User guide

RENISHAW
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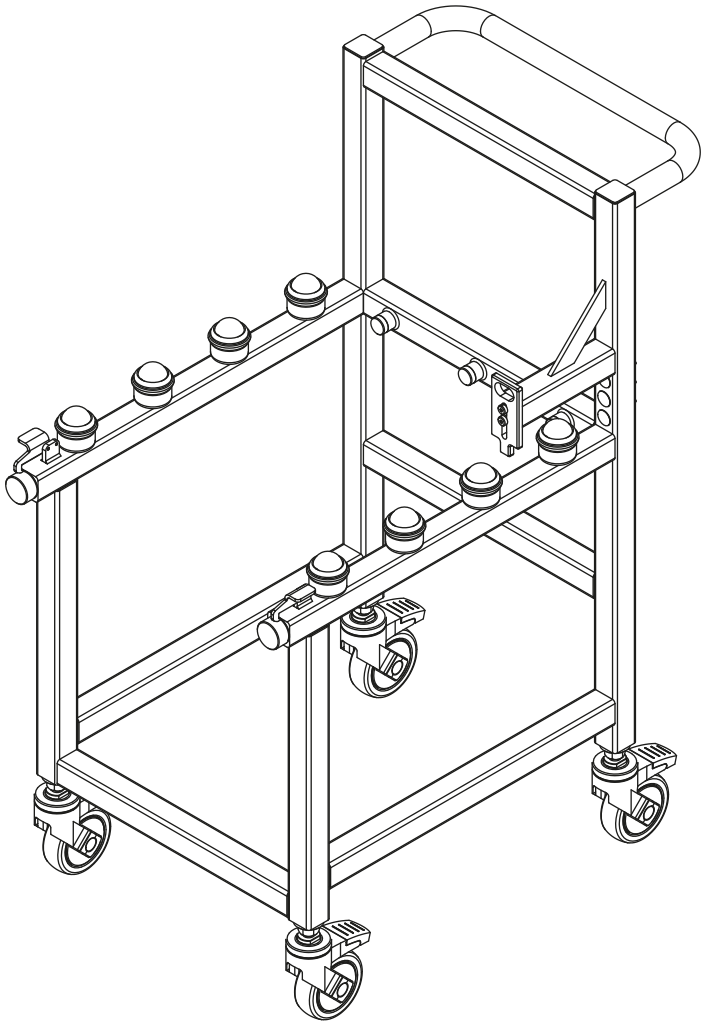
Renishaw hopper trolley



ORIGINAL INSTRUCTIONS

www.renishaw.com/additivemanufacturing

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Chapter 1 – Before you begin

1.1 Introduction

This chapter contains warranty and changes to equipment statements that form part of the standard Renishaw terms and conditions. Details regarding copyright, trade marks and disclaimer information can be found on the back cover.

1.2 Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier. Unless otherwise specifically agreed in writing between you and Renishaw, if you purchased the equipment from a Renishaw company, the warranty provisions contained in Renishaw's CONDITIONS OF SALE apply. You should consult these conditions in order to find out the details of your warranty but, in summary, the main exclusions from the warranty are if the equipment has been:

- neglected, mishandled or inappropriately used; or
- modified or altered in any way except with the prior written agreement of Renishaw.

If you purchased the equipment from any other supplier, you should contact them to find out what repairs are covered by their warranty.

1.3 Changes to equipment

Renishaw reserves the right to change equipment specifications without notice.

1.4 Patents

Features of Renishaw additive manufacturing system, and other similar systems, are the subject of one or more of the following patents and/or patent applications:

1.4.1 RenAM 500M

CA 2731121	EP 2318164	JP 2016-516886	US 2011/0223349	WO2014/125258
CA 2738618	EP 2323787	JP 2016-517357	US 2014/0287080	WO2014/125280
CA 2738619	EP 2331232	JP 5514210	US 2014/0348969	WO 2016/079494
	EP 2342042		US 2014-0271965	WO 2016/079495
CN 102186554	EP 2620241		US 2015-0352668	WO 2016/079496
CN 103357874	EP 2687305		US 2016-0001401	
CN 105102160	EP 2875855		US 8753105	
CN 105228775	EP 2956261		US 8794263	
CN 105414544	EP 2956262		US 9114478	

1.4.2 RenAM 500Q/S

CA 2971675	EP 2318164	JP 2016-516886	US 2014-0287080	WO2014/125258
CA 2731121	EP 2323787	JP 2016-517357	US 2015-0352668	WO2014/125280
CA 2738618	EP 2331232	JP 2016-527101	US 2016-0001401	WO2014/199134
CA 2738619	EP 2342042	JP 5514210	US 2016-0114432	WO 2016/079495
	EP 2620241		US 2017-0189961	WO 2016/079496
CN 102186554	EP 2687305		US 8753105	WO 2016102970
CN 103357874	EP 2875855		US 8794263	WO 2017/013454
CN 105102160	EP 2956261		US 9114478	WO 2017/085469
CN 105228775	EP 2956262		US 9669583	WO 2017/085470
CN 105414544	EP 3007879			
CN 105492188				

1.5 REACH regulation

Information required by Article 33(1) of Regulation (EC) No. 1907/2006 (“REACH”) relating to products containing substances of very high concern (SVHCs) is available at:

www.renishaw.com/REACH.

1.6 Control of pollution, applicable in the People’s Republic of China

Renishaw has prepared a table in accordance with the provisions of SJ/T 11364. This is available on request from Renishaw.

Chapter 2 – Scope of supply

2.1 Introduction

The following chapter describes the items of equipment supplied with the Renishaw hopper trolley as standard, and the items available as options.

2.2 Standard equipment

The following equipment and services are supplied as standard when you purchase a Renishaw hopper trolley.

- Renishaw hopper trolley (Renishaw part no. H-5778-7600)
- *Renishaw hopper trolley* User guide (Renishaw part no. H-5800-4481)

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Chapter 3 – Introduction

3.1 Introduction

The aim of this chapter is to begin to describe the Renishaw hopper trolley and to explain some of the terms, language, related documents, safety information and text structure used within this User guide.

3.2 Summary

The Renishaw additive manufacturing process creates homogeneous solid metal components directly from 3D CAD data using high-powered laser energy to melt fine metal powder.

This User guide covers basic system operation and the relevant safety procedures for the Renishaw hopper trolley. The Renishaw hopper trolley is a piece of mechanical equipment but must be used correctly to ensure safe performance.

The hopper trolley must only be operated in accordance with the instructions and advice contained in this manual.

WARNING: Use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazards.

3.3 Reference documentation

In addition to this User guide, also refer to the following documents for additional information about other aspects of your Renishaw AM system:

- *RenAM 500M* Installation guide (Renishaw part no. H-5800-3102)
- *RenAM 500M* User guide (Renishaw part no. H-5800-3103)
- *RenAM 500Q/S* Installation guide (Renishaw part no. H-5800-3692)
- *RenAM 500Q/S* User guide (Renishaw part no. H-5800-3693)

3.4 Definitions

The following definitions are used throughout this User guide:

Term	Definition
Client or end user	The organisation responsible for purchasing or using the equipment
Supervisor	An individual who is ultimately responsible for ensuring the safe operation and maintenance of the equipment
Trained operator	An individual working for the customer or end user who is competent to operate, maintain and clean the equipment safely. This is because they have been formally trained and assessed in the individual tasks required
Technician	An operator who is trained to change material parameters and fault find
Service engineer	A Renishaw Service engineer or Renishaw trained person who is qualified and experienced to the highest level in repairing Renishaw equipment
Equipment	The scope of supply from Renishaw that the client has purchased
Ancillary equipment	Any item which is required to complete the installation that is not included in the scope of supply
Manufacture or manufacturing	Any process where the equipment is commissioned, trialled, operated, maintained or cleaned
Must	Tasks, actions or activities that are essential for the safe operation of the equipment
Should	Tasks, actions or activities that are recommended for the safe operation of the equipment

3.5 Abbreviations

The following abbreviations are used throughout this User guide:

Term	Definition
AM	Additive Manufacturing
ANSI	American National Standards Institute
ATEX	ATmosphères EXplosives (explosive atmospheres)
BDO	Beam Delivery Optic
BSP	British Standard Pipe (thread type)
COSHH	Control of Substances Hazardous to Health
CSA	Cross Sectional Area
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
EMC	Electro-Magnetic Compatibility
ESD	Electrostatic Discharge
IEC	International Electrotechnical Commission
IEE	Institute of Electrical Engineers
IP	Internet Protocol
IPA	Isopropanol
ISO	International Organisation for Standardisation
LED	Light Emitting Diode
MAC	Media Access Control
MCB	Miniature Circuit Breaker
NFPA	National Fire Protection Association
PC	Personal Computer
PLC	Programmable Logic Controller
PPM	Parts Per Million
PV	Present Value
RenAM 500M	RenAM 500 single laser analogue or digital additive manufacturing system
RenAM 500Q	RenAM 500 quadruple laser digital additive manufacturing system
RenAM 500S	RenAM 500 single laser digital additive manufacturing system
SDS	Safety Data Sheet
SIL	Safety Integrity Level
SOP	Standard Operating Procedure
SP	Set Point
UPS	Uninterruptable Power Supply

3.6 Safety information in this User guide

Within this User guide additional information that is important to read and understand will be presented as a Warning, Caution or Note. The definition of each of these and an example of each is below.

3.6.1 Warning

An example of a Warning is as follows:

WARNING: A warning is to tell the end user that there is a possibility of injury to themselves or other people in the vicinity, if the described course of action is not followed.

3.6.2 Caution

An example of a Caution is as follows:

CAUTION: A Caution is to tell the end user that there is a possibility of damage to the equipment if the described course of action is not followed.

3.6.3 Note

An example of a Note is as follows:

NOTE: A Note is to advise the end user of important information that is related to, or will assist them in the task or activity they are carrying out.

3.7 Contact details

Contact details for Renishaw are below:

Phone number:	+44 (0)1453 524 524 Hours of work: Monday to Friday 08:00 to 17:00 hr (UTC and DST)
Email:	am.support@renishaw.com
Service address:	Renishaw plc New Mills, Wotton-under-Edge Gloucestershire GL12 8JR, United Kingdom

Additional support can be sought by contacting your local Renishaw office. See:

www.renishaw.com/contact

Chapter 4 – Safety

4.1 Introduction

The Renishaw hopper trolley is safe to use when operated correctly. This aim of this chapter is to describe the general and specific safety recommendations to enable you to operate the hopper trolley safely.

4.2 General safety information

NOTE: Please refer to the User guide and Installation guide supplied with your AM system for AM system specific Health and Safety information.

- *RenAM 500M* Installation guide (Renishaw part no. H-5800-3102)
- *RenAM 500M* User guide (Renishaw part no. H-5800-3103)
- *RenAM 500Q/S* Installation guide (Renishaw part no. H-5800-3692)
- *RenAM 500Q/S* User guide (Renishaw part no H-5800-3693)

4.3 Hopper trolley health and safety

When used in accordance with the instructions in this User guide, the hopper trolley is safe to use. There are minor risks of entrapment due to the latches falling, but if the correct operating procedures are followed these risks are negligible.

4.3.1 Essential health and safety requirements

No formal licence or training is required for this type of machinery, although familiarisation training is recommended.

4.3.2 Safe working load

On every hopper trolley supplied there will be a specification and capacity plate, fitted in clear view of the operator (Figure 1). This plate will give information on the load capacity and any load centres to be adhered to.

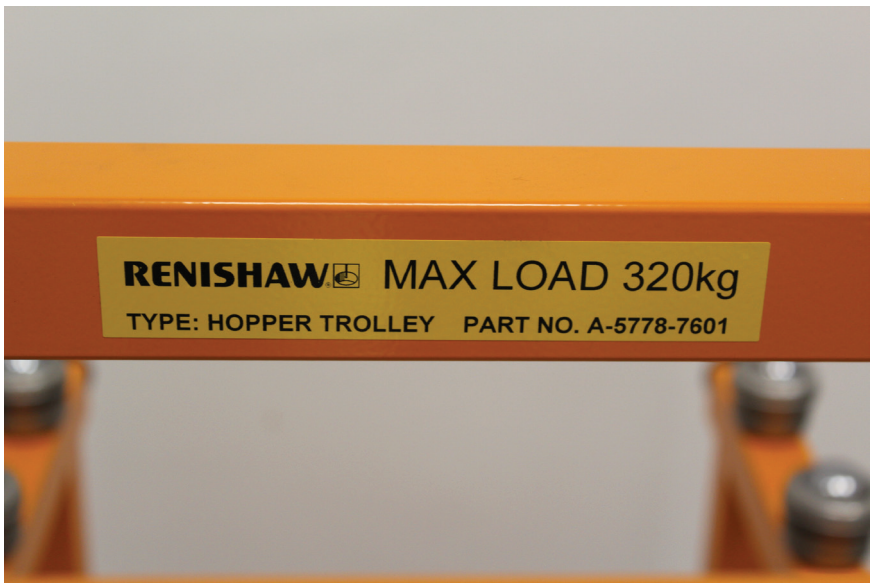

Figure 1 Renishaw hopper trolley specification and capacity plate

These loads are designed as safe working loads and should never be exceeded.

NOTE: All machines are designed, manufactured and tested in accordance with latest directives current at the time of manufacture.

4.3.3 Personal protective equipment (PPE)

NOTE: Refer to the User guide supplied with your AM system for details of the PPE required when operating your Renishaw AM system.

NOTE: When operating the Renishaw hopper trolley in the vicinity of a Renishaw AM system, ESD dissipative safety footwear with toe protection is essential for ATEX zones, and recommended for all areas.

NOTE: When cleaning the hopper trolley using IPA ensure you are wearing suitable gloves and a full face respirator conforming to EN143 Type P3 (dust protection factor) + A1 (gas/vapour protection factor when using IPA or solvent cleaners).

4.3.4 Operational safety

NOTE: The hopper trolley is not to be used for anything other than its intended purpose of transporting the hopper from a Renishaw RenAM 500M or RenAM 500Q/S AM system.

NOTE: The hopper trolley is designed for indoor use only and must not be used outdoors.

NOTE: The hopper trolley is designed to be used on a flat and level floor. Renishaw recommend the use of ESD flooring with AM systems. See the relevant Installation guide for details.

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Chapter 5 – Overview

5.1 Introduction

This chapter contains images of the Renishaw hopper trolley and gives an overview of the user accessible system features.

5.2 Renishaw hopper trolley

The hopper trolley is a metal framed trolley used for transporting the hopper to and from your Renishaw AM system (Figure 2).

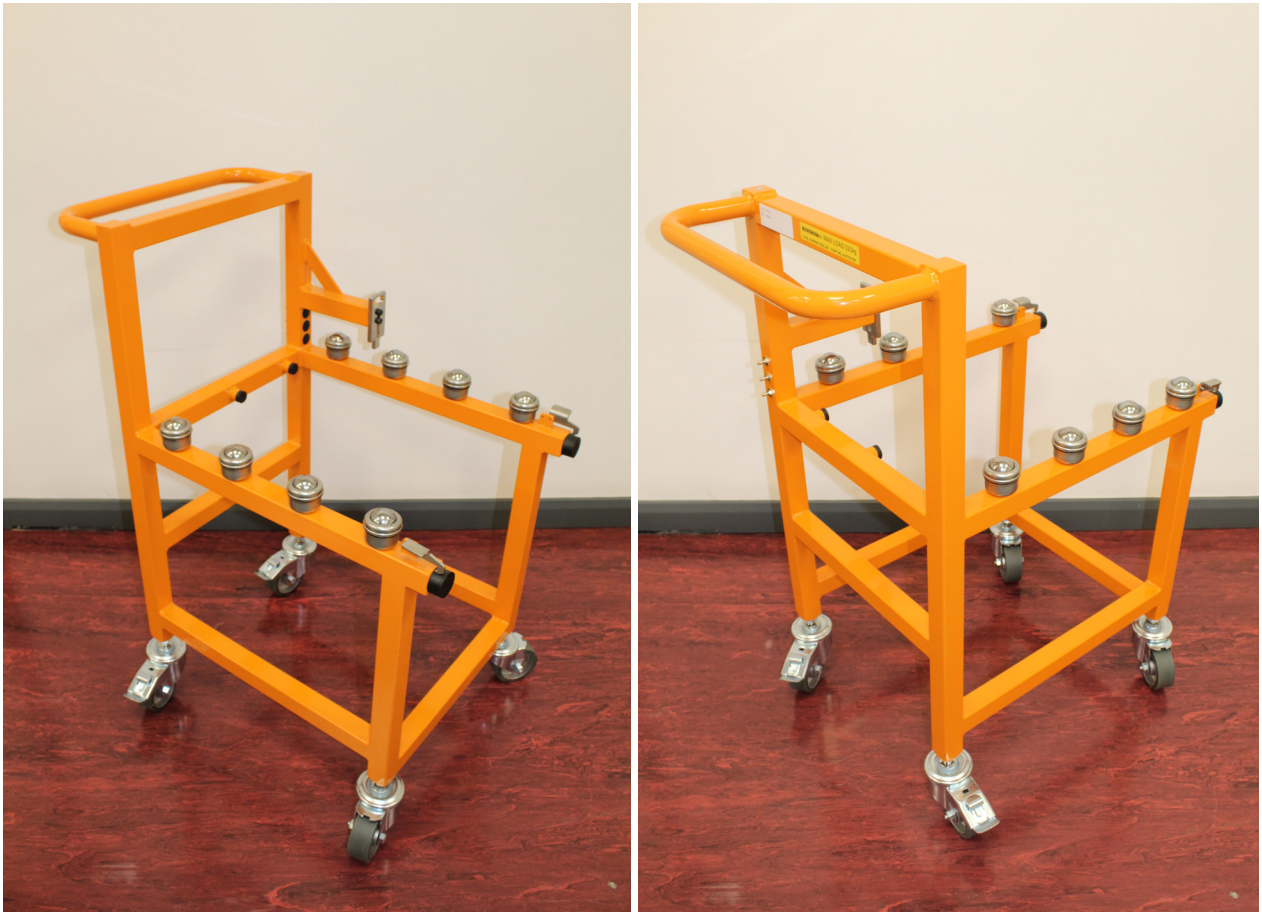

Figure 2 Renishaw hopper trolley – front view (left) and rear view (right)

5.3 Hopper trolley compatibility

The hopper trolley is compatible with the following Renishaw AM systems:

- RenAM 500M (Figure 3 left)
- RenAM 500Q/S (Figure 3 right)

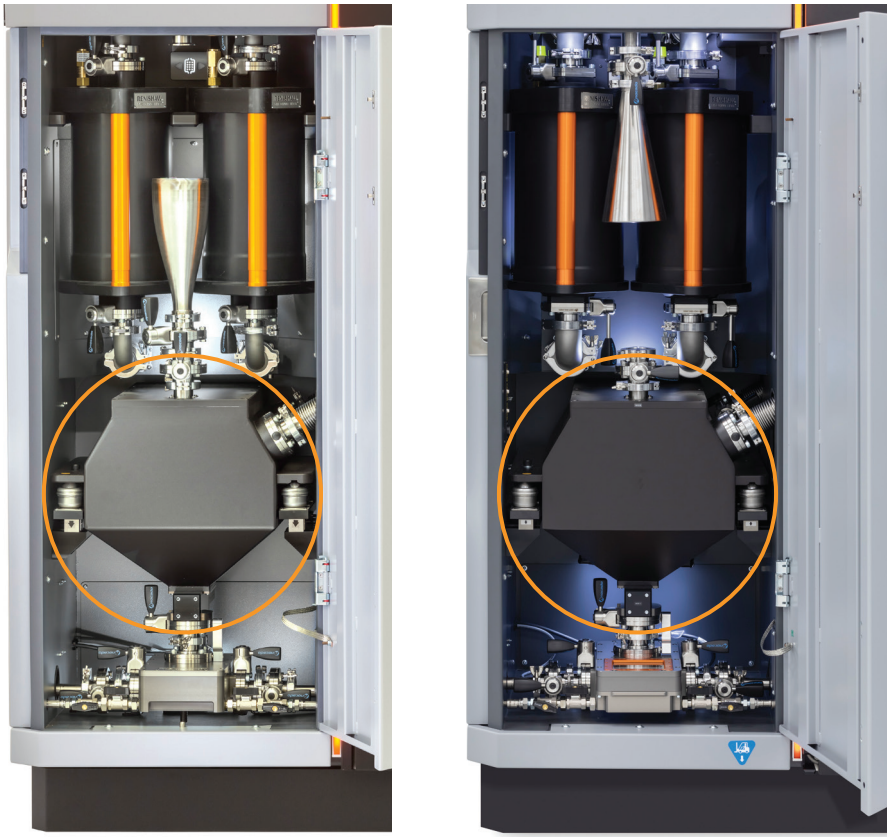

Figure 3 RenAM 500M (left) and RenAM 500Q/S (right) hoppers circled

5.4 Main features

It is fitted with the following items for ease of use:

- Four castors for ease of positioning
- Two latches to secure the hopper trolley to an AM system
- One latch to secure the hopper to the trolley
- Eight rollers to ease loading of the hopper on to the trolley
- ESD cable connection points

Chapter 6 – System specification

6.1 Introduction

This chapter describes the specification of the Renishaw hopper trolley. It contains information relating to the physical size and capacity of the trolley.

6.2 Renishaw hopper trolley specification

Technical specifications may change from time to time. Renishaw reserves the right to change any technical specification at any time. Any specification not listed in the table below is available upon request; see Section “3.7 Contact details” for your local Renishaw office.

NOTE: All dimensions are quoted depth × width × height.

WARNING: Do not exceed the hopper trolley rated capacity of 320 kg (705 lb).

Dimensions without accessories	810 mm × 500 mm × 1070 mm (32 in × 19.5 in × 42 in)
Rated capacity	320 kg (705 lb)
Unladen weight	30 kg (66 lb)

Figure 4 Renishaw hopper trolley specification and capacity plate and location

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Chapter 7 – Functional description

7.1 Introduction

The aim of this chapter is to describe the Renishaw hopper trolley, its major systems and sub-systems.

The chapter is intended to provide a concise description of the functions of the Renishaw hopper trolley.

7.2 Renishaw hopper trolley

The hopper trolley is a metal framed trolley used for transporting the hopper (Figure 5). It is fitted with the following items for ease of use:

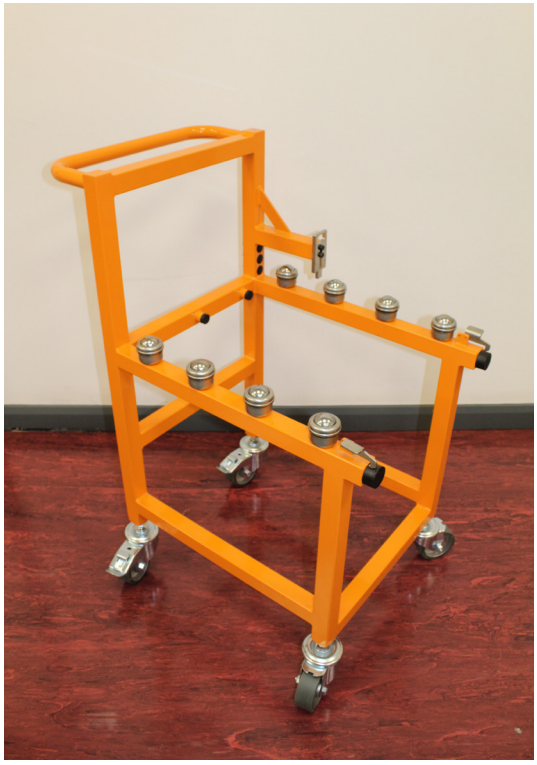

Figure 5 Hopper trolley

- Four castors for ease of positioning (Figure 6)
- Two latches to secure the hopper trolley to your Renishaw AM system (Figure 7)
- One latch to secure the hopper to the trolley (Figure 8)
- Eight rollers to ease loading of the hopper on to the trolley (Figure 9)
- ESD connection points (Figure 10)

Figure 6 Hopper trolley castors

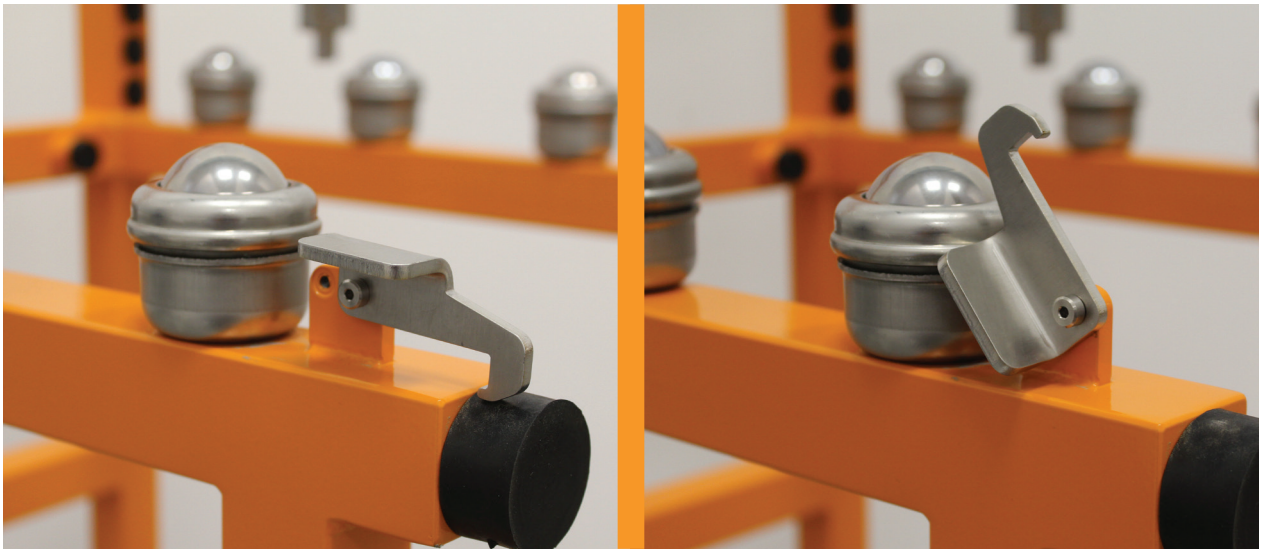

Figure 7 One of the two latches that secure the hopper trolley to the AM system – lowered (left) and raised (right)

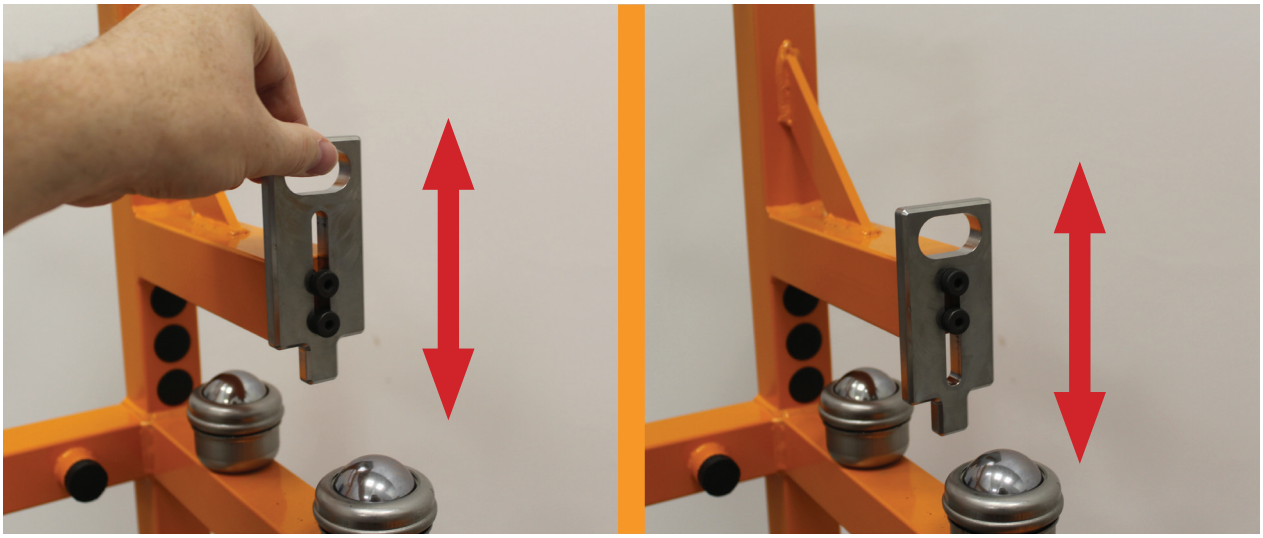

Figure 8 Hand operated latch to secure the hopper to the hopper trolley

Figure 9 Eight rollers to ease loading

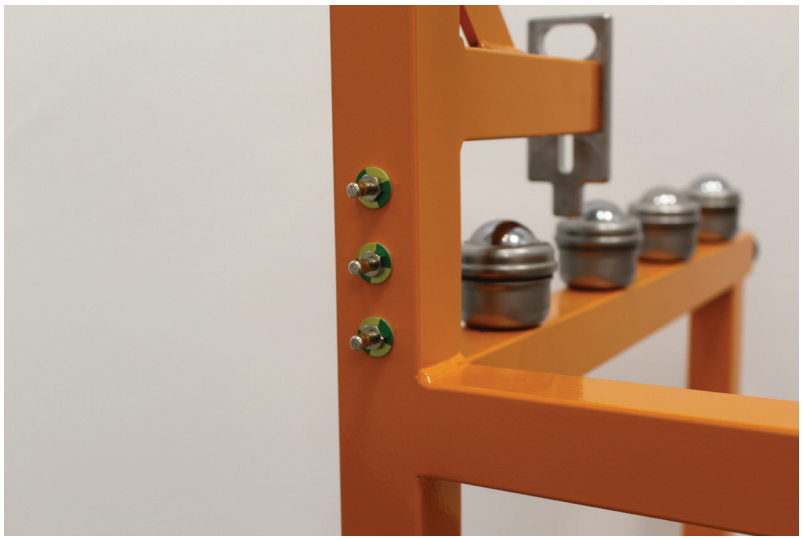

Figure 10 ESD connection points

7.2.1 Castors

There are four castors fitted to the hopper trolley. The two front castors are free moving (Figure 11) and the two rear have movement locks (Figure 12). Operate the locks on the rear castors with your foot to secure the position of the trolley. To release the locks, press the raised part of the lock with your foot.

Figure 11 Hopper trolley front castor

Figure 12 Hopper trolley rear locking castor – unlocked (left) and locked (right)

7.2.2 Hopper trolley to AM system latches

There are two latches (Figure 13) that secure the hopper trolley to the Renishaw AM system. The latches engage with holes in brackets fitted to the AM system. The brackets are supplied with the hopper trolley and additional sets of brackets can be supplied upon request.

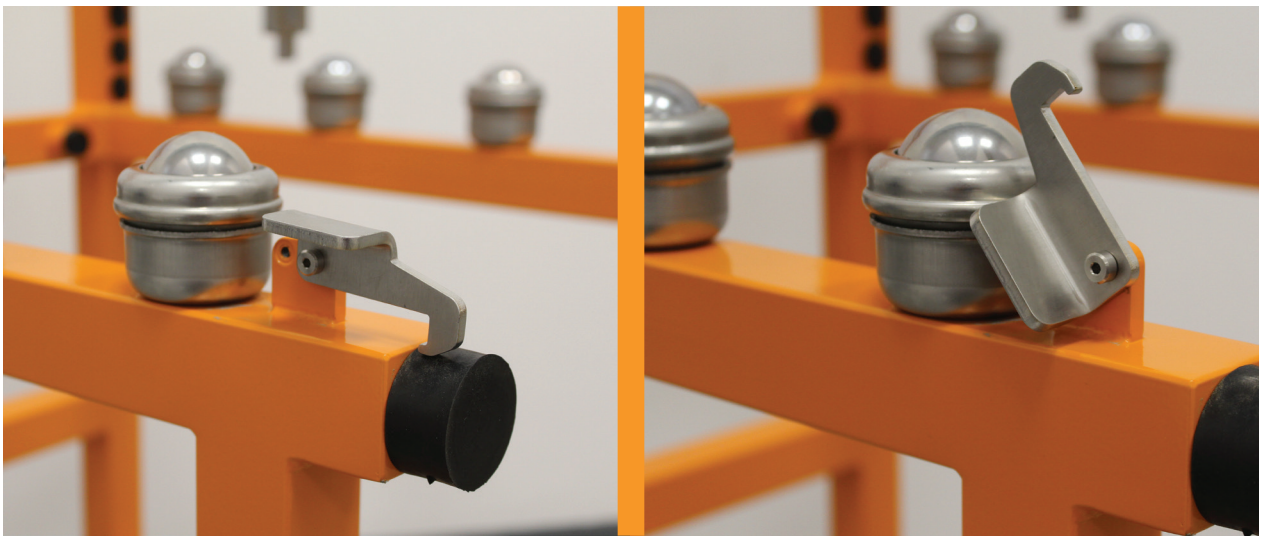

Figure 13 One of the two latches that secure the hopper trolley to the AM system – lowered (left) and raised (right)

7.2.3 Hopper to hopper trolley latch

On the rear left-hand side of the trolley is the hopper to hopper trolley latch that secures the hopper to the trolley. It is a simple hand operated raise and lower latch (Figure 14, Figure 15 and Figure 16).

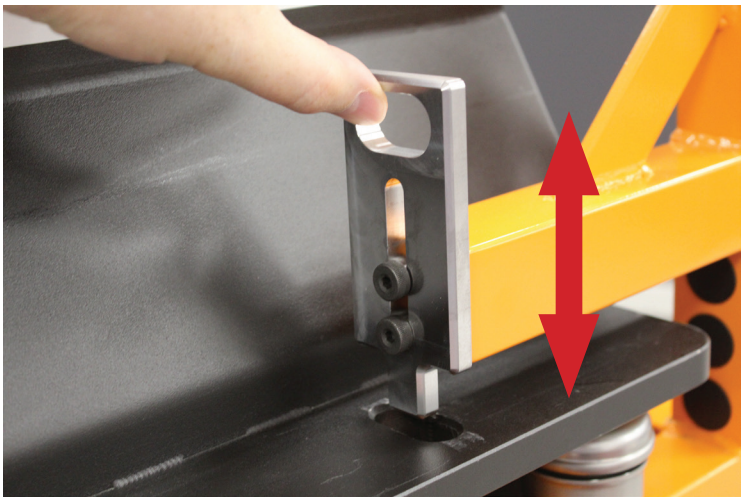

Figure 14 Hopper to hopper trolley latch – raised

Figure 15 Slot machined into hopper left-hand side

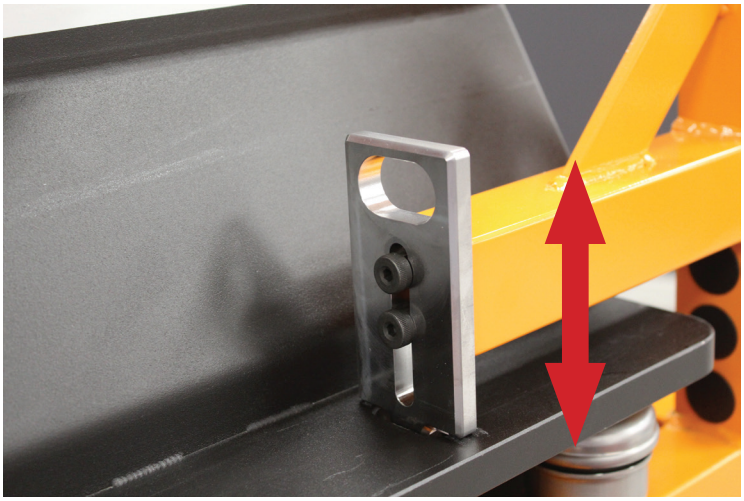

Figure 16 Latch lowered into position and hopper secured on trolley

7.2.4 Trolley rollers

There are eight rollers (Figure 17) fitted to the trolley to ease loading of the hopper on to the trolley.

Figure 17 Eight rollers to ease loading

7.2.5 ESD connection points

There are three ESD connection points on the rear of the trolley (Figure 18). With suitable cables this will enable you to:

- Connect the AM system and hopper trolley whilst hoppers are being removed or installed; a cable is supplied with the hopper trolley.
- Connect an external bulk silo (EBS) (optional) to the hopper trolley; a cable is not supplied.
- Connect an operator to the trolley if your risk assessments deem it necessary; a cable is not supplied.

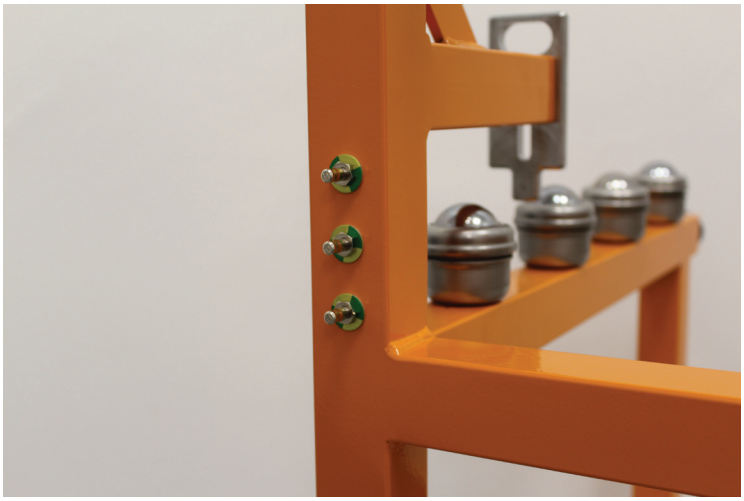

Figure 18 ESD connection point

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Chapter 8 – Operation

8.1 Introduction

The aim of this chapter is to describe how to set up and operate the hopper trolley.

8.2 Operating instructions

8.2.1 Initial hopper trolley set up

NOTE: Before operating the hopper trolley it is necessary to carry out two set-up tasks to ensure it is correctly set up for the AM system it is being operated with. The set up tasks consist of adjusting the height of the trolley to ensure that it is correctly aligned with the receiving brackets on the front of the AM system and installing the receiving brackets on the AM system.

8.2.1.1 Trolley height and levelness check

1. Adjust the height of the hopper trolley as follows.
2. Using a suitable spanner loosen the M16 nut (Figure 19) and screw the castor in or out as necessary from the leg of the hopper trolley.
3. When the top of the hopper trolley frame is aligned with base of the AM system transfer rollers the trolley is at the correct height.
4. The trolley is adjustable at all four corners and therefore needs to be checked for levelness using a spirit level. Place the trolley on a level floor and using a spirit level check the levelness from side-to side and front to back. Adjust the castors as necessary.
5. Using a suitable spanner tighten the M16 nut that secures the castors into the hopper trolley.

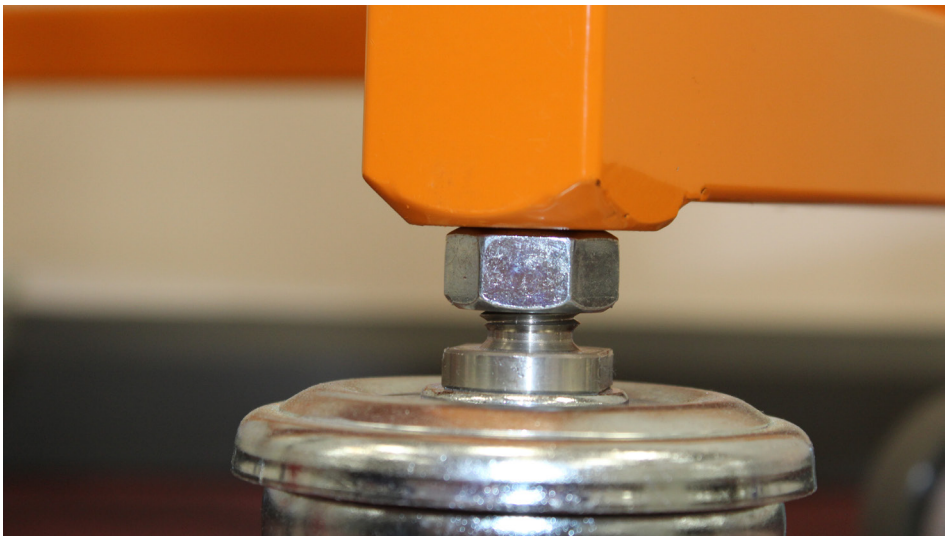

Figure 19 Hopper trolley castor and M16 securing nut

8.2.1.2 Receiving brackets installation

NOTE: This is a two person task. Do not attempt this task on your own.

1. In accordance with the User guide for your Renishaw AM system, disconnect the pipework that feeds into and out of the hopper.

2. Position the hopper trolley (Figure 20) at the front of the Renishaw AM system hopper.

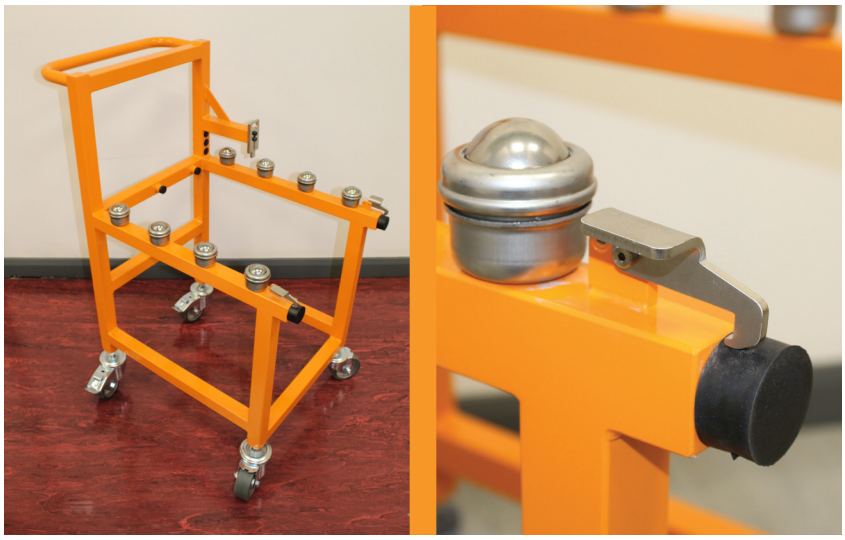

Figure 20 Hopper trolley and latch

3. Apply the brakes on the trolley rear castors to prevent the trolley moving when the hopper is loaded (Figure 21).

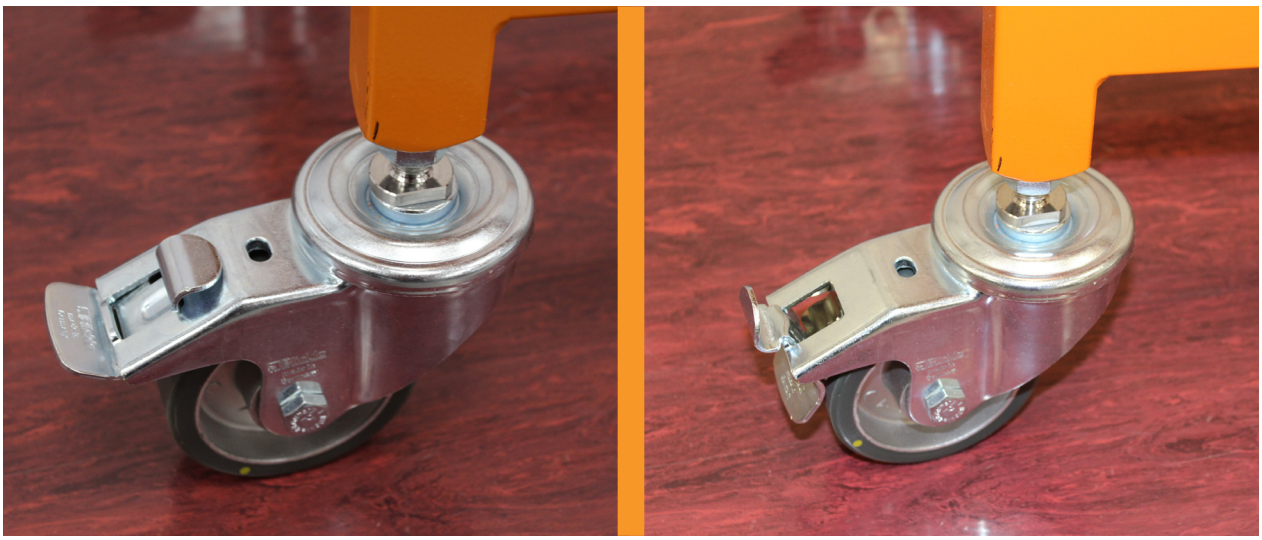

Figure 21 Hopper trolley braked castors – unlocked (left) and locked (right)

4. With one person holding the trolley handle to prevent any movement, the other person should remove the bolt on the left side of the hopper that secures the hopper to the AM system (Figure 22).

Figure 22 Bolt securing the hopper to the AM system

5. Slide the hopper on to the trolley.

6. Release all four castor brakes and move the hopper trolley clear of the AM system.

7. On the left side of the AM system, remove the four fasteners that secure the front transfer roller to the AM system chassis (Figure 23). Repeat for the transfer roller on the right side (Figure 23).

Figure 23 Transfer roller and securing fasteners (left) and left and right transfer rollers (right)

8. Fit the receiving brackets and secure using the fasteners supplied with the brackets.

9. Refit the hopper to the AM system as per Section 8.2.3.

8.2.2 Hopper remove

NOTE: Before use visually check the hopper trolley. Ensure it is safe to use and there are no signs of damage or defects. Check the ESD connection points, hopper trolley to AM system latches, hopper to hopper trolley latch and castor brakes are operating correctly.

1. Position the hopper trolley (Figure 24) at the front of the Renishaw AM system hopper.

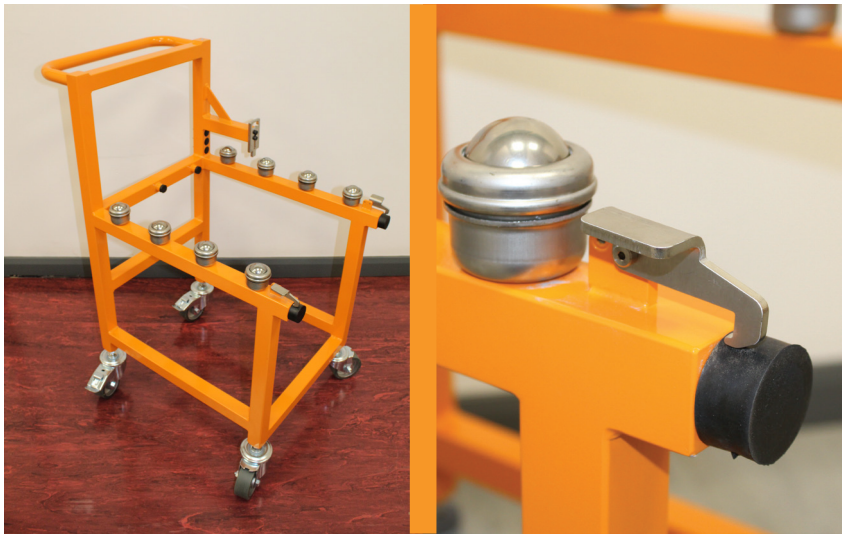

Figure 24 Hopper trolley and latch

2. Ensure the hopper trolley to AM system latches engage with the metal receiving brackets on the AM system (Figure 25).

Figure 25 Hopper trolley to AM system latch, raised (left) and engaged with receiving bracket (right)

3. Apply the brakes on the trolley rear castors to prevent the trolley moving when the hopper is loaded (Figure 26).

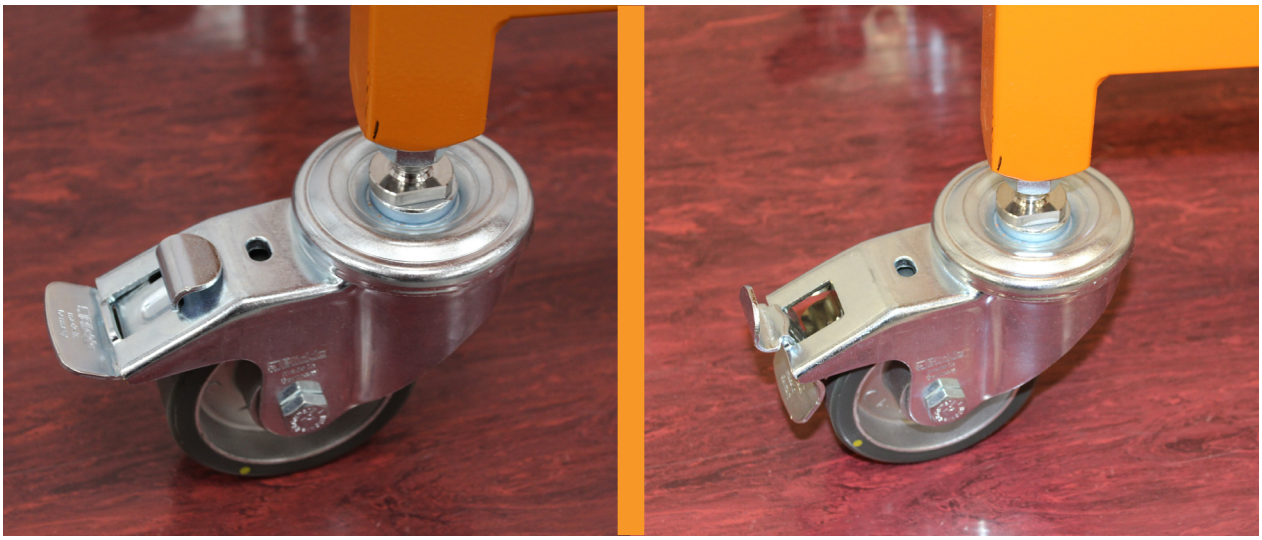

Figure 26 Hopper trolley braked castors – unlocked (left) and locked (right)

4. Using the supplied cable, fit an ESD cable between the hopper trolley and AM system (Figure 27.

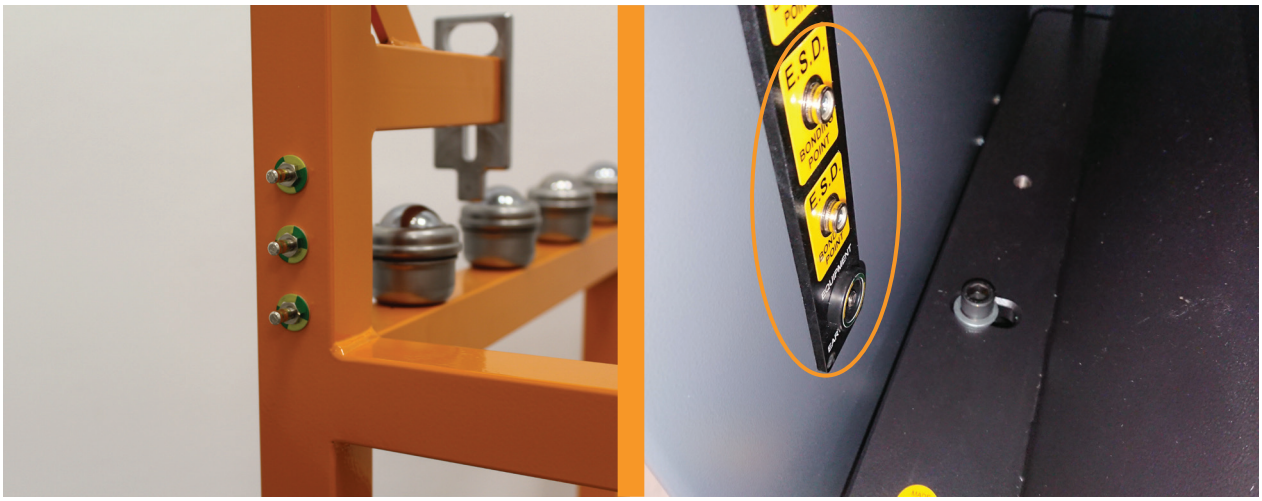

Figure 27 Hopper trolley ESD connection points (left) and AM system ESD connection points (right)

5. As determined by your risk assessments, fit an ESD cable between the operator and the trolley; cable is not supplied.

6. In accordance with the User guide for your Renishaw AM system, disconnect the pipework that feeds into and out of the hopper and fit blanking plates secured with quick-release clamps as necessary.

7. On the left-hand side of the hopper is a bolt that secures the hopper to the AM system (Figure 28). Remove the bolt to release the hopper from the AM system.

Figure 28 Bolt securing the hopper to the AM system

8. Raise the hopper to hopper trolley retaining latch (Figure 29) and keep it raised. Slide the hopper out of the AM system and on to the hopper trolley. To prevent the possibility of injury, keep hands clear of the rollers.

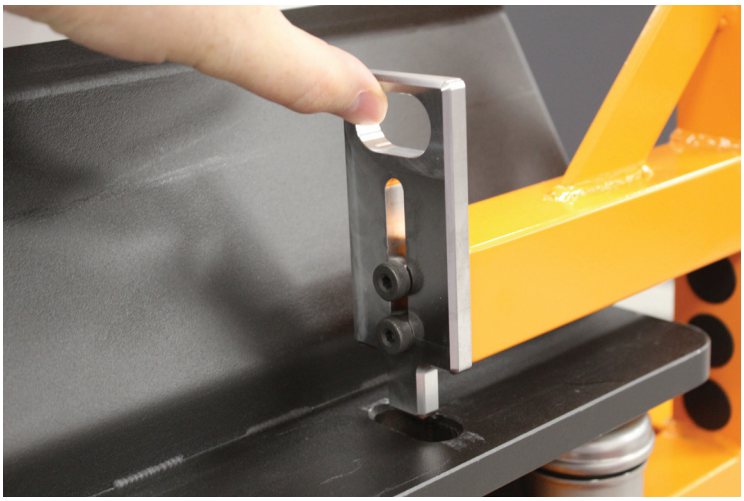

Figure 29 Hopper to hopper trolley retaining latch – raised

9. Lower the hopper to hopper trolley latch (Figure 30) to engage with the slot in the side of the hopper and secure the hopper on to the hopper trolley.

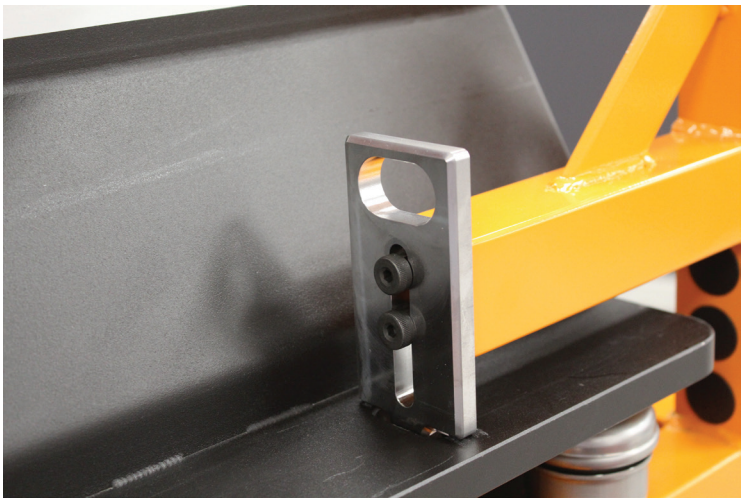

Figure 30 Hopper to hopper trolley retaining latch – lowered

10. Release the castor brakes and the front latches, and the hopper trolley can be moved as required.

8.2.3 Hopper refit

NOTE: Visually check the hopper trolley before use. Ensure it is safe to use and there are no signs of damage or defects. Check the ESD connection points, hopper trolley to AM system latches, hopper to hopper trolley latch and castor brakes are operating correctly.

1. With the hopper positioned on the hopper trolley, position it in front of the Renishaw AM system.
2. Ensure the hopper trolley to AM system latches engage with the metal latch plates on the AM system.
3. Operate the locks on the locking castors at the rear of the trolley to prevent it moving when the hopper is refitted (Figure 31).

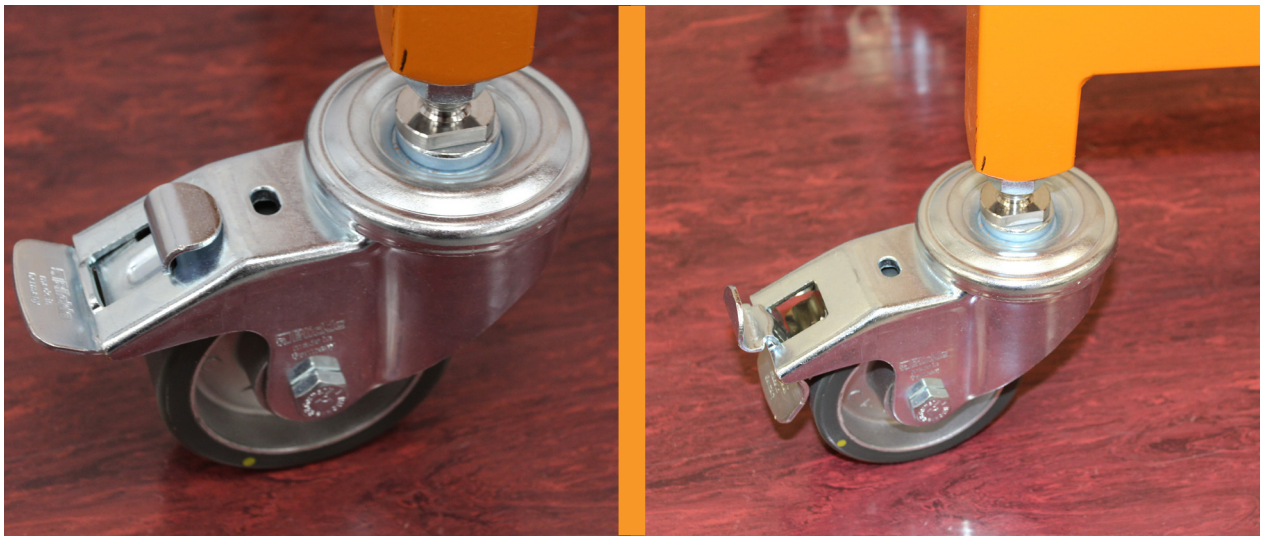

Figure 31 Hopper trolley braked castors – unlocked (left) and locked (right)

4. Raise the hopper to trolley retaining latch and slide the hopper off the trolley and into the Renishaw AM system. To prevent the possibility of injury, keep hands clear of the rollers.
5. On the left-hand side of the hopper is a bolt that secures the hopper to the system, refit this bolt to secure the hopper in the AM system.
6. In accordance with the User guide for your Renishaw AM system, reconnect the pipework that feeds into and out of the hopper.

Chapter 9 – Preventative maintenance schedule

9.1 Introduction

The aim of this chapter is to provide a list of the preventative maintenance tasks that should be carried out to keep your Renishaw hopper trolley functioning correctly. Renishaw recommends that the hopper trolley is maintained in accordance with the following maintenance schedule to ensure its reliability and availability.

It is important that the Renishaw load trolley hopper is maintained so that its performance does not deteriorate to the extent that it puts people at risk or adversely impacts on any applicable warranty.

Operator preventative maintenance tasks are listed in this chapter.

Operator preventative maintenance tasks are prefixed with “PM” followed by a number, for example “PM-001”.

This chapter also contains Preventative maintenance checklists.

9.2 Personal protective equipment

WARNING: Ensure you are wearing the correct personal protective equipment: safety footwear and protective gloves before you start any maintenance task.

9.3 Definitions of maintenance

The definitions of maintenance tasks is as follows:

- Inspect – determine the general condition of the component, that is, conformity to required specification. Check for things such as, damage, wear, cracks, splits, leaks, scoring, distortion, looseness, corrosion and breaks
- Clean – remove all dirt and deposits
- Check – determine a particular nominated condition, for example, completeness of task, security, position or function
- Calibrate – restore the performance of an object or system to a defined state with a known tolerance using tools, equipment and a specification
- Replace – remove and discard the original part and provide a new specified part in its place
- Lubricate – apply the correct amount of a suitable lubricant to enable the smooth movement of a component or assembly
- Function test – prove the function of a system by carrying out a simple test
- Test – prove the correct operation and performance of a system by specified trial

9.4 Renishaw hopper trolley

The method statements for all operator preventative maintenance tasks are contained in Chapter 11.

Equipment	Maintenance activity	Periodicity	Skill level	Task number
Hopper trolley	Check	1 month	Operator	PM-001
Hopper trolley continuity	Test	6 months	Electrician	PM-002
ESD earth cable continuity	Test	6 months	Electrician	PM-003

9.5 Preventative maintenance records

It is essential that records are made and kept of any and all maintenance that is carried out on your Renishaw hopper trolley. Good maintenance record keeping is essential to ensure that any modifications, repairs, system configuration modifications, etc, are known about. This can help with future upgrades, fault-finding, repairs, etc.

9.6 Preventative maintenance checklists

9.6.1 One month tasks

Equipment	Maintenance activity	Skill level	Task number	Completed Y/N?
Hopper trolley	Check	Operator	PM-001	

9.6.2 Six month tasks

Equipment	Maintenance activity	Skill level	Task number	Completed Y/N?
Hopper trolley continuity	Test	Electrician	PM-002	
ESD earth cable continuity	Test	Electrician	PM-003	

Chapter 10 – Preventative maintenance tasks

10.1 Introduction

The aim of this chapter is to describe, in the form of a method statement, the preventative maintenance tasks that must be carried out on the Renishaw hopper trolley.

The list of preventative maintenance tasks and the periodicity at which they must be carried out is contained in “Chapter 9 – Preventative maintenance schedule”.

Preventative maintenance tasks are listed and numbered by skill type.

Operator preventative maintenance tasks are prefixed with “PM” followed by a number, for example “PM-001”. Operator preventative maintenance tasks can be carried out by a trained operator, technician or service engineer.

10.2 Preventative maintenance tasks

10.2.1 PM-001 – Hopper trolley – Check

1. Check the hopper trolley for damage and defects. Rectify as necessary.
2. Operate the hopper to hopper trolley retaining latch on the rear of the hopper trolley (Figure 32) and ensure it operates smoothly and easily.

Figure 32 Hopper to hopper trolley retaining latch and raised

3. Operate the hopper trolley to AM system latches on the front of the hopper trolley (Figure 33) and ensure they operate smoothly and easily.

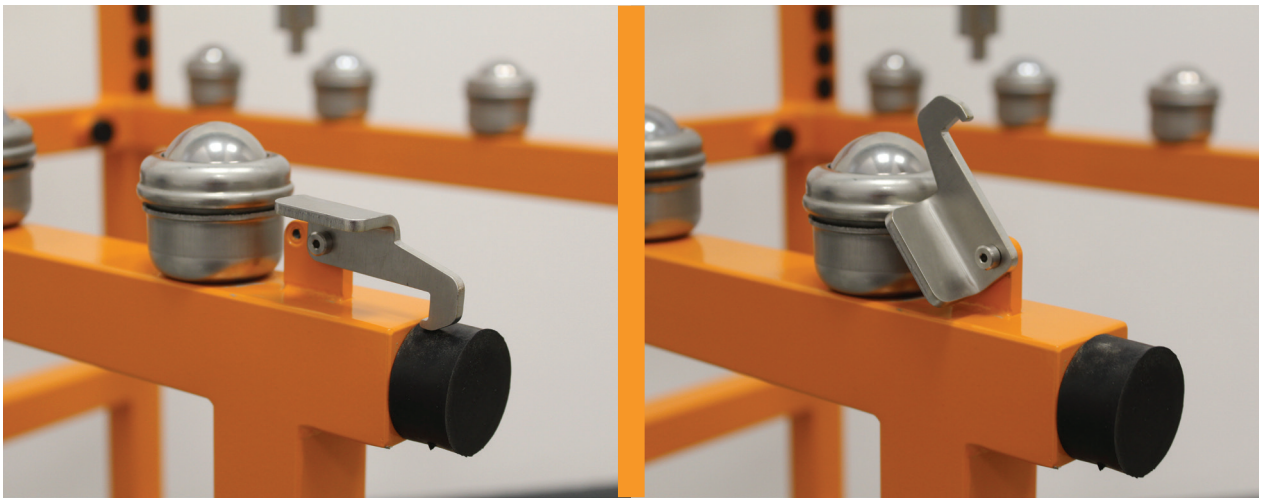

Figure 33 Hopper trolley to AM system latches

4. Operate the rear locking castors (Figure 34), ensure they lock the rear castors and prevent the trolley from moving. Check the castors are free from damage and deformation. Replace as necessary.

Figure 34 Hopper trolley braked castors – unlocked (left) and locked (right)

5. Check the front castors are free from damage and deformation (Figure 35). Replace as necessary.

Figure 35 Hopper trolley front castor

6. Check the running surface of all castors is smooth, in good condition and shows no signs of damage or excessive wear. Replace as necessary.

7. Check the ESD connection points are free of damage, defects and can be easily connected to the supplied ESD cable.

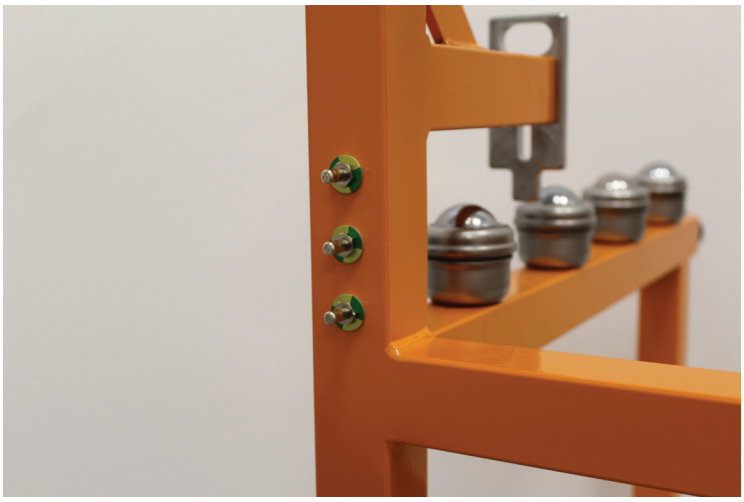

Figure 36 ESD cable connection point

8. The hopper to hopper trolley latch, the hopper trolley to AM system latches, the eight rollers and the castors should not require lubricating.

9. Wipe down the hopper trolley using Class 3 IPA and a disposable cloth and clean any dirt or powder from the hopper trolley

NOTE: When cleaning the hopper trolley using IPA ensure you are wearing suitable gloves and a full face respirator conforming to EN143 Type P3 (dust protection factor) + A1 (gas/vapour protection factor when using IPA or solvent cleaners).

10. For advice on repairs or to schedule a repair visit, contact your local Renishaw office using the contact details in Section “3.7 Contact details”.

11. Record the completion of the maintenance task in the maintenance records.

10.2.2 PM-002 – Hopper trolley continuity – Test

NOTE: This task must be carried out by a suitably skilled and appropriately locally qualified electrician.

1. Measure the continuity between the three hopper trolley ESD points and the eight rollers fitted to the trolley (Figure 37).

Figure 37 Three ESD cable connection points and eight rollers

2. The measurement is to be ≤ 0.3 Ω.

3. Rectify any defects as necessary.

4. For advice on repairs or to schedule a repair visit, contact your local Renishaw office using the contact details in Section “3.7 Contact details”.

5. Record the completion of the maintenance task in the maintenance records.

10.2.3 PM-003 – ESD earth cable continuity – Test

NOTE: This task must be carried out by a suitably skilled and appropriately locally qualified electrician.

1. Measure the continuity between the ends of the supplied ESD earth cable.
2. The measurement is to be ≤ 0.3 Ω.
3. Rectify any defects as necessary.
4. For advice on repairs or to schedule a repair visit, contact your local Renishaw office using the contact details in Section “3.7 Contact details”.
5. Record the completion of the maintenance task in the maintenance records.

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Chapter 11 – Spare parts

11.1 Introduction

The aim of this chapter is to provide contact details for spare parts for the Renishaw hopper trolley.

11.2 Spare parts

Renishaw stocks a vast range of spare parts and can make recommendations on any critical spares for your hopper trolley.

For spare parts or to arrange a service visit contact your local Renishaw office using the contact details in Section “3.7 Contact details”

Part number	Description
A-5778-7780	Hopper trolley earth cable kit
A-5778-7649	AM system receiving brackets kit

www.renishaw.com/additivemanufacturing

#renishaw

+44 (0) 1453 524524 uk@renishaw.com

Part no.: H-5800-4481-02-A
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