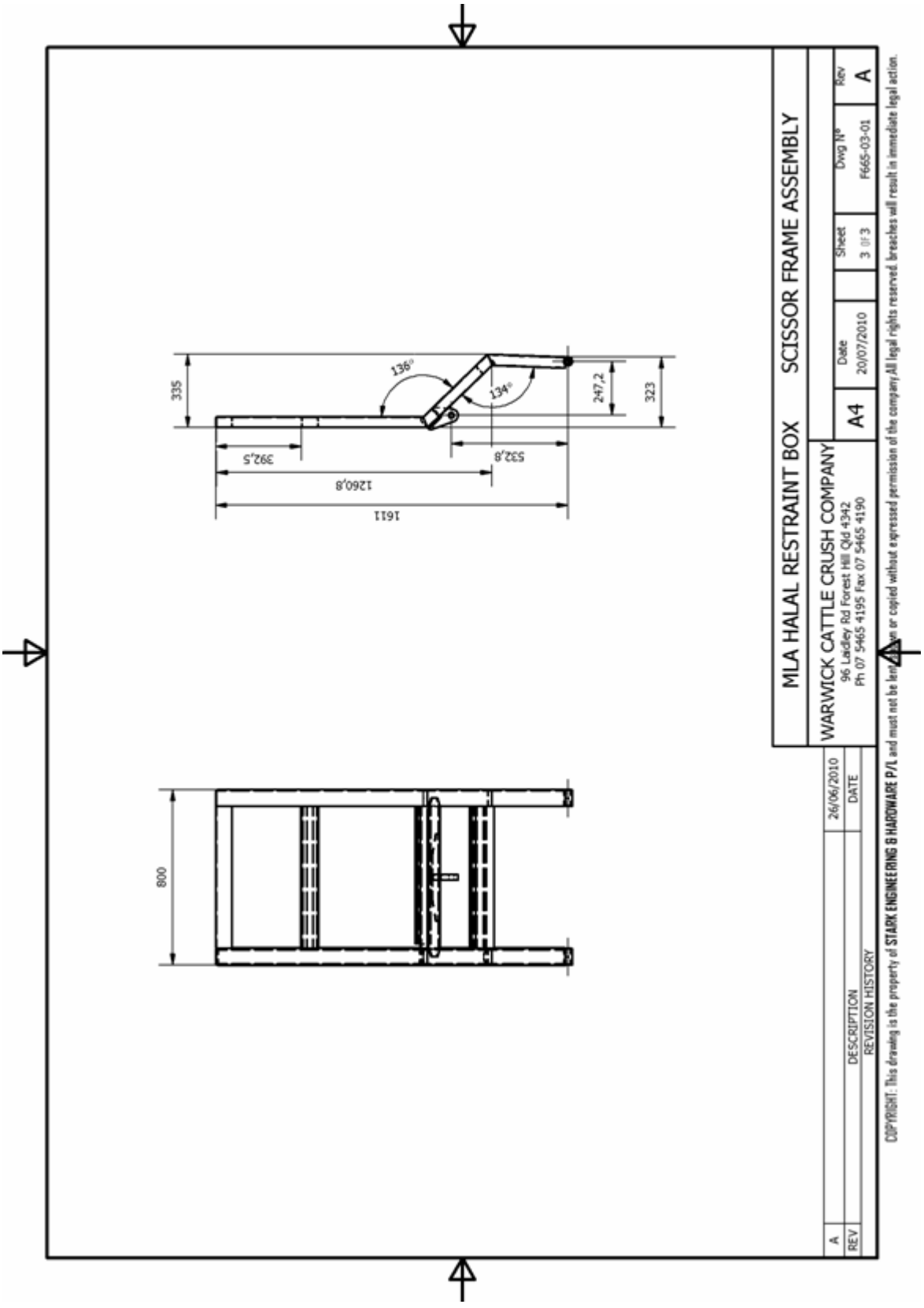
| REV | DESCRIPTION | DATE |
|---|---|---|
| A | REVISION HISTORY | 26/06/2010 |


MLA HALAL RESTRAINT BOX
SCISSOR FRAME ASSEMBLY
WARWICK CATTLE CRUSH COMPANY
96 Ladley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
A4
Date 20/07/2010
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Dwg N° F665-03-01
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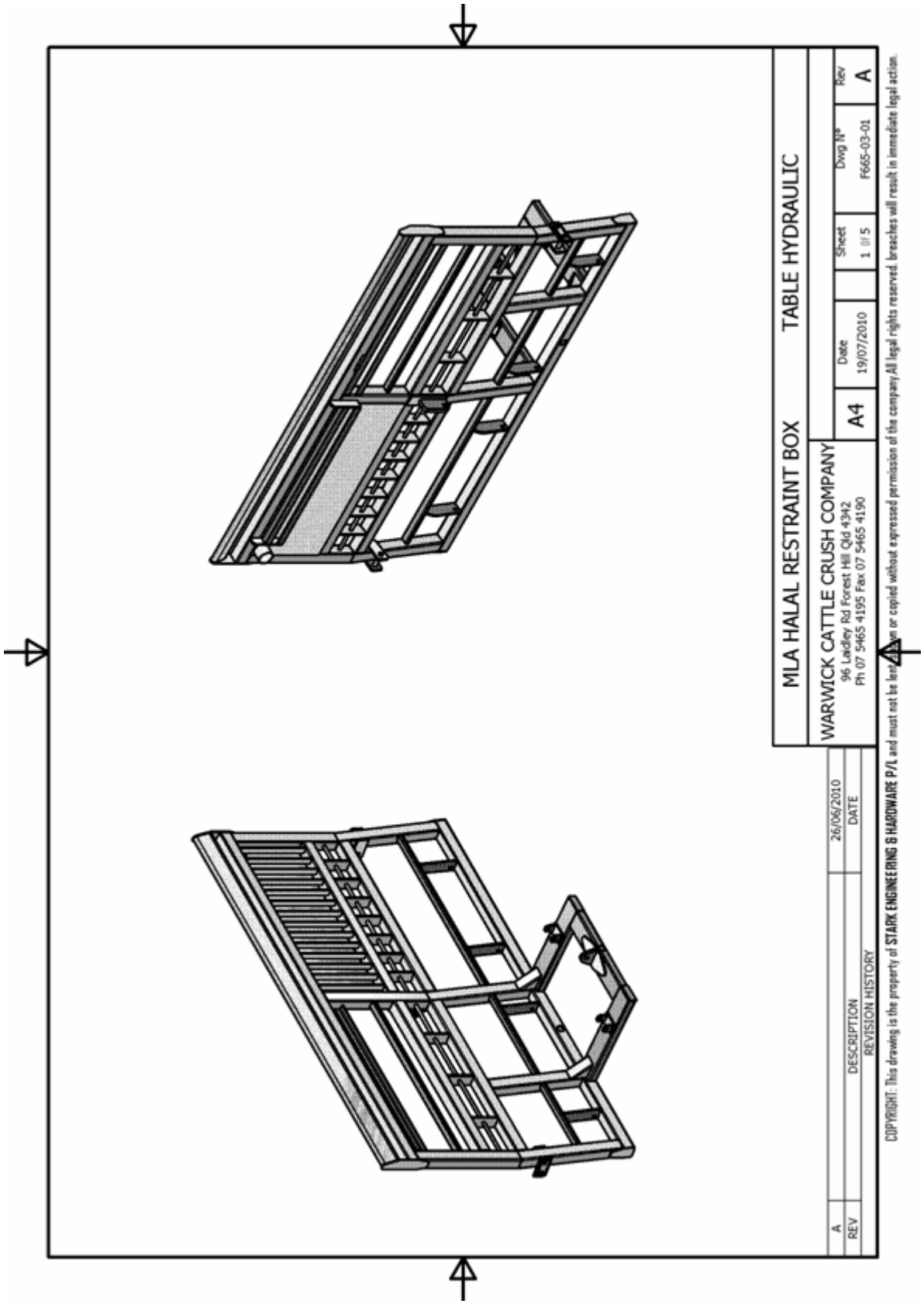
335
136°
134°
247,2
323
392,5
532,8
1260,8
1611
800

## 8.6 Appendix 6 – Hydraulic table drawings


MLA HALAL RESTRAINT BOX
TABLE HYDRAULIC
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
A4
Date
19/07/2010
Sheet
1 of 5
Dwg N°
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REV
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DATE
REVISION HISTORY
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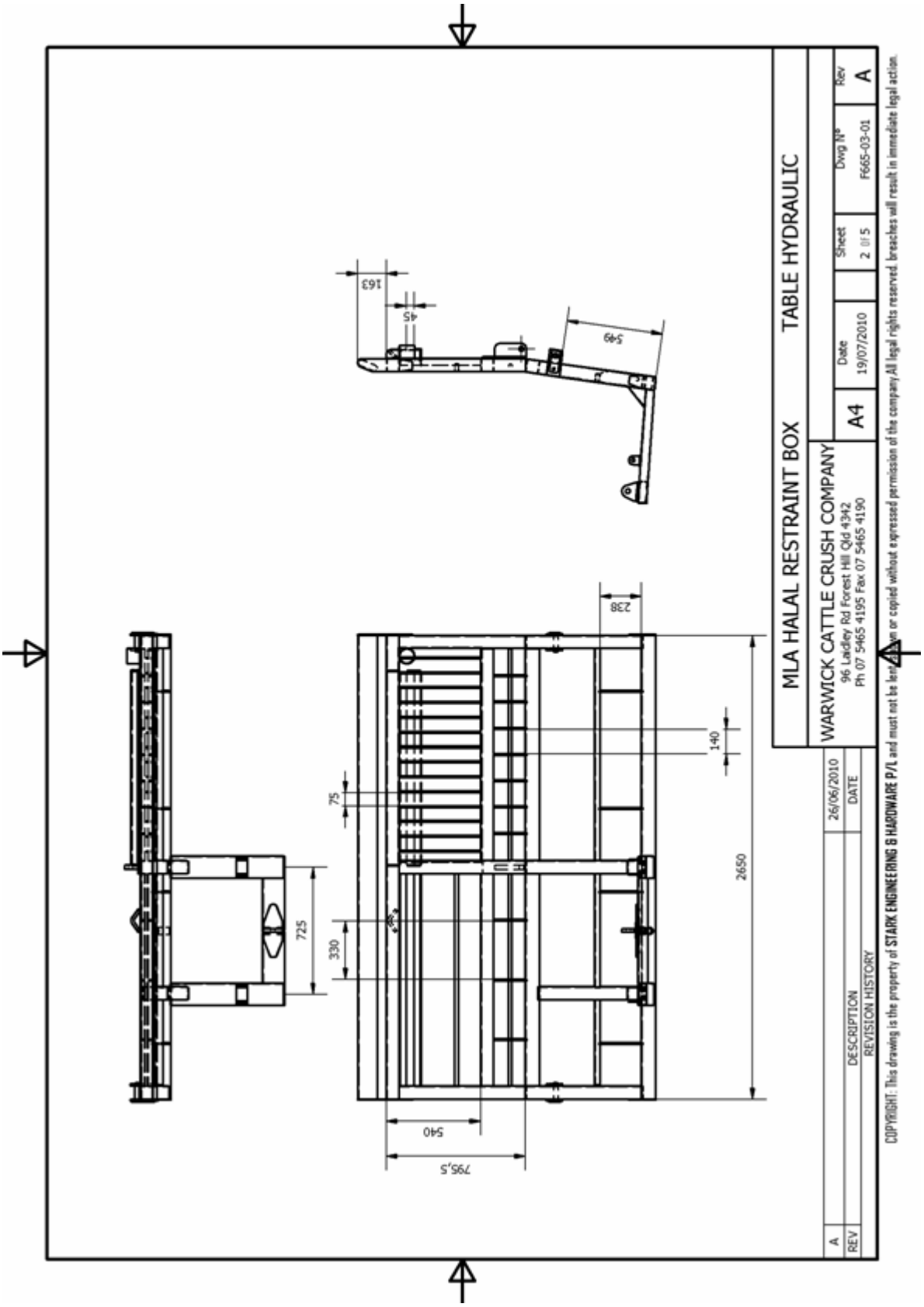
MLA HALAL RESTRAINT BOX
TABLE HYDRAULIC
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
Ph 07 5465 4195 Fax 07 5465 4190
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Date 19/07/2010
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163
45
549
238
140
75
725
330
2650
540
795,5
REV
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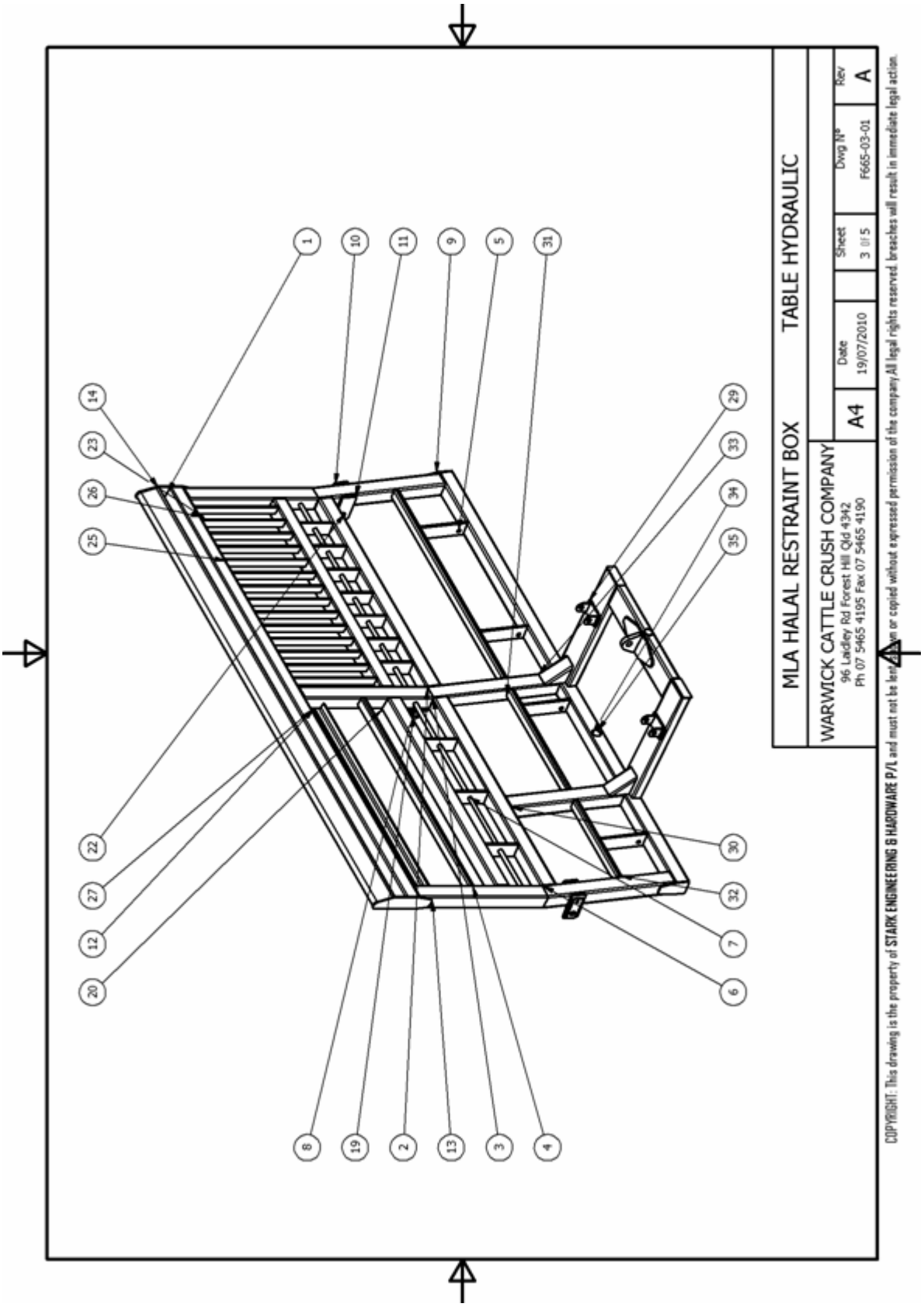
MLA HALAL RESTRAINT BOX
TABLE HYDRAULIC
WARWICK CATTLE CRUSH COMPANY
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A4
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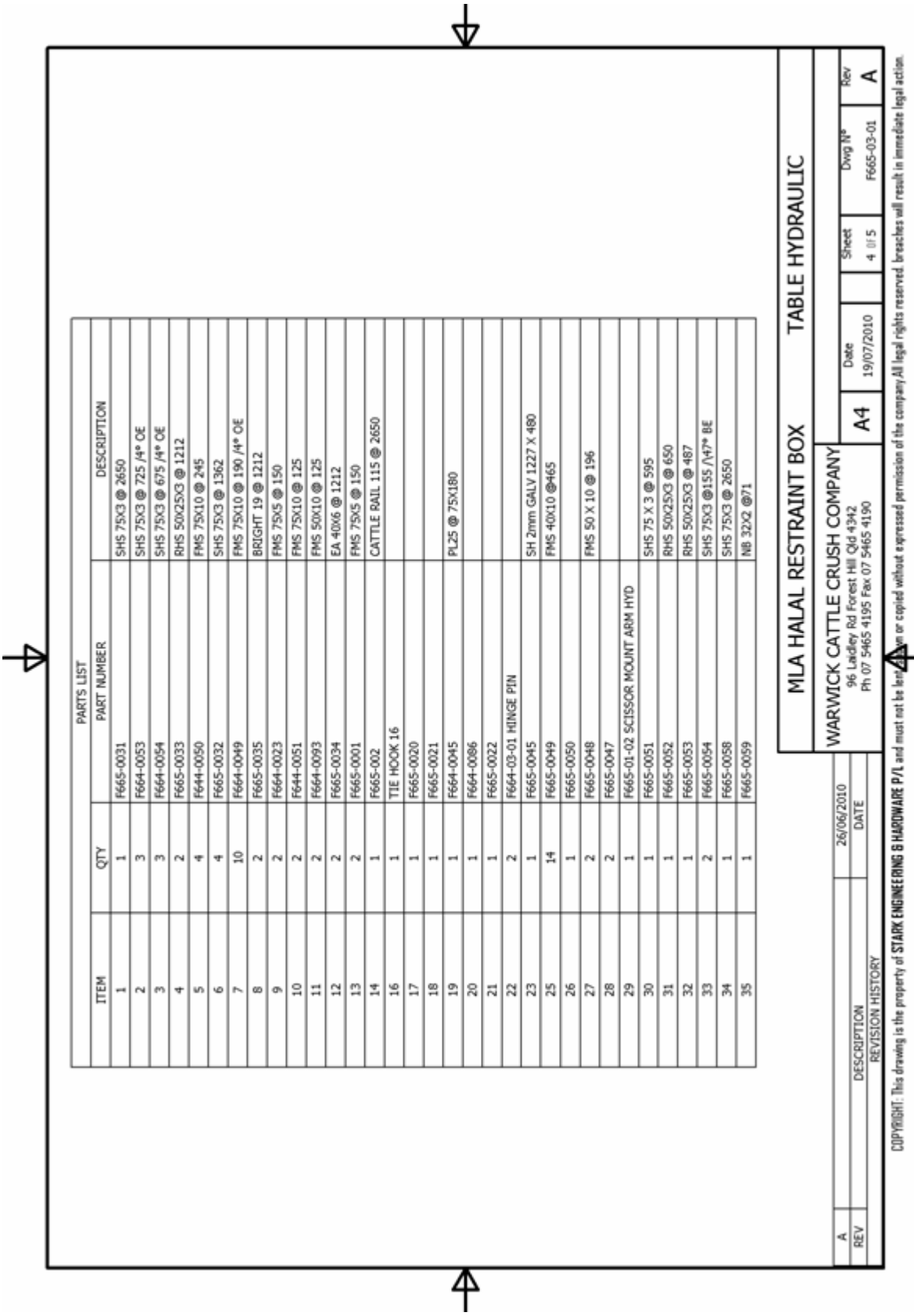

PARTS LIST

| ITEM | QTY | PART NUMBER | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | F665-0031 | SHS 75X3 @ 2650 |
| 2 | 3 | F664-0053 | SHS 75X3 @ 725 /4° OE |
| 3 | 3 | F664-0054 | SHS 75X3 @ 675 /4° OE |
| 4 | 2 | F665-0033 | RHS 50X25X3 @ 1212 |
| 5 | 4 | F644-0050 | FMS 75X10 @ 245 |
| 6 | 4 | F665-0032 | SHS 75X3 @ 1362 |
| 7 | 10 | F664-0049 | FMS 75X10 @ 190 /4° OE |
| 8 | 2 | F665-0035 | BRIGHT 19 @ 1212 |
| 9 | 2 | F664-0023 | FMS 75X5 @ 150 |
| 10 | 2 | F644-0051 | FMS 75X10 @ 125 |
| 11 | 2 | F664-0093 | FMS 50X10 @ 125 |
| 12 | 2 | F665-0034 | EA 40X6 @ 1212 |
| 13 | 2 | F665-0001 | FMS 75X5 @ 150 |
| 14 | 1 | F665-002 | CATTLE RAIL 115 @ 2650 |
| 16 | 1 | TIE HOOK 16 | |
| 17 | 1 | F665-0020 | |
| 18 | 1 | F665-0021 | |
| 19 | 1 | F664-0045 | PL25 @ 75X180 |
| 20 | 1 | F664-0086 | |
| 21 | 1 | F665-0022 | |
| 22 | 2 | F664-03-01 HINGE PIN | |
| 23 | 1 | F665-0045 | SH 2mm GALV 1227 X 480 |
| 25 | 14 | F665-0049 | FMS 40X10 @465 |
| 26 | 1 | F665-0050 | |
| 27 | 2 | F665-0048 | FMS 50 X 10 @ 196 |
| 28 | 2 | F665-0047 | |
| 29 | 1 | F665-01-02 SCISSOR MOUNT ARM HYD | |
| 30 | 1 | F665-0051 | SHS 75 X 3 @ 595 |
| 31 | 1 | F665-0052 | RHS 50X25X3 @ 650 |
| 32 | 1 | F665-0053 | RHS 50X25X3 @ 487 |
| 33 | 2 | F665-0054 | SHS 75X3 @155 /47° BE |
| 34 | 1 | F665-0058 | SHS 75X3 @ 2650 |
| 35 | 1 | F665-0059 | NB 32X2 @71 |

MLA HALAL RESTRAINT BOX — TABLE HYDRAULIC

WARWICK CATTLE CRUSH COMPANY
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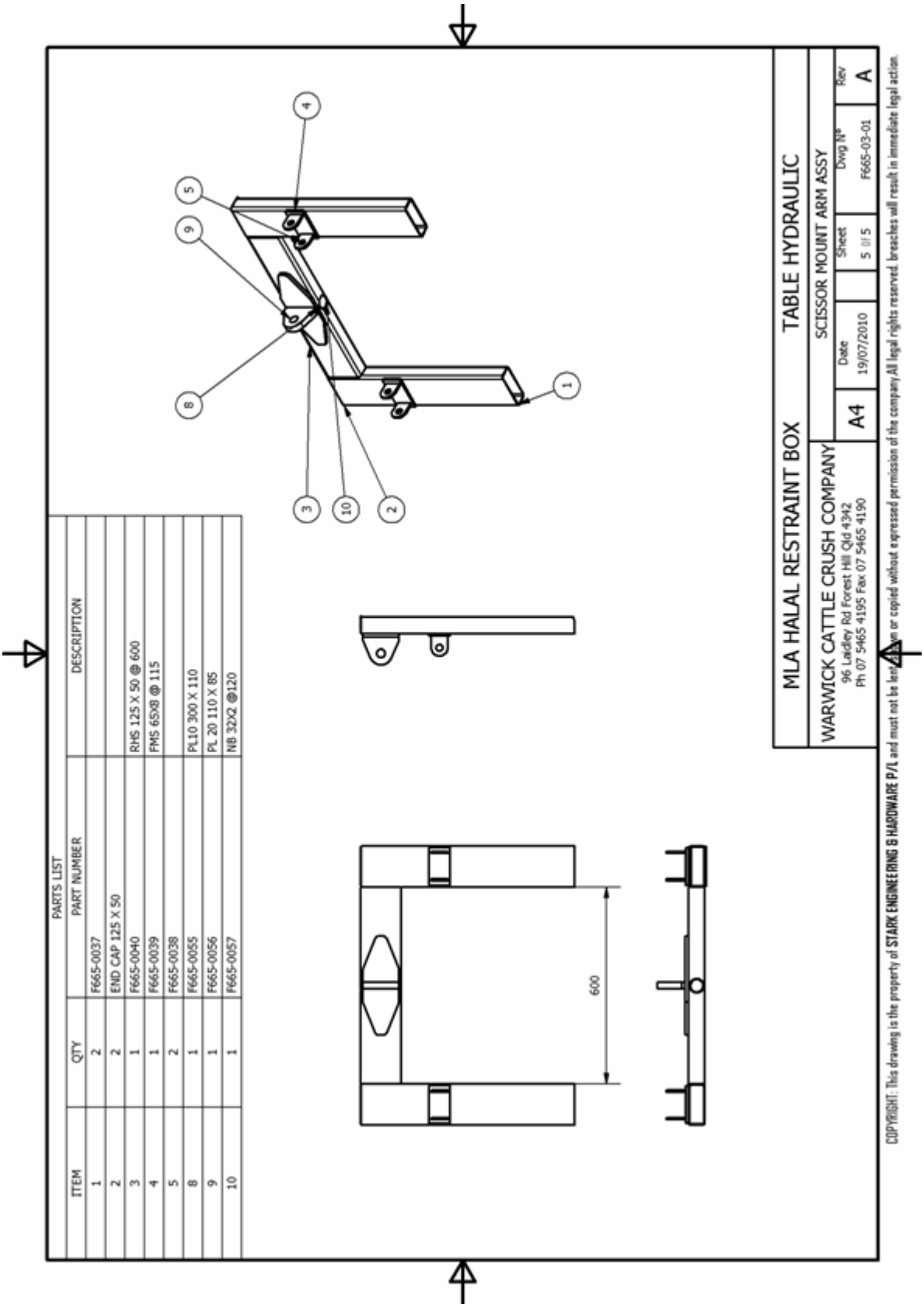
| REV | DESCRIPTION | DATE |
|---|---|---|
| A | REVISION HISTORY | 26/06/2010 |


PARTS LIST
ITEM | QTY | PART NUMBER | DESCRIPTION
1 | 2 | F665-0037 |
2 | 2 | END CAP 125 X 50 |
3 | 1 | F665-0040 | RHS 125 X 50 @ 600
4 | 1 | F665-0039 | FMS 65X8 @ 115
5 | 2 | F665-0038 |
8 | 1 | F665-0055 | PL10 300 X 110
9 | 1 | F665-0056 | PL 20 110 X 85
10 | 1 | F665-0057 | NB 32X2 @120
600
MLA HALAL RESTRAINT BOX
TABLE HYDRAULIC
SCISSOR MOUNT ARM ASSY
WARWICK CATTLE CRUSH COMPANY
96 Laidley Rd Forest Hill Qld 4342
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A4
Date 19/07/2010
Sheet 5 of 5
Dwg N° F665-03-01
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