

RISK & HAZARD MANAGEMENT

JLG Machine Type	400S	SafeWorking Load (kg)	230/455	Max. Drive Height (m)	12.19	Max. Height (m)	12.19
	400S		340/455		12.19		12.19
	460SJ		230		14.02		14.02

INTRODUCTION/SCOPE

The aim of this report is to conduct an investigation into the hazards¹ and risks involved with the operation, maintenance, servicing, inspection, transportation and storage of the above plants². Our aim is to ensure people at work (and any other personnel) are protected against health and safety risks associated with the use of the plant detailed within this report. Possible hazards and risks are to be assessed with respect to use of the plant and control measures incorporated to maximize safety. For each identified risk the probability and consequences of occurrence are assessed and the control measures implemented to reduce this risk as far as practicable³. Additional measures taken to control risk are also listed. The following procedure will be used :

- 1. Identifying Hazards** - associated with the plant or 'systems of work'⁴
- 2. Risk and Hazard Likelihood** - The probability of a hazard occurring, and the probable consequence associated with that hazard occurring.
- 3. Controls implemented to reduce Hazards & Risks** - these include design and any other measures which are put in place to reduce risks and hazards as far as practicable.

NOTE: This assessment is based on the design of the unit prior to additional hazard control measures incorporated into the Australian build design.

TABLE 1 : RISK & HAZARD LIKELYHOOD

HAZARD	(A) Likelihood of Occurring	(B) Consequence of Occurring	RISK SCORE*
As listed in Table 2	(1) Rare (2) Very Low (3) Low (4) Moderate (5) High (6) Very High	(1) First Aid (2) Casualty (3) Hospitalization (4) Disabled (5) Fatality (6) Numerous Fatalities	Risk Scores* are found by adding likelihood (A) & consequence (B) of Occurrence together. Risk Scores range from 2-12

* The higher the risk score the larger the requirement for the hazard to be addressed and guarded against. Please see Table 2 for identification of hazard types checklist.

¹ A hazard is anything with potential to cause injury, illness or harm when the plant is operated, maintained, serviced, repaired, inspected, transported and stored.

² Plant in this case is defined as an M600/J/JP and/or E600/J/JP boom lift elevating work platform.

³ JLG considers that "reducing the risk as far as practicable" to be an undertaking of out duty of care in that we have addressed the potential to exposure to a risk during design and manufacture and have adhered to the required standards during this time. Any identified additional risks raised during this assessment have been addressed and eliminated for normal machine operation by trained personnel.

⁴ Systems of work describe all operating/maintenance procedures and in general systems used by workers in servicing, inspecting, transportation and storage

TABLE 2
***HAZARD TYPE CHECKLIST**

<p>A. CRUSHING. ENTANGLEMENT. CUTTING. STABBING. PUNCTURING. SHEARING. FRICTION. STRIKING.</p>	<ul style="list-style-type: none"> -can anyone's hair, clothing, gloves, cleaning apparatus or any other materials become entangled in moving parts, or objects in motion. -crushing due to material falling from plant. -uncontrolled motion or unexpected movement of plant. -inadequate stopping devices of plant to control movement. -support structure collapse. -being thrown from or within plant. -cutting, stabbing & puncturing due to contact with sharp or flying objects. -parts of plant or worksite material disintegrating or falling. -movement of plant. -can anyone's body parts be sheared between moving parts or surfaces of the plant. -can anyone be burnt due to contact with moving parts or surfaces of the plant. -can anyone be struck by moving objects due to uncontrolled or unexpected movement of plant or workpieces.
<p>B. ERGONOMIC. SLIPPING. TRIPPING. FALLING .</p>	<ul style="list-style-type: none"> -can anyone be injured due to poorly designed seating or repetitive body movements. -constrained body posture or the need for excessive effort. -design inefficiency causing mental or psychological stress. -inadequate or poorly placed lighting of plant or workers. -lack of failsafe measures against human error. -mismatch of plant with natural human limitations.
<p>C. HIGH PRESSURE FLUIDS. HIGH TEMPERATURES. FIRE/EXPLOSION.</p>	<ul style="list-style-type: none"> -can anyone come into contact with fluids under high pressure, due to plant failure or misuse. -can anyone come into contact with objects at high temperatures, or objects which can cause fire or burning. -can anyone suffer illness due to exposure to high or low temperatures. -can anyone be injured by explosion of gases, vapours, liquids, dusts or other substances triggered by the operation of the plant or workpieces.
<p>D. SUFFOCATION. DROWNING.</p>	<ul style="list-style-type: none"> -can anyone be suffocated or drowned due to lack of oxygen, or atmospheric contamination.
<p>E. ELECTRICAL.</p>	<ul style="list-style-type: none"> -can anyone be injured by electric shock due to the plant coming into contact with live conductors. -plant being too close to high tension power lines. -overload of electrical circuits. -electrical wiring or switch shorting. -lack of insulation against water contact shorting. -magnetic interference from workplace corrupting electrical components.
<p>F. STABILITY.</p>	<ul style="list-style-type: none"> -can machine tip or roll over due to outriggers not extending. -outriggers failing mechanically, or retract unintentionally. -control valve or interlock failure. -set up on soft ground, unlevel or uneven ground, excessive slope. -driving on rough surfaces, over potholes, hitting fixed objects, excessive side loads e.g wind.
<p>G. HYDRAULIC FAILURE.</p>	<ul style="list-style-type: none"> -hydraulic system failure. -check valve or relief valve failure. -hose or cylinder failure - mechanical or fatigue.
<p>H. STRUCTURAL FAILURE.</p>	<ul style="list-style-type: none"> -boom or scissor arm failure due to fatigue, corrosion, or overloading. -pin, cable or linkage failure. -general overload- lifting excessive load, loading platform/ basket in an unintended way.
<p>I. MAINTENANCE.</p>	<ul style="list-style-type: none"> -can anyone be injured while carrying out routine, preventative or corrective maintenance. -explosion due to welding spark etc. near charging battery -adjusting equipment for essential components faulty or seized. -guard removal.
<p>J. TRANSPORT.</p>	<ul style="list-style-type: none"> -can anyone be injured due to machine instability while transporting. -plant or objects falling from transport truck.
<p>K. OCCUPATIONAL HAZARDS</p>	<ul style="list-style-type: none"> -plant obstructing other plants at site. -unauthorised use by untrained personnel. -unintended use of duplicate controls while working. -hearing loss or communication interference due to excessive noise. -safety signs or decals removed. -energy supply failure (chemical, electrical or mechanical).

* Table 2 is based upon N.Z Chamber of Manufacture hazard identification guide, & specifications from the Elevating Work Platform purchasing Specification and Operating Guide by the Electricity Association NSW - 1996, and pr EN280.

TABLE 3 - HAZARD TYPES (400 - SERIES BOOM LIFTS)	RELEVANT CODE* ADDRESSED	RISK SCORE**	DESIGN CONTROL MEASURES (To reduce risk as far as practicable)	ADDITIONAL STEPS TAKEN TO REDUCE RISK
A. CRUSHING, ENTANGLEMENT, CUTTING, STABBING, PUNCTURING, SHEARING, FRICTION, STRIKING.	Design Code AS1418.10-1.5.11 Operational Code 2550.10-9 Plant Code 81/1995-305.		Guards are provided in accordance with plant code requirements for guarding, eg's. <ul style="list-style-type: none"> • Motor is enclosed under covers. • Fan blades have a shroud around their circumference • Slew mechanism is enclosed within chassis, and • Slew gearing is out of arms reach with covers down; Guarding is of a fixed permanent nature which can only be removed with tools. A motion alarm is fitted to warn of any movement.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. The manual provided with the plant is in accordance with AS1418.10-1.4. Warning decals are placed on the plant, and safe operating procedures are placed in the manual.
-Entanglement		1+3	Due to design, only two main entanglement points exist between boom and turntable where there are no finger width gaps. The second between wheels and turntable when slewing; again, no tight gaps.	Crushing hazard decals are clearly displayed on the machine as well as slew warning decals. Warnings are placed in manual to prevent entanglement.
-Crushing, shearing		1+3	Motion alarms are fitted to plant to warn of movement.	The boom is clearly labeled with warning decals due to the potential crushing hazard associated with boom type plants. Correct maintenance and operating procedures and safety instructions are placed in the manual.

* Design Codes used at time of publication are Australian AS1418.10-1996 & AS2550.10-1994, American ANSI/SIA A92.5-1992, European EN280
Codes of practice used at time of publication are the Australian OHS Plant Code No.81/1995.

** See Table 1 for Risk Ratings

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-Friction		1+1	Operators are not subject to friction as there are no high speed exposed components. Mechanical failure due to friction is reduced with self-lubricating bushes & wear pads. Drive motors are self-lubricating as they are hydraulic, other friction points have a grease nipple. M600 series engine lubrication points are easily accessed (E600 no engine)..	Locations of lubrication points are shown on a chart in the manual. Also, a lubrication schedule is provided along with oil/grease types to be used.
-Striking		1+1 (operator) 1+3 (pedestrian)	Striking due to sudden platform movements when driving is restricted with speed limiting limit switches. Braking and a footswitch are provided to prevent inadvertent movement of plant. Braking is achieved through the use of spring applied brakes (electric over hydraulic release).	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. The manual provided with the plant is in accordance with AS1418.10-1.4. Warning decals are placed on the plant, and safe operating procedures are placed in the manual
-Cutting, stabbing, puncturing		1+1	Contact surfaces such as handles and platform entry points have no sharp edges. Controls are ergonomically designed. The platform is low mounted for easy access and has a non-slip mesh floor.	As above.
B. ERGONOMIC, SLIPPING, TRIPPING, FALLING	Design Code AS1418.10- 1.10,1.5.10		Interlocks are provided to ensure against inadvertent operation. A footswitch must be pressed before machine operation. Operators are protected from falling from platform with a solid peripheral rail around entire platform. The access door opens inwards and self latches as per AS1418-10. A red emergency stop button is positioned at top and ground controls. Safety harness attachment points are provided for intended number of operators.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10
-Seating	N/A	N/A	No seating required	

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-Excessive effort, bad posture	Design Code AS1418-1.10	1+1	Controls are designed to operate with one hand and are either of joystick, toggle or button type. Non-assisted controls are minimized using electrical actuation. Where controls are mechanical in nature operating effort is reduced as far as practicable. Controls return to neutral upon release and movement will only occur when physically actuated.	Safe operating procedures are placed in the manual.
-Operating stress		1+1	Control panels use pictures for functions, and switches, which control direction operate in that direction. Plants are field tested in IPD*** process for controllability and ease of use. Hand rails are provided around control station for support during motion.	Warning decals are used to warn of incorrect operating procedures.
-Lighting		1+1	Where lighting is requested, positional spotlights are fixed to mounts on the platform rail at waist height.	
C. HIGH TEMP OR PRESSURE FIRE/EXPLOSION	Design Code AS1418.10-1.14 Maintenance Code AS2550.10-10		High temperature components (motor and pump) are positioned within turntable. Exhaust tubing passing out through the turntable cover is designed not to get hot using a loose fitting tube. Potential contact points within covers are covered with asbestos sleeving to prevent burns on contact. High pressure hydraulic hoses are secured together with fasteners and in potential failure areas (tight radius bends) are covered in spiral wrap.	These hazards are related to incorrect and or lack of maintenance. Correct inspection and maintenance procedures are placed in the manual. Regular maintenance in accordance with AS2550.10 is required.
-high pressure fluid jets	Design Code AS3791	1+3	Hydraulic hoses used have a bursting pressure of four times the working pressure for critical hoses and two times for non-critical hoses.	Inspection and maintenance procedures (including warnings) are placed in manual.
-high temperatures	Design Code AS1418.10-1.5.11.3	1+1	Hot surfaces are positioned within covers.	Operating & maintenance procedures are placed in manual.

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** See Table 1 for Risk Ratings.

*** IPD is a internal JLG process used in research and development of new products. This process includes testing and evaluation of new machines by engineers, safety experts and operators.

TABLE 3 - HAZARD TYPES (400 - SERIES BOOM LIFTS)	RELEVANT CODE* ADDRESSED	RISK SCORE**	DESIGN CONTROL MEASURES (To reduce risk as far as practicable)	ADDITIONAL STEPS TAKEN TO REDUCE RISK
D. SUFFOCATION /DROWNING	N/A	1+1	Exhaust gas is directed away from the operator. The size of machine prevents operation in confined spaces, therefore exhaust gas inhalation is not considered to pose a problem.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. On M600 series the generator can be disabled by the operator.
E. ELECTRICAL	Design Code AS3000 AS1418.10-1.7		This EWP is not fitted with high voltage (i.e. above 32V a.c). Those units fitted with 240 V a.c. outlets have an earth leakage circuit breaker and wiring is in accordance to AS3000 as applicable.	A decal warning of insulation protection and electrical hazard as per AS1418.10-1.15 (j)/(m) is placed on the plant. Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10.
-Accidental electrical shock		1+1	Cables insulated & secured to plant. Major current carrying cables are marked red for positive, and black for negative. These cables have protective rubber boots over connection points to prevent contact shorting during maintenance	Regular inspections to AS2550.10. Maintenance procedures are placed in the manual maintenance should be carried out by trained personnel.
-Loose wire shorts		2+1	Connectors used are either insulated crimp lugs, locking plastic plugs, or permanent type clamps. Wiring is protected against rubbing in exposed areas with flexible braided sheathing.	Control wiring is grounded through the electrical system not through a chassis ground.
-Working too close to power lines	Design Code AS1418.10-1.5.13.2(b) Operational Code AS2550.10-9.3	3+5	Machine is clearly marked with electrical warning decals to reduce the risk.	Warning decals are placed on the machine and the machine is marked non-insulating. Safe operating procedures and allowable distance to power lines are placed in the manual.
-Electromagnetic interference	Design Code AS3000	1+1	Design is sufficient for normal use.	Testing is completed per EN 50081-2 Class B and EN50082-2 Sections 1.1, 1.2 and 1.4 per method IEC 801-2
-Water bridging		1+1	Wiring looms of control boxes are covered with water resistant covers. Control cards for functions and flow control are encased in epoxy resin to prevent water damage. Machines are tested for water damage in the IPD*** process.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. Pressure washing tests are completed on machine per IPD*** process. NOTE: Manuals have weatherproof storage containers.

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F. STABILITY	Design Code AS1418.10-1.5.5 AS1418.10-4.2		The plant is designed to meet A92.5-4.9 for stability. In and out of service braking is spring applied (electric over hydraulic release).	The plant is tested in accordance with AS1418.10 for stability requirements. Upon commissioning of a new machine the customer is provided with a short operator training session which reduces the chance of the machine being put in an unstable position.
-Outrigger failure	Design Code AS1418.10-1.5.12	N/A	These units are not fitted with outriggers.	
-Control valve or interlock failure	Design Code AS1418.10-1.8,1.10.4 AS1418.1-8.8	1+3	Interlocks are self monitoring i.e they are normally off/open so that in the event of malfunction motion is prevented. Holding valves are installed to prevent decent due to hydraulic failure. A manual mechanically actuated emergency descent is installed for emergency retrieval.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. A daily inspection list is included in the manual which details checking of manual descent. The manuals provided with the plant are in accordance with AS1418.10-1.4.
-Setup hazards (eg. Slope, side force)	Operational Code AS2550.1 Design Code AS1418.10-1.10.2/4 Design Code As1418.10-1.15	2+5	Tilt switch provides an audible and visual alarm when plant is put in an out of level condition, also function speeds are reduced to creep speed. Machines are counterweighted to meet Australian requirements.	A permanent type specification plate is permanently attached to the plant which shows S.W.L , max slope, max side force and wind speed etc. Warning decals are placed on machine, and safe operating procedures are placed in the manual

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-Travelling hazards (eg. Rough surface, dynamic loading.)	Design Code AS418.10-1.125.2.3(a) AS1418.10-1.5.10.6 Operational Code AS2550.10-9.1/2/3	2+5	Audible and visual alarms warn the operator when driven onto excessive slope. Travel speed is also limited when elevated. Braking is designed to hold the unit on its maximum rated gradeability. Machine is tested for dynamic stability in various conditions. eg. driven into a kerb, side loading and side slope per AS1418 performance requirements.	Warning decals are placed on machine, and safe operation and transportation procedures placed in the manual. The plant is tested for braking on its max gradeability and a kerb test performed. A permanent type specification plate is stamped with machine design limits.
G. HYDRAULIC FAILURE	Design Code AS1418.10-1.8		Relief valves are used to prevent over pressurizing the hydraulic system. Holding valves prevent unsafe descent in the advent of failure.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. The manuals provided with the plant are in accordance with AS1418.10-1.4.
-check or relief valve failure		1+3	Manual descent valves are installed to allow emergency retrieval in the advent of failure.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. A daily inspection list is included in the manual which details checking of manual descent. The manuals provided with the plant are in accordance with AS1418.10-1.4.
-Pump or motor failure	Design Codes AS1418.10-1.5.8	1+3	In the advent of electrical or mechanical failure, a manual lowering system is installed on the machine.	These plants have malfunction signals to assist in fault finding. Codes are placed in the manual.
-general failure		1+3	As above	
H. STRUCTURAL FAILURE	Design Code AS1418.10-1.5.4		Rigorous stress analysis plus IPD process is used to ensure structural soundness. Full rated life cycle testing is carried out before introduction to the workplace.	Design calculations have been reviewed by a local independent engineer. Also the plant has been overload tested at 1.25 times the S.W.L. required by AS1418.10.
-component failure due to fatigue	Design Code AS1418.10-1.5.6	2+3	The plant has been cyclic tested beyond its rated design life cycle against fatigue.	Regular inspection in accordance with AS2550.10. Annual inspections are required as stated in manual. A full 10 year rebuild is also required per AS2550.
-component failure due to corrosion or wear		2+3	Corrosive surfaces are painted, components subject to wear have provisions to minimize wear by using sacrificial components or lubrication eg. boom sections use wear pads along telescoping sections, pins use self lubricating bushes. Components which are not self lubricating such as the slew ring have grease nipples provided.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10. The manuals provided with the plant are in accordance with AS1418.10-1.4. Lubrication points and a schedule for maintenance are included in the manual to reduce chance of fatigue.

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-general overload eg. use as a crane (which is unintended).		1+3	A relief valve is used to prevent excessive loads being lifted by the platform. Tools are required to alter pressure settings. Test points are provided for checking of pressures.	Warning decals are placed on machine to show safe working loads. Safe operating procedures are placed in manual – manuals explicitly state that the plant should not be used as a crane. Correct pressure settings are placed in the manual.
I. MAINTENANCE	Design Code AS1418.10-1.14.3 Maintenance Code AS2550.10-10		Historical records are used in design to reduce maintenance (and thus risk) as far as practicable. This is part of the IPD process.	Inspection and maintenance procedures are placed in the manual and are to be in accordance with AS2550.10-10. NOTE: Manuals have weatherproof storage containers.
-routine inspection or maintenance		1+1	Components which require regular maintenance such as filters are placed in an easily accessed area. M600 series has a removable engine cover which enables easy access to the engine.	Illustrated parts list is provided in manuals for ordering replacement parts. Additional to this, JLG conducts operator and service training courses to all customers.
-battery charging	Design Code AS3000	1+1	The battery compartments are ventilated, gas (hydrogen) buildup is not considered a problem. The battery charger senses the charge level to prevent over charging the batteries.	Service instructions are placed in the manual, and on a decal with charging instructions on the unit.
-adjusting equipment	Design Code AS1418.10-1.8	1+1	Test points are provided for checking of pressure settings eg. lift relief. Adjustment points require tools to change.	Correct adjusting procedures are placed in the manual. Hydraulic (and other) specifications are listed to enable adjustment.
-guard removal	Plant code 81/1995-305	1+2	Guards are provided in accordance with plant code requirements for guarding. Guarding is of a fixed permanent nature which can only be removed with tools.	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10.
J. TRANSPORT	Operational Code AS2550.10-9.4		Provision is provided for both lifting and tie down points (which double as one) on chassis section.	Decals are placed on the plant to clearly label lifting/tie down points. Safe transportation procedures are placed in the manual.

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-objects falling from plant	Design Code AS1418.10-1.5.10.3.	1+1 (operator) 1+2 (pedestrian)	Components are designed to withstand vibration, and are tested in harsh conditions in excess of normal use. The platform has and 150mm high kickplate around periphery of platform to prevent objects falling	Inspection and maintenance procedures are placed in the manual and are to be done in accordance with AS2550.10-10.
K. OCCUPATIONAL HAZARDS	Operational Code AS2550.10		Plants with duplicate controls can be overridden from ground for emergency retrieval.	Safe operating procedures are placed in the manual in agreement with AS2550.10.
-unintended use	AS1418.10-1.5.8	1+3	Only one set of controls may be used at one time. Ground controls are recessed to prevent inadvertent engagement by hitting an object. Plants have a removable key switch which prevents operation by unintended personnel. A clearly visible emergency stop button is positioned at top and bottom controls to stop unintended movement.	Correct operating procedures are placed in the manual. Warning decals are placed on the machine. Safety warnings are also placed in the manual. Additional to this, JLG conducts operator and service training courses to all customers.
-excessive noise	Design Code AS1055.2/AS1269	1+1	M600 series motor use baffled mufflers and are within acceptable sound limits. E600 series has electric motors.	Where noise is considered excessive, level testing is done to AS1055.2/AS1269.
-decals or safety sign removal	AS1418.10-1.15	2+5	Decals have permanent type marking & weatherproof backing. Specification plate is stamped for longevity.	Recommended inspections requires that decals are checked for readability and in place. Safety warnings are in manual.
-energy supply failure	Various	1+2	See previous control measures such as “indicator warning lights” and “emergency retrieval systems.”	Emergency retrieval instructions are placed in the manual and on the machine.

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OTHER SAFETY RELATED INITIATIVES

Please Note : The risk assessment compiled and attached is prepared in addition to many other activities which have been undertaken by JLG to ensure the safety of the product. These include :

- JLG Industries (USA) performs computer simulation/modeling of product and internal design calculations.
- Independent design review by an independent engineer to local design requirements is completed in Australia.
- Cycle testing of components to ensure fatigue life is adequate for a 10 year life is completed.
- Extensive field testing of prototype units to ensure faults and hazards are identified before manufacture is completed.
- JLG conducts an intensive Integrated Product Development (“IPD”) Process to fully specify, design, risk assessment and safety test and field prove the design.
- JLG Industries (Australia) offers training and maintenance courses to any interested companies. All machines come with a Operation, Safety, Service and Maintenance manual.
- JLG Industries (Australia) supports industry safety for operations and maintenance (being an EWPA member and an AS1418 & AS2550 Standards Association of Australia committee member).