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Research Methods

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1.0 INTRODUCTION

This report involves the presentation of a project proposal suitable for a MSc dissertation.

The proposal will address the following:

- Project Title
- Project Aim
- Background and Rational
- Objectives
- Methodology/Main Activities Involved in the Project
- Resource Requirements
- Constraints
- Potential Problems
- Literature Review and References
- Relevant Analytical Techniques

2.0 PROJECT PROPOSAL

Improvement of the Generic Test Packing Rig (GTPR) by Re-Evaluating Packing Weights and Tolerances to Reduce Down Time, Missed and Incorrect Orders Within Renishaw.

The project aim is to reduce the current weight tolerance of the Generic Test Packing Rig's which are used to weigh and check the correct items are being packed and shipped to customers. Reducing the current tolerances will ensure customers are shipped the correct items. A review of the current packing specs will also be conducted to ensure the packed weight for each item is correct and remove any deviations which are currently being seen which result in down time to the line and missed orders.

3.0 BACKGROUND RESEARCH

Renishaw are one of the world's leading engineering and scientific technology companies with core skills in measurement, motion control, healthcare, spectroscopy and manufacturing (Renishaw, 2018). With offices in more than 35 countries the aim is to provide leading-edge technology by encouraging innovation to address the customers' needs (Renishaw, 2018).

Renishaw Manufacture a wide variety of encoder products including both linear and rotary encoders. One of the highest running encoder products are the RGH24 incremental encoder systems. As stated by Renishaw incremental encoder systems have a strong reputation for providing highly reliable position feedback even when subjected to unsuitable conditions which most optical linear encoders would suffer from. (Renishaw, 2018)

RGH24 encoders are a compact readhead with integral interpolation which offers both digital and analogue outputs with a non-contact method. Offering high speed and reliable operation with no friction or wear. The encoders use a linear scale which is used to gather straight line positioning information, the encoder uses a 20 μm pitch scale (Renishaw, 2018).



Figure 3.0.0 – RGH24 Linear Incremental Optical Encoder

In order to fulfil customer orders within the encoders division of Renishaw the parts are manufactured on the line and the packed on the line using the Generic Test Packing Rig (GTPR). The GTPR allows the assembler to scan in the works order which contains details of what the part is, any additional extras such as shims along with all the items required for packing such as the box size, any inserts and antistatic bags. The Job order also contains details of how many completed units are assigned to the job order.

The job number bar code is scanned into the GPTR using a barcode scanner and the software will ask the assembler to select the right box, antistatic bag, shim and place the encoder read head in the box. The user must then scan in the encoder bar code which will check that the right readhead is being packed. The GPTR will then weigh the items placed on the scale and compare the result obtained to a result stored in the database. The current tolerances of the GPTR are set to +/- 10g. Provided the value obtained during weighing comes within +/- 10g of the target weight the part is deemed suitable to be shipped to the customer. A label is printed which is stuck on the right-hand side of the box and the job is completed and can be shipped to the customer. A detailed description of how the GPTR works can be found in Appendix 1 which contains the Work Instructions for the GPTR.

Within the Renishaw Miskin site the RGH24 Encoders division has numerous products which customers can order based on their requirements as shown in figure 3.0.1. Due to this Renishaw have numerous parts and part numbers which will all be packed using the GPTR. An example of all the available options for customers can be found in image 3.0.1.

RGH24	TYPE (TOP PCB)	CABLE LENGTH (Packing Kit)	TERMINATION TYPE (Cable Assembly)	OPTION (STANDARD) (Lid Assembly)	CORE TYPE (Core Assembly)
B	Analogue Typop A-9541-0560 A-9541-0780 (JST)	00 NO CABLE A-9541-0222	Z 'END' JST CONNECTOR NO CABLE	00 STANDARD HEAD A-9541-0300	A STD H24 RM CORE A-9541-0250
D	5µm RS-422-A A-9541-0560 A-9541-0800 (JST)	01 0.1m (DXS) A-9541-0215	F FLYING LEAD A-9541-1000/1019	01 END ENTRY JST A-9541-0301	B STD LIMIT CORE A-9541-0101
X	1µm RS-422-A A-9541-0560 A-9541-0800 (JST)	02 0.25m (AXS) A-9541-0215	A 9 'D' TYPE PLUG A-9541-1020/1039	30 Retimed 12MHz A-9541-0300	H HI SPEED RM CORE A-9541-0263
Z	0.5µm RS-422-A A-9541-0560 A-9541-0800 (JST)	03 0.3m (DLXS) A-9541-0215	L 15W 'D' Type for ANALOG A-9541-1120/1139	31 Retimed 8MHz A-9541-0300	
W	0.2µm RS-422-A A-9541-0720 (IC-NO) A-9541-0820 (JST) A-9541-0890 (use with H Core)	04 0.4m (X) A-9541-0215	D 15W 'D' Type for DIGITAL A-9541-1140/1159	32 Retimed 6MHz A-9541-0300	
Y	0.1µm RS-422-A A-9541-0720 (IC-NO) A-9541-0820 (JST) A-9541-0890 (use with H Core)	05 0.5m (ADFLSTUX) A-9541-0215	T 15 'D' Skt, 'B' o/p for TNC A-9541-1160/1179	33 Retimed 4MHz A-9541-0300	
H	50nm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	06 0.6m (L) A-9541-0215	U 15W 'D' Pig - Digital/Heidi. A-9541-1240/1259	35 JST Retimed 12MHz A-9541-0301	
I	20nm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	07 0.7m (LX) A-9541-0215	X Inline Connector A-9541-1220/1239	36 JST Retimed 8MHz A-9541-0301	
O	10nm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	10 1.0m (ADFLSTUX) A-9541-0215	S Specials (combine with Option column)	37 JST Retimed 6MHz A-9541-0301	
		15 1.5m (ADFLSTUX) A-9541-0215		38 JST Retimed 4MHz A-9541-0301	
		20 2.0m (ADFLSTUX) A-9541-0215		60 Retimed 50MHz A-9541-0300	
		30 3.0m (ADFLSTUX) A-9541-0215		61 Retimed 20MHz A-9541-0300	
		32 3.2m (S) A-9541-0215		62 Retimed 10MHz A-9541-0300	
		50 5.0m (ADFLSTUX) A-9541-0215			
		70 7.0m (S) A-9541-0215			
		90 9.0m (S) A-9541-0215			
		10 10.0m (F) A-9541-0220			

(ZADFLSTUX) = AVAILABLE TERMINATION TYPES

RGH24	TYPE (TOP PCB)	CABLE LENGTH (Packing Kit)	TERMINATION (Cable Assembly)	OPTION (Specials) (Lid Assembly)	CORE TYPE (Core Assembly)
03	SPEA SPECIAL #1 A-9541-0300	RGH24B SPEA SPECIAL, use cable S03 A-9541-1180/1186, 9Way D Custom Pin out			
11	ABERLINK SPECIAL A-9541-0300	RGH24Y & Z ABERLINK SPECIAL, use 50S11 cable A-9541-1178 or 70S11 cable A-9541-1179, 15HDD Custom Pin out			
12	ASML SPECIAL A-9541-0300	RGH24D ASML SPECIAL, use 10S12 cable A-9541-1306, 9Way D 45° Custom pin out			
15	PM BEARINGS SPECIAL A-9541-0300	RGH24B PM BEARINGS SPECIAL A-9541-1307 & 1308 15 Way D PLUG (Custom Pin Out) 1Metre Cable '10S15' and 1.5Metre Cable '15S15'			
16	BACHINI SPECIAL A-9541-0300	RGH24Z BACHINI SPECIAL, use 30S16 cable A-9541-1321, 9Way D Custom Pin Out			
17	PRIOR SPECIAL A-9541-0300	RGH24Y PRIOR SCIENTIFIC SPECIAL, use cable 30S17 A-9541-1322, 12Way Circular Binder Custom Pin out, retimed at 4MHz (as Option 33)			
23	T&S SPECIAL A-9541-0300	RGH24B T&S SPECIAL, use cable 15S23 A-9541-1334 Flying Lead (Tonic cable)			
24	Orthodyne Special A-9541-0300	RGH24Y K&S/ORTHODYNE SPECIAL, use 03S24 cable A-9541-1336 LED O/P 0.275Metre Cable with JST Connector, use JST Top PCB A-9541-0820, retimed at 12MHz (as Option 30)			
25	N&K SPECIAL A-9541-0300	RGH24X N&K SPECIAL, use 03S25 cable A-9541-1348, 8 Way Molex			
26	Orthodyne Special A-9541-0300	RGH24Y K&S/ORTHODYNE SPECIAL, use 01S26 cable A-9541-1350 LED O/P 0.09 Metre Cable with 10 Way JST Connector, use JST Top PCB A-9541-0820, retimed at 12MHz			
27	Orthodyne Special A-9541-0300	RGH24Y K&S/ORTHODYNE SPECIAL, use 01S27 cable A-9541-1351 LED O/P 0.125 Metre Cable with 10 Way JST Connector, use JST Top PCB A-9541-0820, retimed at 12MHz			
28	Orthodyne Special A-9541-0300	RGH24Y K&S/ORTHODYNE SPECIAL, use 02S28 cable A-9541-1353 LED O/P 0.175 Metre Cable with 10 Way JST Connector, use JST Top PCB A-9541-0820, retimed at 12MHz			
39	Panasonic Special A-9541-0300	RGH24D READHEAD WITH RoHS CABLE - CUSTOMER CLOCK REQUIREMENT 3.4MHz (CUSTOM)			
40	Panasonic Special A-9541-0300	RGH24D READHEAD WITH RoHS CABLE - CUSTOMER CLOCK REQUIREMENT 3.4MHz LOW HYSTERISES (CUSTOM)			
41	Orthodyne Special A-9541-0300	RGH24Y K&S/ORTHODYNE SPECIAL, use 03S41 cable A-9541-1354 LED O/P 0.275 Metre Cable with 10 Way JST Connector, use JST Top PCB A-9541-0820, retimed at 12MHz			
42	Orthodyne Special A-9541-0300	RGH24Y K&S/ORTHODYNE SPECIAL, use 01S42 cable A-9541-1355 LED O/P 0.068 Metre Cable with 10 Way JST Connector, use JST Top PCB A-9541-0820, retimed at 12MHz			

RGH24	TYPE (TOP PCB)	CABLE LENGTH (Packing Kit)	TERMINATION TYPE (Cable Assembly)	OPTION (STANDARD) (Lid Assembly)	CORE TYPE (Core Assembly)
C	12µA MICROCURRENT A-9541-0557	00 NO CABLE A-9541-0222	Z 'END' JST CONNECTOR NO CABLE	00 STANDARD HEAD A-9541-0300	A STD RM CORE A-9541-0260 (Best)
B	Analogue Typop A-9541-0560 A-9541-0780 (JST)	01 0.1m (DXS) A-9541-0215	F FLYING LEAD A-9541-1000/1019	02 ANORAD SPECIAL #1 A-9541-0112	B STD LIMIT CORE A-9541-0101
D	5µm RS-422-A A-9541-0560 A-9541-0800 (JST)	02 0.25m (AXS) A-9541-0215	C 9W CIRCULAR A-9541-1100	04 VIEW SPECIAL A-9541-0113	
X	1µm RS-422-A A-9541-0560 A-9541-0800 (JST)	03 0.3m (DLXS) A-9541-0215	A 9 'D' TYPE PLUG A-9541-1020/1039	05 VIEW SPECIAL A-9541-0114	
Z	0.5µm RS-422-A A-9541-0560 A-9541-0800 (JST)	04 0.4m (X) A-9541-0215	L 12W 'D' Type for ANALOG A-9541-1120/1139	06 SPECIAL 4.5MHz 'W' A-9541-0	
W	0.2µm RS-422-A A-9541-0560 A-9541-0800 (JST)	05 0.5m (ADFLSTUX) A-9541-0215	D 15W 'D' Type for DIGITAL A-9541-1140/1159	07 SPECIAL 3m 3M conn A-9541-0115	
W	0.2µm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	06 0.6m (L) A-9541-0215	T 15 'D' Skt, 'B' o/p for TNC A-9541-1160/1179	08 SPECIAL 5m 3M conn A-9541-0116	
Y	0.1µm RS-422-A A-9541-0560 A-9541-0800 (JST)	07 0.7m (LX) A-9541-0215	U 12W 'D' Pig - Digital/Heidi. A-9541-1240/1259	09 KODAK SPECIAL A-9541-0153	
Y	0.1µm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	10 1.0m (ADFLSTUX) A-9541-0215	X Inline Connector A-9541-1220/1239	10 GRIBETZ SPECIAL A-9541-1147	
H	50nm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	15 1.5m (ADFLSTUX) A-9541-0215	S Specials (combine with Option column)	13 ERSA SPECIAL 9WD 45Deg A-9541-1305	
I	20nm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	20 2.0m (ADFLSTUX) A-9541-0215		14 UNAXIS SPECIAL A-9541-1179	
O	10nm (IC-NO) RS-422-A A-9541-0720 A-9541-0820 (JST)	30 3.0m (ADFLSTUX) A-9541-0215		18 Not Used	
		32 3.2m (S) A-9541-0215		19 Not Used	
		50 5.0m (ADFLSTUX) A-9541-0215		20 Not Used	
		70 7.0m (S) A-9541-0215		21 RGH24B WITH JST	
		90 9.0m (S) A-9541-0215		22 Orthodyne Special A-9541-0300	
		10 10.0m (F) A-9541-0220		29 Retimed 25MHz A-9541-0229	
				34 JST Retimed 25MHz A-9541-0234	

*BEST CORES
The following Readheads are fitted with a Best Core:
RGH24B39F00A
RGH24X05D00A
RGH24X10D00A
RGH24X30D00A
RGH24X05D00A

Image 3.0.1 – RGH24 Nomenclature

4.0 OBJECTIVES

Review the current highest runners of encoders in the RGH24 section and select the most profitable items.

Review the current weight specs including current target weight, maximum and minimum tolerances for each part.

Calculate new target weights for each product.

Calculate new upper and lower targets for each product using a ± 3 standard deviation method.

Implement the changes to ensure they are suitable for each individual product.

Test the new specifications to ensure the changes are suitable for production

Test the new specs to ensure the wrong products cannot be shipped due to incorrect items being packed.

Calculate the cost saving that can be incurred by reducing the number of call outs due to packing weight failures, missed orders and customer complaints due to incorrect orders.

Review all specifications 1 year after the implementation to ensure the target specifications are still suitable.

5.0 METHODOLOGY

A review of each part number and the current target weight will be conducted starting with the highest running part numbers. Each part number will have a graph produced to show the current state as shown in Figure 5.0.1.

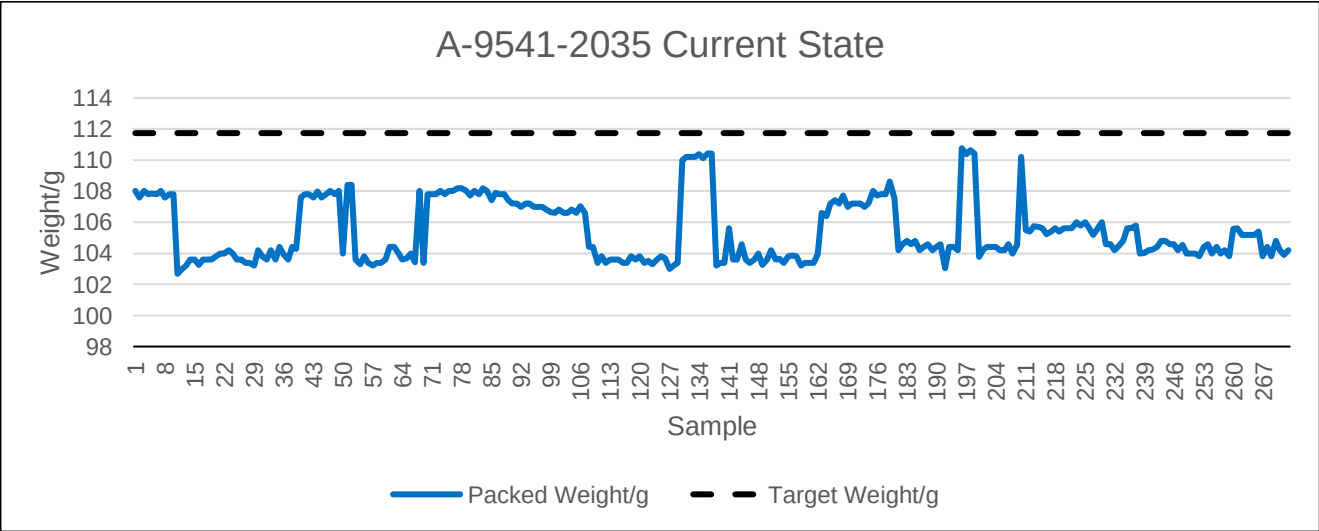


Figure 5.0.1 – A-9541-2035 Current State

As shown in figure 5.0.1 the target weight for A-9542-2035 is currently set to 111.735g. Each individual part number will go through the same process to produce a visual graph which will show the weights recorded during packing for the specific part number and the target weight in order to see how far away from the target weight the packed weights are as shown in Table 5.0.1.

Packed Weight	Target Weight	Difference
108	111.735	-3.735
107.6	111.735	-4.135
108	111.735	-3.735
107.8	111.735	-3.935
107.84	111.735	-3.895
107.8	111.735	-3.935
108	111.735	-3.735
107.6	111.735	-4.135
107.8	111.735	-3.935
107.82	111.735	-3.915
102.68	111.735	-9.055
103	111.735	-8.735
103.2	111.735	-8.535
103.6	111.735	-8.135
103.6	111.735	-8.135
103.24	111.735	-8.495
103.6	111.735	-8.135
103.6	111.735	-8.135
103.6	111.735	-8.135
103.8	111.735	-7.935
104	111.735	-7.735
104	111.735	-7.735
104.2	111.735	-7.535
104	111.735	-7.735
103.6	111.735	-8.135
103.6	111.735	-8.135
103.4	111.735	-8.335

Table 5.0.1 – Difference between packed weight and target weight for A-9541-2035

Due to the target weight being pre-set the upper and lower limits are determined by adding and subtracting 10g to the target weight. In the case of A-9542-2035 the upper and lower targets are set to 121.735g and 101.735g respectively. A graphical representation will then be produced as shown in Figure 5.0.2

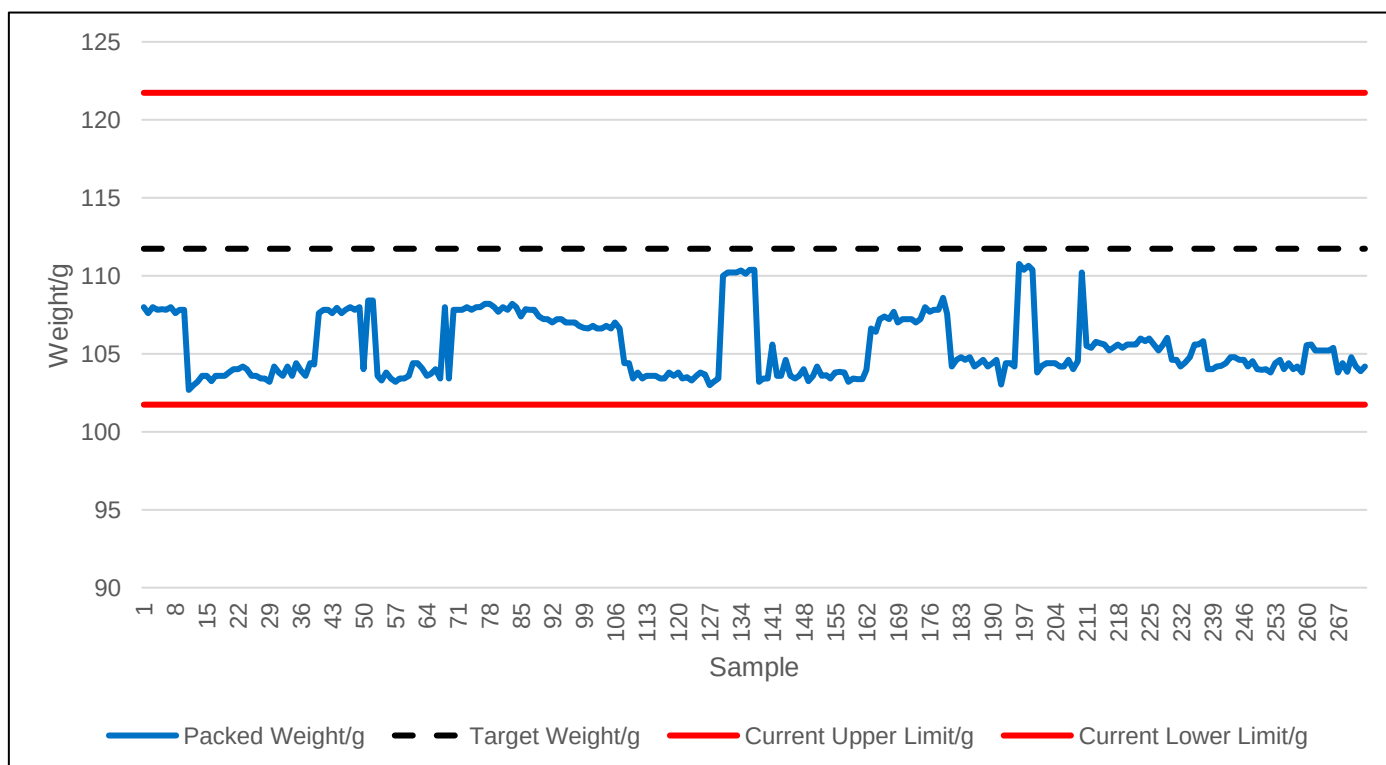


Figure 5.0.2 – Graphical Representation of Current Packed Weights Against Target Weight and Upper and Lower Limits.

The new and improved target weights are to be set to ± 3 standard deviations from the target weight. In order to determine the new target weight and average is taken of all the current products that have been weight and the average value is to be used as the new target weight as shown in Table 5.0.2.

Packing Rig Target Weight / g	111.735
Average Packed Weight / g	105.441
Average Difference / g	6.294
Standard Deviation	1.980
3 Standard Deviations	5.941

Table 5.0.2 – Average Packed weight for A-9542-2035

New Target weight /g	105.441
Max Weight/g	111.382
Min Weight/g	99.500

Table 5.0.3 – Proposed Target Weight, Maximum and Minimum Weights for A-9541-2035

The results obtained for the new target weight and upper and lower limits are then placed into the graph to compare the new limits to the current packing results as shown in Figure 5.0.3.

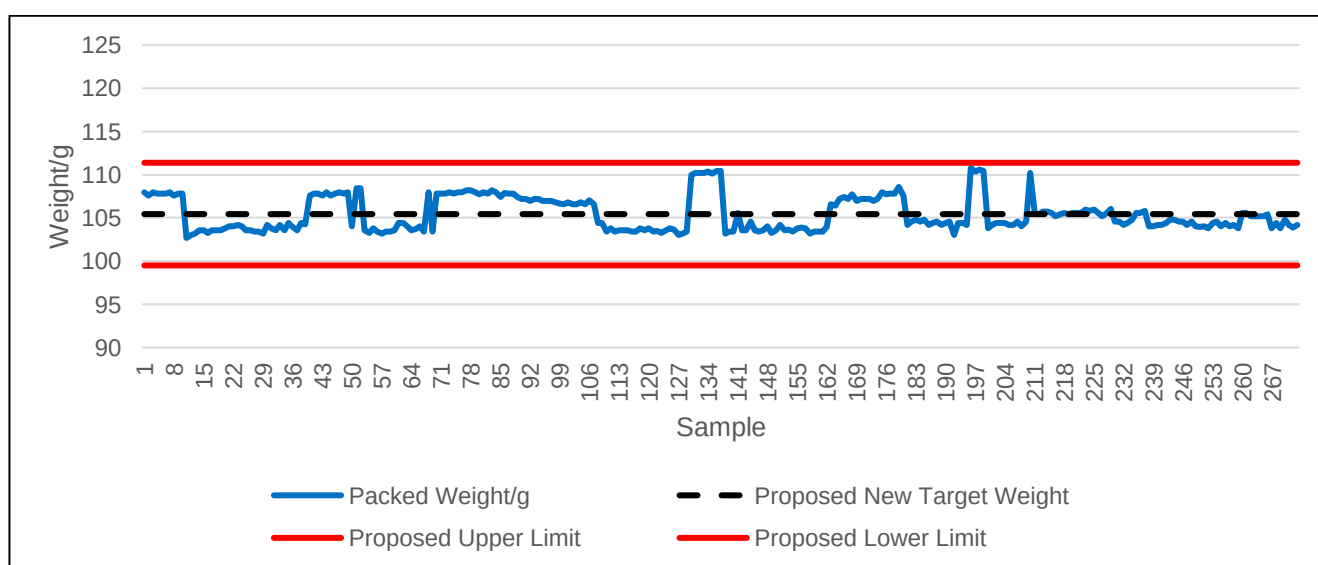


Figure 5.0.3 – Graphical Representation of Current Packed Weights Against New Proposed Target Weight and Upper and Lower Limits.

As shown in Figure 5.3 the new proposed targets and upper and lower limits will be reviewed to ensure the suitability. This process will be followed for each of the 23 A part numbers which are the highest running parts. Once completed the same process will then be followed for all of the remaining part numbers for encoders.

In Order to ensure the target weights, set for the part is suitable monitoring will be required to begin with. Once the changes have been implemented a review every 3 month will be required for the first year. The review will then be conducted on a yearly basis to ensure consistency and ensure that there is

no large change in average weights which would be a large indication to a process change or issue which needs to be investigated.

6.0 CONSTRAINTS

Due to the variety of parts each individual part number has its own specific target weight therefore each part must be reviewed individually which has around 66 different variants of products. This means a lot of time will be required to review each individual part.

Additionally, as Renishaw has some much larger companies they supply parts to who occasionally will request different product variants which are not currently made. Due to this there will be no current data for the packing, so a review of the packing weights will have to be conducted fairly regularly to monitor the weights until enough data has been collected to set a suitable target.

Currently there are two different shims which can be used for the customer to set up their encoder. The shim is used to set up the height of the encoder from the scale. The two different shims come in a Blue and a Red colour. But due to the very minute differences in the weight of the shim the scales are not sensitive enough to detect that the right shim has been placed in the box. Therefore, an alternative solution will be required in order to overcome this issue so that customers do not receive the wrong shim due to human error. Including a pick by lights system would help overcome this issue but would need to be incorporated into the GTPR rig software.

There are currently 5 packing rigs used within the encoders system so there is variation from rig to rig which needs to be minimised as much as possible. By reducing the weight variances to a smaller tolerance, it is essential to ensure the rigs calibration weights are as close as possible in order to prevent parts from being able to be packed on one rig but not on another due to different calibration tolerances on the rigs.

7.0 POTENTIAL PROBLEMS

Potential problems which might be encountered within the project and must be considered include;

1 - With Renishaw having numerous sites within the UK which use the same database for the GTPR it is essential not to make any alterations to items which are used site wide such as boxes and shims as this could cause a packing issue for all sites which would result in numerous orders being missed and down time whilst the problem is resolved. Any changes made must be approved by all common users of the GTPR within encoders across all sites.

2 - Selecting a suitable tolerance for the product range. Ensuring the correct tolerance is set for the product that isn't too large or minute allowing incorrect items to be packed. It is also essential to ensure all regulations for packing are followed.

3 - Rig to Rig Variation – All rigs are individually set up and manually calibrated so there will be rig to rig variation. The rigs scales are very sensitive and can measure to 3 decimal places so there will be variation between rigs. This needs to be minimised as much as possible to ensure the tolerance set for the part is suitable for all rigs.

4 - Ensuring all human error is removed – As the rigs are used by assemblers there is going to be human error within the process. Minimising this is essential and making the process as simple as possible

5 - Addition of future products to the GTPR – In order to determine the target weight, upper and lower limits of products previous data is required so that an average value can be taken, and the previous data can be review. With new products this data will not be available for a significant amount of time, so it is essential that reviews of the new product are conducted more frequently until the process is stabilised.

6 - Change of box supplier – In the process of reducing costs alternative suppliers of the boxes may be used this will have a significant effect on the use of the GTPR as the weight of the new boxes will differ from the current ones depending on the material used and thickness of the material. All of which will need to be reviewed and any changes to boxes will need to be incorporated into the software and all products will need to be updates all of which is a very long process and will need to be done on a regular basis until the process stabilises.

7 - The Change In the 1kg weight standard which is currently in the news – With the fluctuation of the Le Grand K being around 50 parts in a billion described as less than the weight of a eyelash the use of the standard weight is no longer going to be used. Instead an electrical measurement will be used which is said to be more stable, accurate and egalitarian. However, all GPTR rigs are calibrated with a 1kg weight. Although it has been stated that Le Grand K is currently fit for purpose it will not be in 100 years. The change in this weight could mean that due to the sensitivity of the scales the new way of measuring a kg will need to be incorporated into the scale (Ghosh, 2018).

8.0 LITERATURE REVIEW

Packing is described as the function used to exchange products between a supplier and a customer (Guru99, 2018)

In previous years Renishaw use to pack their items by hand using a buddy check system. The readhead label was checked against the works order and then buddy checked by a second person to ensure the correct item had been packed. A label would then be printed and placed on the packaging before being sent to the customer as shown in figure 8.0.1



Figure 8.0.1 – Completed Packaging Item

There are many issues with manually picking, packing and checking items some of which include;

- Very Inefficient due to the increased cost of labour, the risks of mistakes being made is also increased.
- No visibility of the item stored on a database, so checks can be made on the job order or part number.
- Large pallets of items that require packing can easily be mixed up and cross contamination of batches
- Lost sales can be incurred as customers receive the incorrect product, this can give the customer low confidence in the company and the items they purchase causing them to take their business elsewhere.
- Customer complaints, returns and CCAR all of which are very expensive and time consuming to a company.

- For every wrong order additional costs are incurred due to returns and rework costs, administrative costs, additional handling and shipping costs and the cost of re-shipping the correct part to the customer.

(Peoplevox, 2018) (EmeraldTC, 2016) (Plant Handling Limited, 2018) (Cisco-Eagle, 2014)

It has been stated by EmeraldTC that every error in a warehouse has an impact on profit. When it comes to picking and packing parts the error rate is between 1% and 3% which equates to between £38.46 to £230.77 per error. This has been further emphasised by intralogistics who state that on average a single picking and packing error costs around 17 euros. The study shows that a distribution centre packing 180 parts per hour assuming a 99% precision rate can incur 14.4 errors per day. Equivalent to 245 euros in costs per day. Over a year long period this equates to 73,400 euros a very significant amount. (Intralogistics, 2018) (EmeraldTC, 2016)

In order to overcome the issues of manual picking and packing, manual companies use an automated system which removes the human error and checks what is being packed against the works order. Companies such as Ordoro offer this service which is a packing list barcode scanning workflow. This allows the users to scan the works order and then the items being packed and confirm the correct items are being shipped to the correct customer. (ORDORO, 2018)

Provided all of the correct items have been packed for the works order the user will see a confirmation screen appear as shown in figure 8.0.2 allowing the user to move onto another job order.

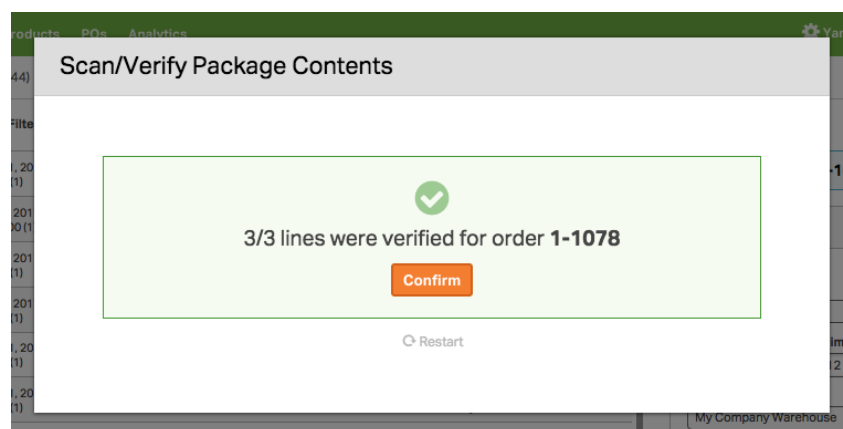


Image 8.0.2 – Confirmation Screen

However, if the incorrect item is scanned the user will be faced with an error message as shown in figure 8.0.3.

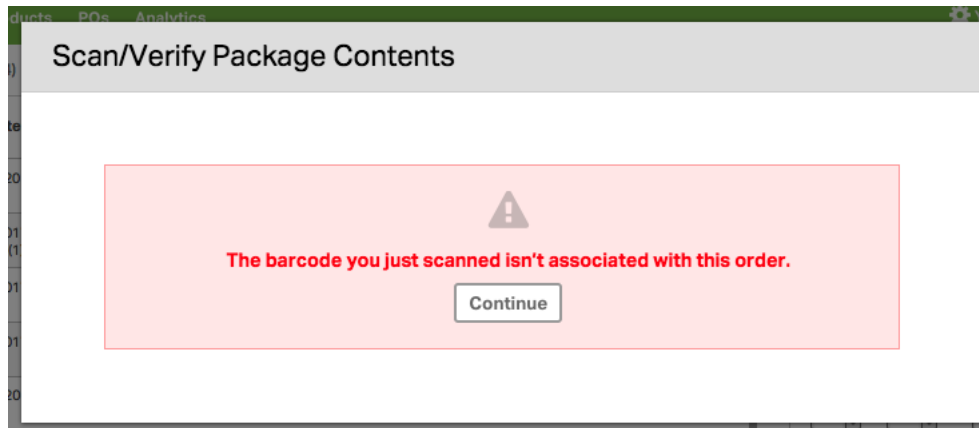


Image 8.0.3 – Error Screen

As well as using barcode scanners a checkweigher is used in conjunction with the barcode scanning system in Renishaw.

Checkweigher is a system that weighs items as they pass through the packing line. The process involves weighing 100% of the items on a production line. The benefit of using the two systems allows not only the barcode of the item to be checked against the works order but the checkweigher had the additional benefits of;

- Checking for under or overweight packages
- Checks for missing components and parts within a package
- Checking package weight limits to keep within the established standards
- Measure and report production line efficiency

(Hi-Speed Checkweigher Company, Inc, 1997)

Many companies use a checkweigher system due to the versatility of them. They can be used for;

- Counting items
- Weighing items
- Checking density or volume
- Checking for missing items
- Avoid under fill fines

- Minimise the number of false rejects and rework
- Protect the reputation of the company
- Improve OEE

(Hill, 2016)

There are numerous benefits to using both a barcode scanning system as well as a checkweigher system together. This will not only ensure the reputation of the company is protected but will also ensure all customers receive a top-class service from Renishaw by receiving the correct items ordered providing them with a high level of confidence from Renishaw as the supplier.

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10.0 APPENDIX 1

PE421 Issue 13

WI 13623 - 01	Sheet 1 of 16	Product: ENCODERS	Desc: PACKING
---------------	---------------	-------------------	---------------

[illegible]

Fill the section below if the WI concerns a product from a division involved in the management of medical devices:

Product division concerned:			
Product Division Approver:	Job Title:	Signed:	Date:

RELATED DOCUMENTS:

SDP-1214

TOOLING:

T-97715 GPTR

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TRAINING REGISTER:

Operator training	<i>All operators to sign and date a box below when they have been trained & understand the WI, trainers to confirm training completed successfully. This also applies if any changes occur in the WI.</i>							
Operator name (print)								
Operator signature								
Trainer name (print)								
Trainer signature								
Date								
WI manual updates	<i>The engineer to include all details of manual update including page number, all operators to sign and date a box when they have read and understand the manual update.</i>							
Update 1 details					Engineer		Date	
Operator signature								
Date								
Update 2 details					Engineer		Date	
Operator signature								
Date								
Update 3 details					Engineer		Date	
Operator signature								
Date								

WI 13623 - 01	Sheet 3 of 16	Product: ENCODERS	Desc: PACKING
---------------	---------------	-------------------	---------------

Distribution

- All Assembly & Engineering personnel associated with RGH24 Customization and Interfaces cells

Health & Safety Considerations:

- Warnings for laser awareness requirements, ESD and pacemaker precautions specific to the documented process.



- This Process has been assessed (AS1541) as RoHS not applicable, as no non-BOM materials or consumables are used within it.



- Warnings for PPE requirements specific to the documented process

**Cautions:**

- **DO** ensure that any warning labels that are required are stuck to the inside of the lid.
- **DO NOT** ship products in boxes where the products labels have been put on crooked, or the box is damaged.

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**For initial start-up of PC and use of Packing Rig (T-97715 – GPTR) for all RGH products and Interfaces please refer to SDP-1214.
For box folding instructions refer to the contents page below.**

Contents

Box Making Instructions for M-9598-0003.....	5
Box Making Instructions for M-9598-0026.....	6
Box Making Instructions for RGH20/24/25 Vacuums M-9598-0003.....	7
Box Making Instructions for P10102.....	8
Packing Instructions for P-WM01-0007.....	9
Box Making Instructions for M-9598-0004.....	10
Box Making Instructions for M-9598-0026.....	11
Box Making Instructions for M-9777-0620.....	12
Box Making Instructions for P10102 with P50197 Foam Insert.....	13
Appendix 1 – Printing of M-9537-0250 Label.....	13
Appendix 2 – Folding of Antistatic Bags.....	15
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Box Making Instructions for M-9598-0003

- Assemble M-9598-0003 Packaging 1/2 Height Carton (see Fig 5A) to form (see Fig 5D)



Fig 5A



Fig 5B



Fig 5C



Fig 5D

- Attach label to box as shown in Fig 5E



Fig 5E

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Box Making Instructions for M-9598-0026

- Assemble M-9598-0026-01 CARTON - <3M (see Fig 6A) to form (Fig 6D)



Fig 6A



Fig 6B



Fig 6C



Fig 6D

- NOTE Attach label to back of box as shown in Fig 6E



Fig 6E

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Box Making Instructions for RGH20/24/25 Vacuums M-9598-0003-03

- Assemble M-9598-0003 Packaging 1/2 Height Carton (see Fig 7A) to form (see Fig 7D)



Fig 7A



Fig 7B



Fig 7C



Fig 7D

- Attach vacuum handling label M-9537-0250 to inside of box Fig 7E. To print label M-9537-0250 refer to appendix 1.



Fig 7E

- Attach label to box as shown in Fig 7F



Fig 7F

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Box Making Instructions for P10102

- Assemble Display Box Small STD P10102 Fig 8A to form Fig 8D
- Make up the packaging insert M-9598-0002 (see Fig 8D) and insert into the carton with the raised pocket orientated to the right-hand side (see Fig 8F)
- Fold Void fill insert M-9598-0010. (See Fig 8G) and insert into box
- Attach label to box (see Fig 8K)



Fig 8A



Fig 8B



Fig 8C



Fig 8D



Fig 8E



Fig 8F



Fig 8G



Fig 8H



Fig 8I



Fig 8J



Fig 8K

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Packing Instructions for P-WM01-0007

- Insert Interface into bubble bag (see Fig 9A)
- Place printed label onto back of bubble bag to seal (see Fig 9B)



Fig 9A



Fig 9B

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Box Making Instructions for M-9598-0004

- Assemble Packaging 1/4 Size Box M-9598-0004. (see Fig 10A)
- Take one insert (see Fig 10B) then make up to form Fig 10C.
- Take one top insert (see Fig 10D) and place inside box (see Fig 10E)

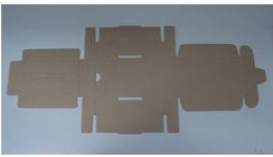


Fig 10A



Fig 10B



Fig 10C



Fig 10D



Fig 10E

- Attach label to box as shown in Fig 10F



Fig 10F

WI 13623 - 01	Sheet 11 of 16	Product: ENCODERS	Desc: PACKING
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Box Making Instructions for M-9598-0026

- Fold box and insert (see Fig 11A and 11B) to form (see Fig 11C and 11D)
- Place insert (see Fig 11C) into box to form completed article (see Fig 11E)



Fig 11A



Fig 11B



Fig 11C



Fig 11D



Fig 11E

- Attach label to box as shown in Fig 10F



Fig 11F

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Box Making Instructions for M-9777-0620

- Fold box and insert (see Fig 11A and Fig 11B)
- Place insert (see Fig 11B) inside of box to form completed article (see Fig 11C)



Fig 12A



Fig 12B



Fig 12C



Fig 12D

- Attach label to box as shown in Fig 12E



Fig 12E

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Appendix 1 – Printing of M-9537-0250 Label

- On the booking in PC locate the home screen and open document M-9537-0250 (see Fig 14A)
- Once the document has loaded, load printer in packing area with part P40215 (see Fig 14B) Ensure paper is placed in the tray with the white side facing up following the feed in directions shown on the paper
- Print document, printed document should have 6 clear labels (see Fig 14C)
- **Note:** When printing labels ensure to print a minimum of 5 sheets at a time

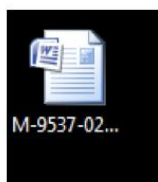


Fig 14A

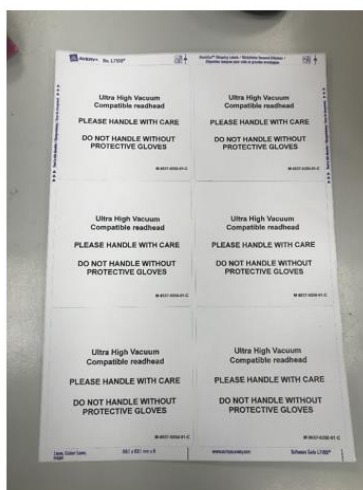


Fig 14D

WI 13623 - 01	Sheet 15 of 16	Product: ENCODERS	Desc: PACKING
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Appendix 2 – Folding of Antistatic Bags

- For correct folding of antistatic bag for all parts
- Place part into antistatic bag and seal bag as shown in Fig 15A
- Fold bag in half to as shown in Fig 15B
- Fold bag in half as shown in Fig 15C to create a tight fit
- Place part in box specified by job sheet Fig 15D
- Ensure a tight fit is achieved and the bag is folded neatly and sealed.



Fig 15A



Fig 15B



Fig 15C



Fig 15D

Appendix 3 – Inputting Serial Numbers for Items Which Cannot be Scanned into Packing Rig

- For items where the serial number cannot be scanned into the packing rig i.e. RGI's and Vac units the serial number is to be typed in manually i.e. RGI's and Vac units

Packing instructions for use with T-97715 GPTR

- Start the PC and log in with username & password **epdassyxp2**. Open the shortcut labelled 'GPTR'.
- Scan ID badge. (see Fig 8a)
- Scan job sheet number. (see Fig 8b & 8c)
- Note: Figures in WI are of a RG41 for illustration but process is generic across items.

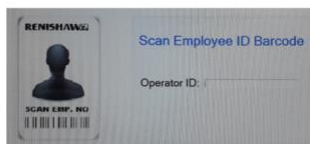


Fig 8a



Fig 8b

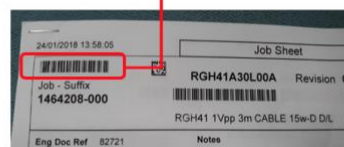


Fig 8c

- Complete the cosmetic checks on the readhead listed on screen. (see Fig 9a)
- If an item fails cosmetic checks, select 'Unit Failed Cosmetic Inspection' and contact engineer. Quarantine label will be printed. (see Fig 9a)
- Follow the instructions on screen and pack all the items in the materials' list. (see Fig 9b & Fig 9c)
- For **RGH 22 Bracket Kit K**, follow instructions in page 13 for bracket fitting.
- Place the readhead and connector into **P-ASBG-0020** bags. (see Fig 9d)

Fig 9a

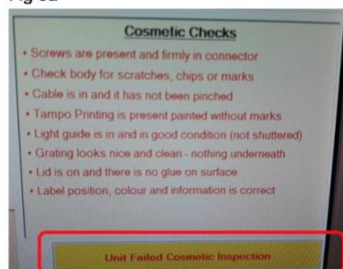


Fig 9c



Fig 9b

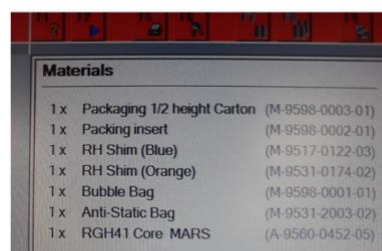


Fig 9d



- Scan all the required items. (see Fig 10a)
- The Serial Number of the scanned readhead will change to green if it is correct. (see Fig 10b)
- For **Vacuums** and **RGH34s**, serial number has to be typed as it is not scannable. (see Fig 10c & 10d)
- If the Serial Number check fails, quarantine label with failure mode will be printed, to be stuck on **jobsheet** and instructions on screen should be followed.
- Confirm that everything in the materials list has been packed and place the readhead in the box cavity. (see Fig 10e)
- If there are items that need to be **individually weighed**, follow instructions on **page 11**, if not, follow instructions on **page 12**.

Fig 10a

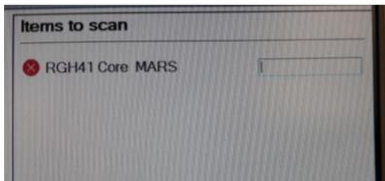


Fig 10b

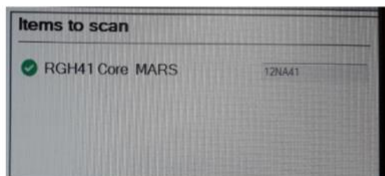


Fig 10c



Fig 10d



Fig 10e

If there is any item that needs to be individually weighed:

- Leave the box **open** and place it on the scale, **without** that specific item. Press the button to start first weight check. (see Fig 11a)
- Do not remove box from scale until all the required weight checks are completed and label is printed.
- If the first weight check is passed, follow instructions on screen and place individual item in the box. (see Fig 11b)
- Press the button to start the second weight check. Repeat this if more than one item needs to be individually weighed.
- Once all the required weight checks are completed and passed, the box label will be automatically printed. (see Fig 11c)
- Close box and follow instructions on **page 13**.
- If the weight check is failed, make sure all the items are present. If everything is correct, contact engineer.



Fig 11a



Fig 11b



Fig 11c

If there is **no** requirement for individual item weight check:

- Close the box, place it on the scale and press the button to start weight check. (see Fig 12a)
- Do not remove box from scale until weight check is finished. (see Fig 12b)
- If the weight check is passed, the box label will be automatically printed. (see Fig 12c)
- If the item fails the weight check, open the box and make sure all the items are present. If there are no items missing, contact engineer.



Fig 12a



Fig 12b



Fig 12c

- Place the packing label onto the left-hand side of the box making sure it is fitted squarely.
- Check label has been printed correctly and the quality is appropriate.
- Scan the 2D Data Matrix Barcode. (see Fig 13a)
- If the information in the label is correct the packing will be finished (PASSED screen) and the user would be able to continue with job by pressing the button in the scale. (see Fig 13b)
- If the box label check fails, open the box, check the label information matches the product inside. If everything is correct, contact engineer.
- Use exit to change the job or reprint feature if necessary. (see Fig 13b)

Fig 13a

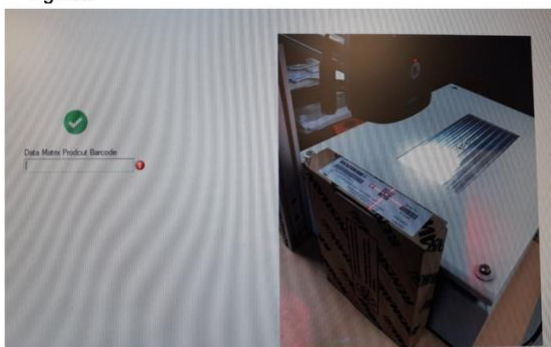


Fig 13b

