SAVONIA

Conveyor maintenance in Famifarm Oy

Zheliang Jiang

Bachelor's Thesis

__. __. ____ _____

SAVONIA UNIVERSITY OF APPLIED SCIENCES **THESIS**
Abstract

Field of Study Technology, Communication and Transport			
Degree Programme Degree Programme in Industrial Management			
Author(s) Zheliang Jiang			
Title of Thesis Conveyor maintenance in Famifarm Oy			
Date	05.11.2012	Pages/Appendices	33+6
Supervisor(s) Heikki Salkinoja Olli-Pekka Kähkönen			
Client Organisation/Partners Famifarm Oy, Jani Kärkkäinen			

Abstract

The final thesis focused on studying the existing conveyor in Famifarm Oy, Joroinen. The existing problems of the conveyor were pointed out and proper solutions were given to make them have a sustainable service life. The aim of this final thesis was to improve the conveyor to be more reliable and efficient thus conveyor could achieve a larger scale of production.

Waiting to make repairs until a conveyor system breaks down is a serious and costly mistake. The key of zero breakdowns on the conveyor is to do not only preventive maintenance but also the maintenance plan. In order to enhance the larger productivity of products, the conveyor system must be reliable. Some breakdowns could be avoidable if the regular inspection, special treatment and continuous maintenance were carried out.

Keywords
Maintenance, Conveyor, Drum motor.

Note

CONTENTS

APPENDICES

1 INTRODUCTION

The final thesis focuses on studying the existing conveyor systems in Famifarm Oy, Joroinen. The existing problems of the conveyor will be pointed out and proper solutions will be given to make them have a sustainable service life. The aim of this thesis is to improve the conveyor to be more reliable and efficient thus the conveyor could achieve larger scale of production.

The majority of conveyor user manuals and conveyor information were provided by the maintenance supervisor. This final thesis was guided and based on those study materials.

The existing conveyors were supplied by following main three companies: Flexlink, Kospirt and Interroll. The most common equipment and spare parts of the belt conveyor are supplied nowadays in Famifarm, Joroinen by Interroll Company. Those equipment play a big role in the production work.

1.1 Famifarm introduction

Järvikylä Mansion has been producing traditional agricultural products since 1674. Traditions are respected, but the vitality is brought by continuous production and operation of the development.

Now the non-traditional agricultural production in different modes of production is carried out. Järvikylä began to search for enabling technologies. Järvikylä‘s estate was seen as a new opportunity to pot in vegetable production. This was a new kind of growing use of technology. In 1987 Famifarm Ltd was found and the potted vegetable productions were started. The potted vegetables and herbs were sold under Järvikylä ®.

Today the range of Järvikylä products is the largest in Finland. In addition to the more traditional pot of lettuces and herbs, a number of specialty salads are produced. The clean and fresh environment is available, for pot of salads and herbs all year round.

The products are under the certified activities throughout comprehensive quality system (Bureau Veritas, 2007), as well as guidelines for Quality Garden (GlobalGAP) and ISO 9001:2008. (Järvikylä 2012)

Nowadays Famifarm Oy has about 80 permanent workers and about 25 temporary workers. Famifarm has three greenhouses located in Joroinen and Juva and a subcontractor in Turakkala. Lettuce products are mostly planted and produced in Joroinen and Juva locations. Herbs are produced in Turakkala greenhouses as subcontracted. Last but not least, there is a marketing department located in the capital of Finland, Helsinki. The marketing department has responsibility to develop and maintain the customer relationship.

2 EXISTING PROBLEMS OF CONVEYORS

A conveyor is a reliable and sustainable system that uses automatic distribution and storage in the modern factory. It can be seen as a labor saving system that allows large volumes of products to move through a process without break. The conveyor system allows company to load or unload higher volumes in a limited factory space and with less labor expenses. (Webb Conveyor)

The conveyors in Famifarm Joroinen are served as a linkage between the production line and packing room. Each conveyor system works usually approximately 3700 hours per year. If the conveyor breakdown occurs during the production period, company has to pay the waiting time, raise havoc, escalate cost, and reduce profit.

In this chapter, the existing problems will be illustrated.

2.1 Product blocking

As can be seen in Figure 1, the phenomenon of blocking product is a historical problem. It happened in every production day especially in the period of high production output and in the places of conveyor border according the working memo. Blocking products were usually corrected to right pattern by the production worker when they saw it. The worst situation was that when the conveyor belt stopped because it was very much products blocking. It always stopped the production line during the daily working life. It is always seemingly small things. But the conveyor breakdowns raise havoc, escalate cost, and reduce profit. The following is some analysis in order to help prevent a costly conveyor breakdown.

Figure 1. Products blocked on the conveyor

Conveyor speed

Conveyor belts were installed by many independent conveyor and not all the conveyors have the same speed. The problem of blocking product occurred when the conveyors have different of speeds. Different speeds of conveyor belts led to the products getting closer to each other. It always seemed that the previous conveyor belt was faster than the front one.

The different speed between conveyors was a serious problem of the conveyor systems, which could make the products to block in a high frequency. The differences speed between the conveyors happened because the maintenance worker ignored checking the speed of drum motor.

Sharp edge of conveyor baffles

Those baffles which were running along the conveyors were cut. Therefore the head of conveyor baffles was created to sharp edges, thus it easily made the products get snagged. According to the working memo, the sharp edge of the conveyor

located from House 3C to 3B, was the most problematic place. Products easily got snagged on this edge, especially when the products in the conveyor were crowded.

Gateway/ Bend Location

Gateways or bends are the typical locations where products frequently got snagged on the conveyor. The gateway was located in a place with specific construction characteristics. The conveyor belt changed direction from horizontal to incline at the gateway between House 3 and House 2. Meanwhile, the gateway and bend locations were constructed by joint place where products could get blocked with high frequency. Furthermore, the gateway located between House 3 and House 2 was one of the most frequent places causing product blocking in the conveyor system in Famifarm Joroinen production plant. There were many bend places in Team 3. Since the position of products was changed in the bend of the conveyor, the products were easily blocked and fell down.

Water on the conveyors and products

According to the user manual of Interroll Conveyor Belt, it is forbidden the belts to get wet. The reason why the products and conveyors were wet was that salad plants always had water with it and rain dropped down from the ceiling. The water dropped easily on the plastic bag so that it made the conveyor belts slippery.
The coefficient of friction between the conveyor belt and product is between 0.1 and 0.35 according to the user manual.

Operative factor

- Number of operatives: The number of operatives in harvesting team should be appropriate according to request of the each harvesting house and product characteristics. The amount of products would be too big and made the products get blocked and snagged, if there are too many operatives harvesting at the same time.

- Working requirements: A caution to reduce frequency of products blocking was to ensure a suitable distance between the products on the conveyor belts. It

always seemed that the operatives laid the products on the conveyor belt without checking. Each co-worker in the harvesting team had their own responsibility to remind operatives stopping the work when the conveyor belt stopped.

- Packing plastic bag: The salad packing bag is usually made of plastic. It is easy to break it without sense of tearing. Consequently, the broken packing bag easily leads to getting snagged on some sharp edge of the conveyor.

- A photoelectric eye could be a potential device to identify where the product blocking is taking place. The packer can figure out the certain place where the product blocking is happening and what is the amount of products on the conveyor.

2.2 Consuming on roller drive and drum motor

The existing drive rollers in Famifarm Joroinen are supplied by Interroll. Those equipment are usually easy to clean of the woolen yarn, plastic bag, dusts during the process of operating. If it is much of it, the equipment will make noise. If it is too much, the bearings, spring or spindle will be bent and broke along with the running as shown in Figure 2. The duty of replacing and cleaning the driver roller is the one of the most important jobs for reducing the cost of maintenance. The maintenance worker will directly replace a new one when it is broken.

Figure 2. Belt fabric blocked in the driver roller and broken driver roller

2.3 Dirty conveyor

The ground of conveyor, motor and surface of the conveyor was dirty. Paint, powder, acid or alkaline fluids, abrasives, glass bead and steel shot on the conveyor are potential factors that affect the duration of conveyor service time. It needs to be cleaned in order to stop polluting products. In order to have good status of conveyor, scheduled cleaning job needs to be carried out. The workers not only clean their own rubbish but also they do the job for conveyors.

2.4 Belt breaks in the joint

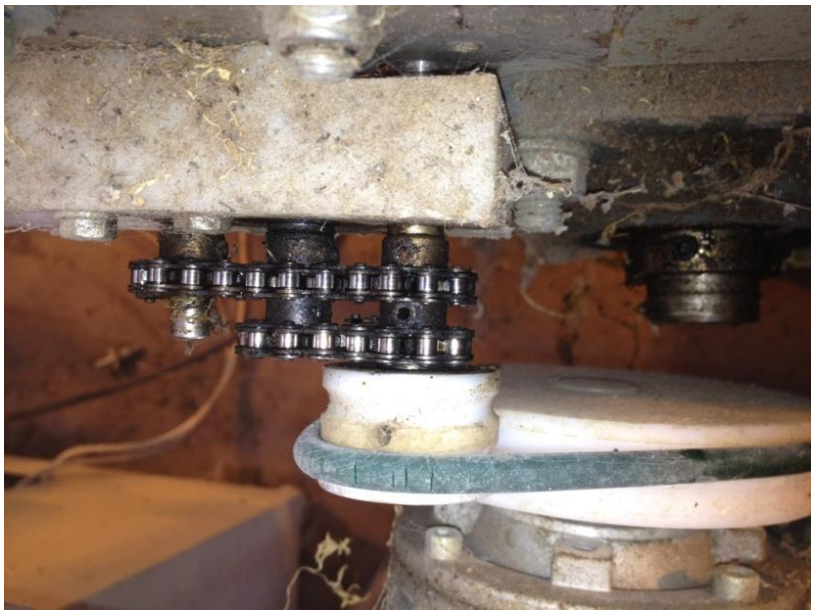


Figure 3. Belt joint broke

As can be seen in Figure 3, there are some conveyor motors which need a plastic belt as transmission in which the belts are usually made manually. The most possible breaking place is the joint that got heated to be clingy. The replacement of a belt took thirty minutes to carry out. The work device of belt welding is shown in Figure 4.

Figure 4. Belt welding device

2.5 Belt slipping on drum motor

The conveyor belts ran away from middle to the margin. The belts were blocked due to inefficient friction between the drum motor and the belt. It happened because the conveyor tension was not adjusted to a suitable extent. The condition of the drum shell or the condition of lagging was bad.

2.6 Drum motor oil leaking and overheating

Figure 5. Temperature measuring device

Oil leakages around the shaft seal and around cable/ terminal box were the most serious effects on the duration of a lifetime. The drum motor overheating especially on the hot summer weather was the disregarding problem on machine operating. The temperature of drum motor was measured by the temperature measuring device presented in Figure 5.

2.7 Missing maintenance records

The most basic method is a maintenance log (presented in Appendix 6) kept at or near the system with information on what maintenance tasks has been performed: the date, and any additional concerns that should be monitored. It documents the history of the equipment. If there is ever an issue with a manufacturer, a maintenance record can support the case. The maintenance records can be particularly useful in facilities where there are several shifts. As can be seen in a Appendix 6, several components that need to be checked both on the drum motor and idler pulley are included. The general condition of drum motor is determined by the following condition of features: noise level, shaft condition, shell condition, lagging condition, shaft seals, bearing condition, cable condition in terminal box and seal, gearbox, motor, motor current, break, thermal control continuity and connectivity, earth check and application. In addition, the general condition of idler pulley is determined by the noise level, shaft condition, shell condition, lagging condition, shaft seals, bearing condition and application. (John 2011, 2)

The level of condition was divided into five categories: good, fair, bad, accepted and failed. The maintenance worker will determine the category by checking all the components. If it is failed, the replacement or repair will be handled to achieve the qualified work condition. The detailed information was created in order to let a colleague notice the maintenance history.

When the whole of check-up is done, the maintenance worker will write their own caution sentence and the suggestion for the next action. Meanwhile, the detailed information have to be written including the position number, product type, serial number, product make, date, and the inspector of the irem. It helps company to realize and

analyze the conveyor systems, as well as, the maintenance history of the conveyor systems.

The aim of creating this documentation is that it lets the maintenance worker clearly know what to check and the reason why the conveyor components break down. Meanwhile, it is a medium to let supervisor know what has been done and the point which should be focused on in the future of operation.

3 PROPER SOLUTIONS

In this chapter, the proper solution for each component will be described that a maintenance worker needs to acknowledge and handle the conveyor in the maintenance task.

3.1 Driver Roller

The spring-loaded spindle like presented in Figure 6 is a typical type of a spindle. The spring-loaded spindle is easy and quick to fit and remove by a spanner. Adequate strength should be put on the side profiles in order to connect to one another with cross-ties. The distance between the two profiles has at least 1 mm gap in relation to installation length (EL) of the fitted roller.

The maintenance worker must also check that there is adequate space available for fitting the roller in the side profiles. Due account must be taken of the space requirements indicated in the illustration below and in the formula. An excess (d1) of approx. 0.5 mm is larger than the diameter of the spindle is sufficient distance in most cases:

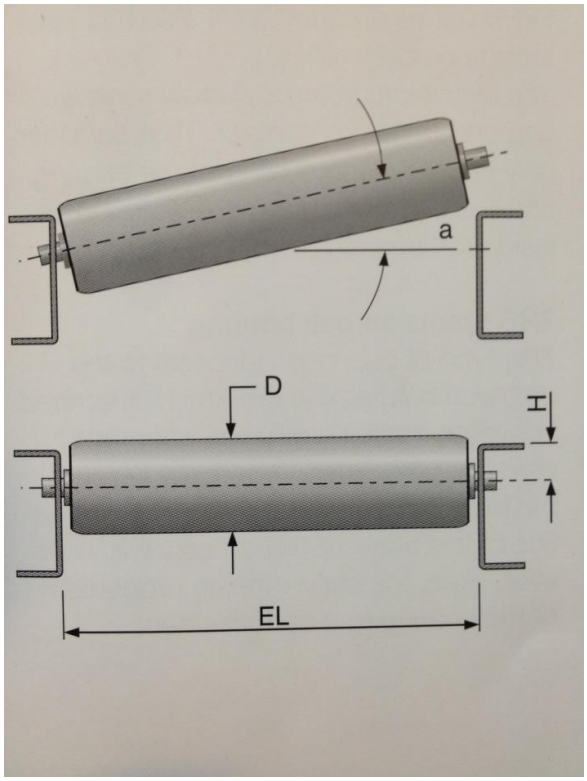


Figure 6. Spring-loaded spindle

As can be seen in Figure 6, the required excess distance (d1) depends on installation length (EL) of the fitted roller, width (D) of the roller, height (H) from the spindle to steal.
Following is the applying equation applied:

$$d1 \geq \frac{S \times \left(H + \frac{D}{2}\right)}{(EL - 1)} + d \qquad (1)$$

(INTERROLL handbook, 4-5)

Threaded spindle

There are some rollers that need to be fitted with bolts in the profile. Therefore, the spindles are requested to be strong enough. Roller spindles and profiles are requested to stabilize each other. In this case, the rollers can be subjected to higher loads compared to fitting loose. As can be seen in Figure 7, the concentricity deviation raised according to the roller length.

It is not necessary to use cross-ties when the maintenance worker strengthens the profiles. The rollers can be simply removed from or fitted in an existing profile at any time. (INTERROL handbook, 9)

The monthly inspection of the driver roller is needed to ensure the rollers are cleaned and in good position and condition. The break-up of bearings and spring in drive roller was easy to judge according to noise. Once it occurred the maintenance worker was going to check and replace one.

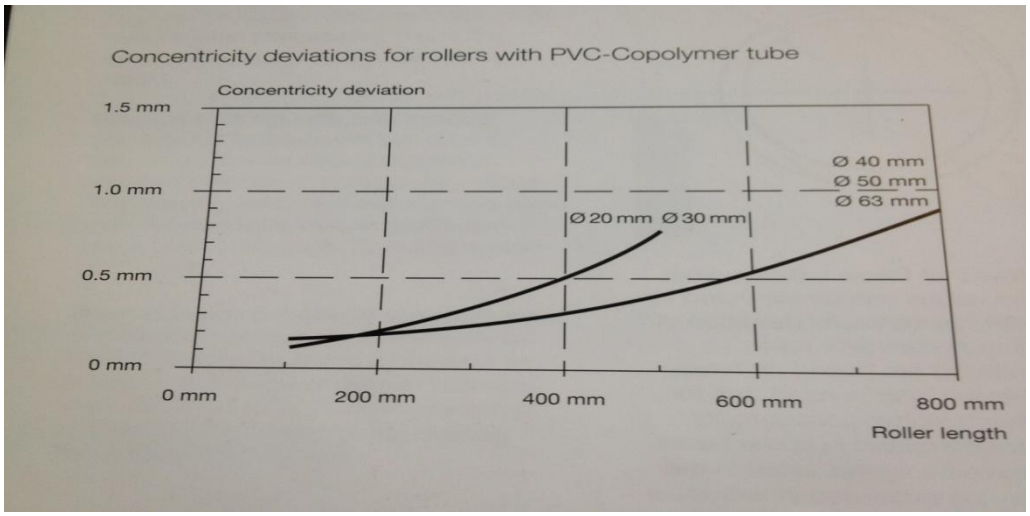


Figure 7. Concentricity deviations for rollers with PVC-Copolymer tube

3.2 Conveyor friction

The friction produced by conveyor force in the rollers is relative to the weight of the material to be loaded. The conveyor force is seriously affected by the following factors:

- The Weight of the material to be loaded
- The base material to be loaded
- The humidity of working area
- Temperature
- The percentage of accumulation mode over the entire running time

To some extent, these factors have an effect on the operation and duration of the lifespan of the conveyor roller. Accumulation mode should only be applied to as long as, if is necessary. (INTERROLL handbook, 9)

Figure 8. Soft sticking-plaster

The soft sticking-plaster like in Figure 8 could be a short-term backup to reduce the friction between the product and the conveyor. It needs to be pasted on the sharp edges.

3.3 Belt Tension

The possibility of shortened lifespan was caused by the belts which led to worn bearing and oil leakage in the drum motor.

A tensioner like in Figure 9 is a device that applies the force to an object to maintain the belt in tension. The amount of force could be adjusted according to the status of the belt. Tension in a drive belt may be adjusted, either manually or automatically.

Tensioners can be described as industrial springs. For instance, a marine riser tensioner on board consists of two sheave blocks with a wire over it. The sheave blocks are connected by a hydraulic cylinder. The oil of the hydraulic cylinder is connected to a gas volume under pressure. The wire rope is kept under a certain stress when the wire rope is connected to a riser. The tension in the wire rope will be changed a bit (depending on the spring characteristic) if the ship moves up and down.

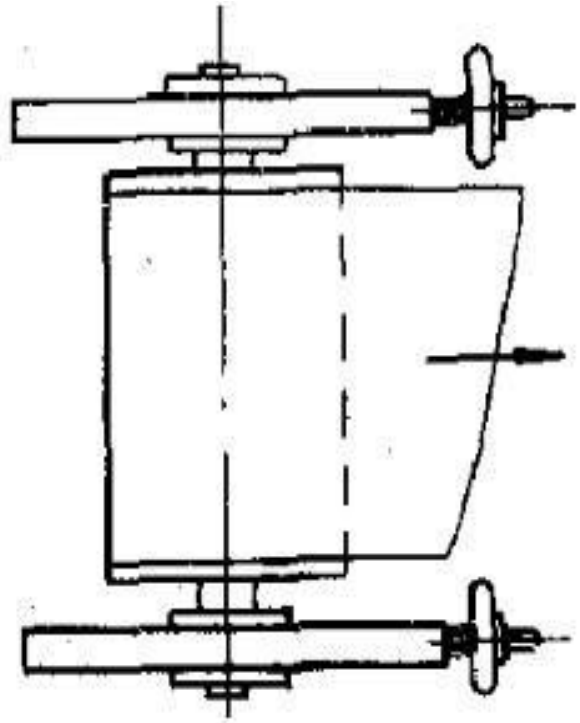


Figure 9. Screw-type tensioner

Operation

As can be seen in Figure 11, the best position is required to be checked with the following work methods. The belt tension is adjusted by tightening or loosening. The respective screws on both sides of the conveyor are to ensure that drum motor remains square to the conveyor frame and parallel to the tail/ idler pulley. The belt is tensioned sufficiently only to drive the belt and its load. In addition, the best position in the diagonal as presented in Figure 10 and lateral was required to be checked after operation.

In order to achieve the best position and carry out well-done maintenance, the structure and features of the conveyor system need to be got familiar with. From Appendix 1 to Appendix 5 there are presented the structure of the parts of the conveyor systems. The drum motor, the idler pulley and the conveyor structures are shown respectively from Appendix 1 to Appendix 5. It helps the maintenance operative to figure out where each part locates. Those detailed databases of conveyor systems are provided to enhance to make maintenance work more efficient.

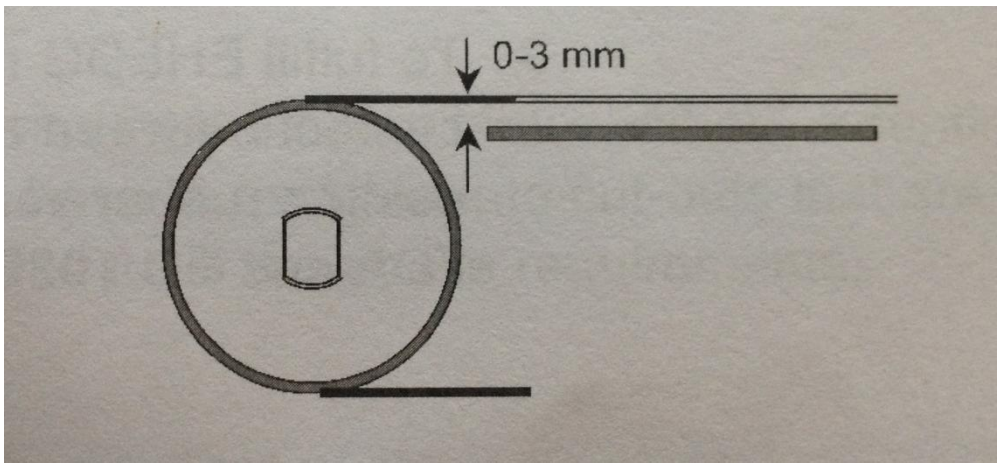


Figure 10. Belt position

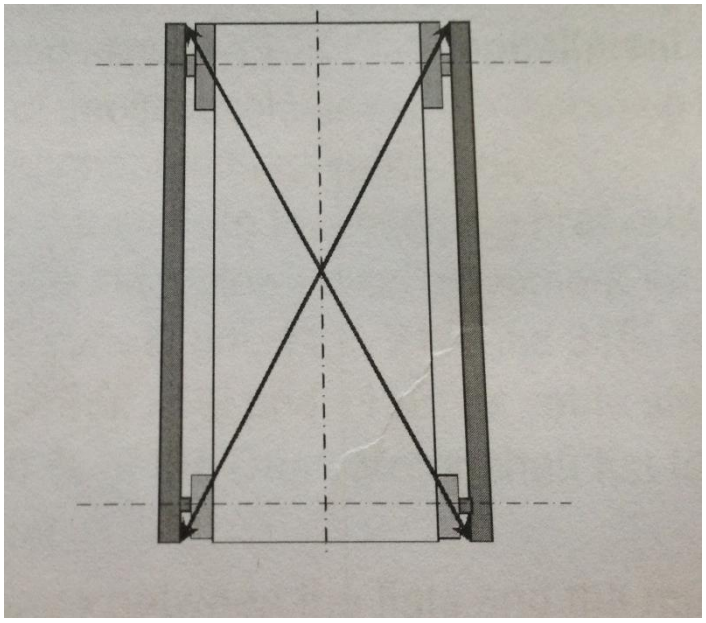


Figure 11. Diagonal check

3.4 Drum motor

Although all components are internally secured in the roller tube after installation, nevertheless some inspection should be done at periodical intervals.

Risk of overheating due to a small belt:

The covers at least 70% of the drum motor face width (roller length) are requested to be fitted with a conveyor belt. A different design is required at the time of order if

drum motors has less than 70% of belt contact or is fitted with a modular belt or without a belt.

The electric fan was a proper way to solve the overheating problem. The electric fan took the role of the temperature reducer during the motor operating.

3.5 The frequency of Conveyor

The frequency of ice salad conveyor could not be increased because the drum motor and packing machine will be overheated. In addition, the packing room was going to be busy and give the mass of works to operatives. The consequence of increasing the frequency was that the quality of products was bad. The coefficient of frequency was adjusted only to 20 HZ to achieve the balance between the production and packing. Conveyor generators as presented in Figure 12 were always working eight hours per shift one after the other.

Figure 12. Frequency Controller

3.6 Cleaning

Special care was needed to be exercised to keep the return rolls and snub pulleys clean. It was advisable wherever possible that the return idlers were suspended far enough below the structure so that any misalignment or dirty idlers could be easily seen. Caution was used to insure that cleaning devices like a vacuum in Figure 13 was used before the materials had been allowed to accumulate to the point that the belt was running in it, and it created more damage than if cleaning had not been done at all.

Attention: the possibe belt damage and belt misalignment were caused by material build up on the drum motor or on the underside of the belt. The belt speed reduction and increase in the power requirement were also caused by material builds up between the belt and slide bed plate or rollers. A high drive efficiency and good belt alignment by the pressure washing gun were ensured by handling periodic cleaning as showed in Figure 14.

The cleaning tools are a high pressure washer, a vacuum cleaner, and a brush.

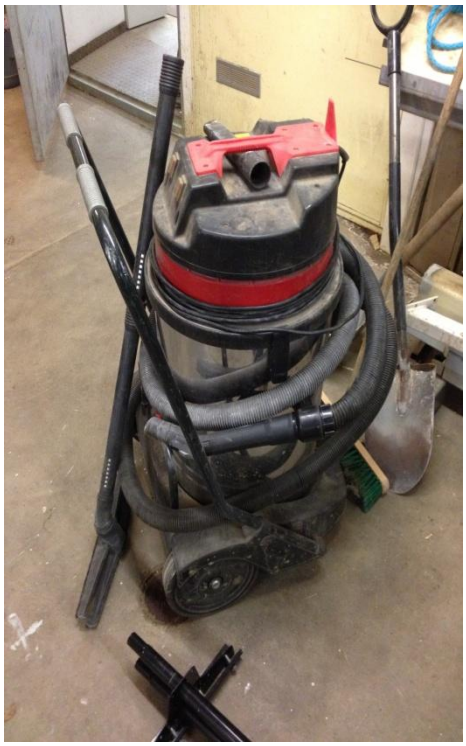


Figure 13.Vacuum Cleaner

Figure 14. Pressure washing gun

If needed, an acid cleaning is advised maximum four times in a month if lime deposition happen. Cleaning with an alkaline cleaning and disinfection agent is recommended if the use of chlorine is approved. Washing the conveyor belt with a water spray was requested to apply when the work has been done everyday night.

Figure 15 shows that the need for several working phases when the operative is going to clean the conveyor belts. The hygienic wash must be handled smoothly and precisely. The maximum temperature of water is 50 degree centigrade when the pressure washing gun is used. The point is that the belt must be cleaned without leaving any visible rubbish. The cold alkaline or acid cleaning agent is used on the belts in order to give a hygienic environment. Last but not the least, the grooves, surfaces and crevasses for residues must be checked after cleaning.

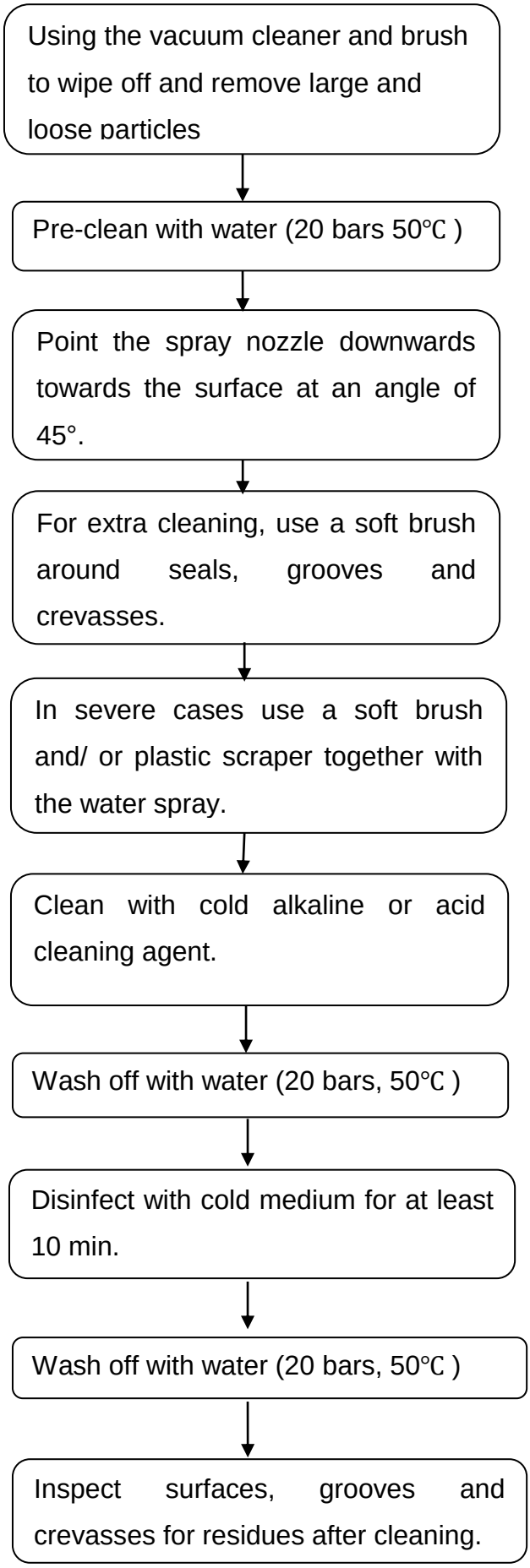


Figure 15. Method of hygienic wash

4 CONTINUOUS MAINTENANCE

It is becoming cliché: “If isn’t broken just let it go, and don’t worry about it.” Everyone knows the value of changing home heating and air conditioning system filters regularly to avoid occurring dirt and dust reducing airflow and damaging the system. (John 2011, 3)

In this chapter, the regular inspection, total productive maintenance (TPM), storage maintenance and safety label will be presented.

4.1 Regular inspections

Regular inspections must be done with the following procedure.

I. The belt shut down and empty

The first step of inspection is to check the conveyor belt while the system is shut down and empty. The visible damage to the belt or splice needs to be checked. The conveyor should be locked out when the maintenance worker is doing this inspection. A maintenance caution sign needs to be put nearby the switch to provide a safe work situation.

The method of using belt welding device is to repair the rubber belt damage. Belt fabrics that blocked the drum motor and driver roller should be cleaned and dried properly. In order to prevent product contamination from abrading the carcass and also breaking down the adhesions, these repairs are critical to prevent moisture from penetrating the belt and breaking down the cover adhesions.

The place of joint should be inspected and if damage in the joint is visible it is necessary that the joint is repaired or replaced.

This is the time to inspect the following components:

A) Tail pulley damage and free from build-up and trapped material
B) Skirting in the loading area
C) Impact bed or impact idler damage
D) Slider bed clean and smooth
E) Carrying side idler damage
F) Carrying side self trainers
G) Secondary loading stations skirting on impact bed or impact idler damage
H) Tripper frame damage
I) Head pulley and/or drive pulley
    a) clean
    b) check for worn lagging
    c) regal drive pulley if rubber is old, worn, smooth and hard
J) Tripper discharge pulley

The preceding list can be seen as a guide when a maintenance worker is inspecting the conveyor and the conveyor is empty and shut down. Numerous items in the preceding list contained the words clean or operation. Pulleys or idlers that have been built up on them will cause tracking problems. (Fenner Dunlop)

II. Belt running empty

The purpose of this phase is to walk the conveyor to check for any tracking problems while the belt is running empty. The system will need to be inspected under running conditions when loaded before any adjustments are made to correct a tracking problem. The reason is that empty belts and loaded belts do not necessarily track the same way.

III. Belt running loaded

The last step in the inspection process is to run the belt in a loaded condition. The new steps are added in the inspection process and a few of the previous steps are repeated.

The following is the check list for operating the conveyor while loaded:

A) Tail pulley - Turning freely without bearing noise, product build up or carry back; belt tracking satisfactory
B) Load area spillage
C) Carry side idlers - turning freely
D) Carry side self-trainers – functioning
E) Tripper area
    a) tracking
    b) spillage

F) Secondary loading station spillage
G) Head pulley snub - turning freely without bearing noise and clean
H) Head pulley and / or drive pulley
    a) smoothly running
    b) slippage when starting or running
    c) belt cleaners - functioning
    d) belt tracking
I) Return idlers - clean and turning freely
J) Bend pulleys
K) Take-up pulley
L) Return side self trainers
M) General belt tracking
(Fenner Dunlop)

IV. Corrective action

The last step is to take the corrected actions required on the conveyor in addition to:

A) Clean up
B) Lubrication
C) Safety concerns - such as installing or repairing conveyor crossovers, edge limit switches, safety stop cables, holdbacks on incline conveyors, motor guard and hand rails. (Fenner Dunlop)

4.2 Drum motor maintenance

The drum motor maintenance must be done according to the following procedure:

Inspection before every startup

- Check the drum motor for visible damage.
- Check safety devices.
- Ensure that no objects are in contact with rotating or moving parts.
- Ensure that the drum motor and the conveyor belt are free to move.

- Ensure that no colleagues are in dangerous areas around the conveyor.
- Clearly specify and monitor the way goods are placed on the conveyor. (INTERROLL handbook, 9)

Preparation for maintenance and hand cleaning

- Switch off the power supply of drum motor
- Turn off power supply switch to disconnect the drum motor.
- Open the Terminal Box and disconnect the cables.
- Put up a caution sign at the control box signalizing. (INTERROLL handbook, 9)

Checking the drum motor

- Ensure that the drum motor is free to rotate every day.
- Check the drum motor for visible damages every day.
- Check that the belt is aligned correctly and runs central to the drum motor and parallel with the conveyor frame every day. Adjust the alignment if necessary every day.
- Ensure that the drum motor shaft and brackets are secured properly to the conveyor frame once per week.
- Ensure that cables, leads and connections are in good condition and fixed securely once per week. (INTERROLL handbook, 9)

4.3 Total Productive Maintenance (TPM)

SFS-EN 13306 standard

> Maintenance consists of all technical, administrative and management procedures concerning lifetime of the item. The purpose of this is to maintain or restore the working capacity of the item so that the target can perform the needed functions. (SFS-EN 13306 Standard)

Total Productive Maintenance should have the highest levels of quality and yield possible. It is about people working together to make sure the equipment is operated and maintained the way it should be and to make sure that newly designed equipment is easier to install, start up, operate and maintain than that which it replaces.

Goals/Pillars of TPM

1. Improving equipment effectiveness
2. Involving operators in daily maintenance
3. Improving maintenance efficiency and effectiveness
4. Educating and Training
5. Designing and managing equipment for maintenance prevention.

4.4 Storage maintenance

Belts should be stored in a dry room, away from sunlight, steam pipes, oil and corrosive fumes. Humidity will shrink any exposed fabric which gets damp from such storage and the belt is liable to "bow" on one edge.

The belts need to be marked with the date of purchasing and the expiry date.

While components were limited in Famifarm Joroinen, the maintenance manager had responsibility of filling the spare parts in the storage. If the maintenance work figured that one component will be broken next week probably, the maintenance

manager would buy the spare part today. The maintenance supervisor has predictive estimation that the component would definitely break tomorrow.

Software like SAP (ERP) system would analyze how many and what spare parts are now in the store.

There are several optional database systems like:

CMMS (Computerized Maintenance Management System): guiding the computerized functions of maintenance
EAMS (Enterprise Asset Management System): following and maintaining the condition and value of production plant (solid assets)
MIS (Management Information System): database system for management and leadership

Those database systems have the same aim for analysis the maintenance work phases and situation of work. They provide the clear view of maintenance and management and let the manager know the work history and future plans. The aim of using system is that the system makes the work more efficient and accurate. There are different kinds of database systems existing which can be chosen according to the work requirements by the manager.

4.5 Safety labels

The employer has a responsibility to remind the employee of those hazards or potential hazards around the working environment. So the safety label is the key to provide common sense and avoid accidents occurring. The working environment in Famifarm, Joroinen was somewhere slippery. The employees should take their own responsibility to wear non-slip shoes or proper shoes in case of falling down. In Figure 16 it is presented the different kind of safety labels for the conveyor systems. The label shows how it the potential dangerous injury may take place when employees come behind the conveyors. The labels are divided into three categories: warnings, cautions and dangers. The color of labels provides clear point of view that employees understand what the level of danger with the conveyor is and what is not allowed to do. The picture makes it very visual and easy to let employees have common understanding of the hazard. Safety labels provide a safe and reliable work place.

Figure 16. Safety labels for the conveyor systems

5 CONCLUSION

As the conclusion of this final thesis, the existing problems were pointed out as figured. The proper solutions for improving the conveyor were discovered, as well as, the method of continuous maintenance. The key of zero breakdowns on the conveyor is to do not only with preventive maintenance but also with the maintenance plan. This is the reason why the writer of this thesis created the list of maintenance history. It could be easily handled in the daily working life. The list helps the employee remember what they need to do before and after work. So, the employees could get the idea that they need to treat the conveyor. The safety aspect would pay the benefits for both employees and company.

The research of this thesis has been done in Famifarm Oy. During the six months training, there were many different kinds of works that were carried out so that it gave a clear view of maintenance experience as well as the practical experience of maintenance and repair works was grasped. In one word, work experience played the significant role in this final thesis.

Waiting to make repairs until a conveyor system breaks down is a serious and costly mistake. In order to enhance the larger productivity of products, the conveyor system must be reliable. Some breakdowns could be avoidable if the regular inspection, special treatment and continuous maintenance were carried out.

REFERENCES

A. Jarvikyla (Online)
Famifarm introduction
Available at: http://www.jarvikyla.fi/famifarm/
Retrieved 01 October 2012

B. Webb Conveyor (Online)
Conveyor
Available at:
http://www.jervisbwebb.com/Categories/Conveyors.aspx?cid=2
Retrieved 27 October 2011.

C. John T. P 2011
Factory Automation: 12 most costly conveyor maintenance mistakes, ISA, p2.

D. INTERROLL handbook
Conveyor Rollers, INTERROLL company product handbook, p4-5

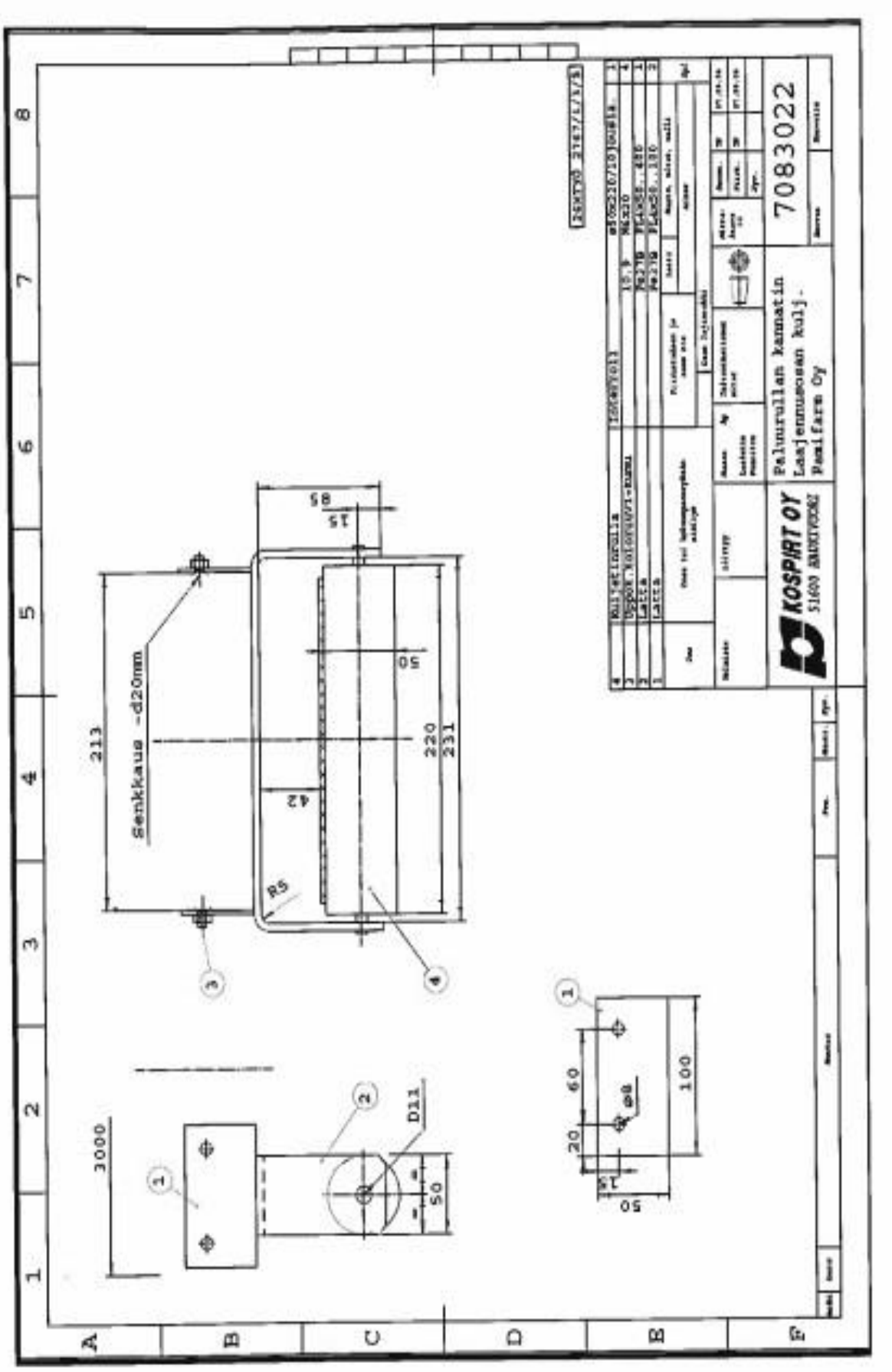
E. INTERROLL handbook
Conveyor Rollers, INTERROLL company product handbook, p9

F. John T. P 2011
Factory Automation: 12 most costly conveyor maintenance mistakes, ISA, p3

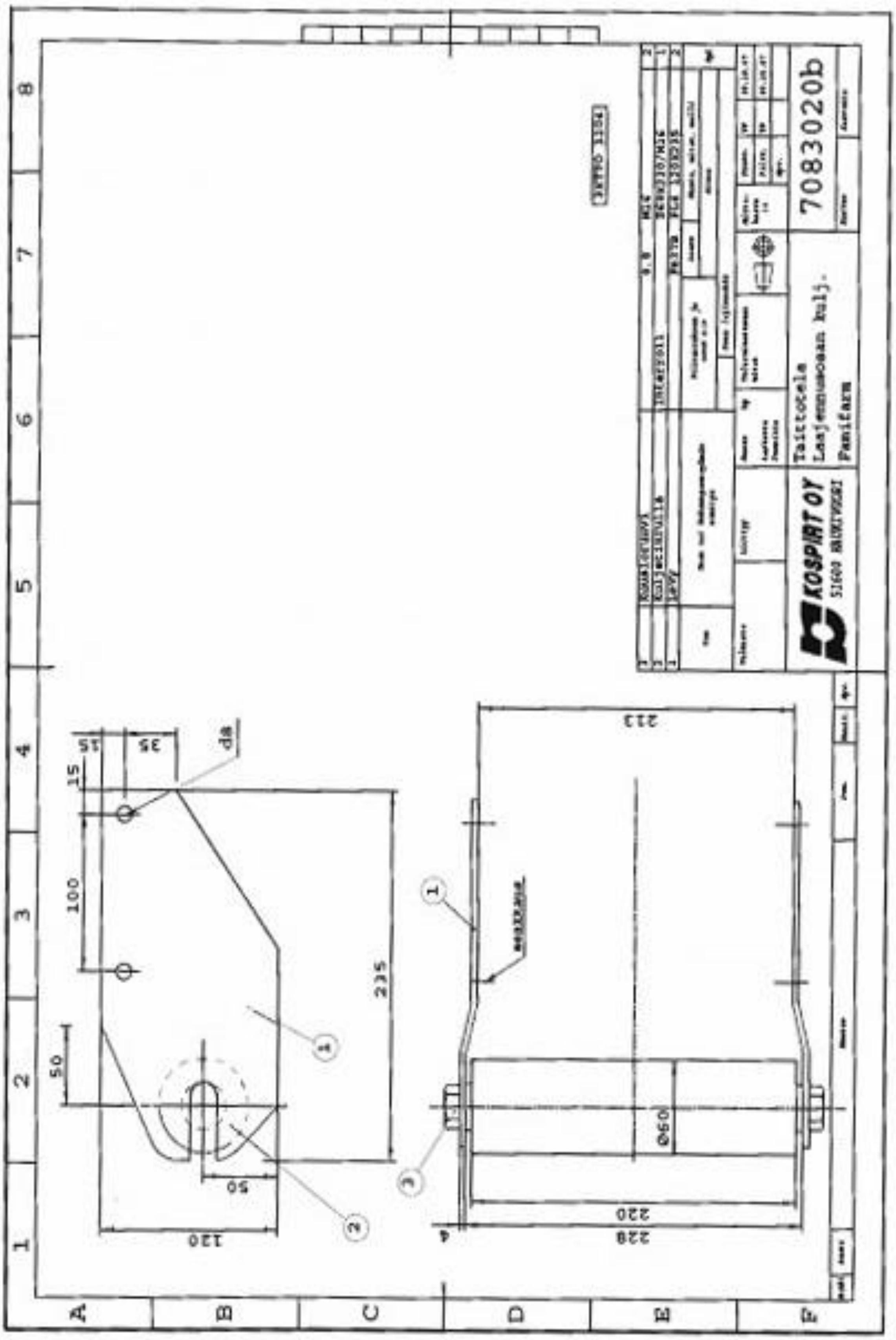
G. FENNER DUNLOP
Conveyor Belt Maintenance, Conveyor Belting

H. SFS-EN 13306 Standard
Overall Equipment Efficiency Study
Available at: http://libris.bahcesehir.edu.tr/dosyalar/Tez/071489.pdf

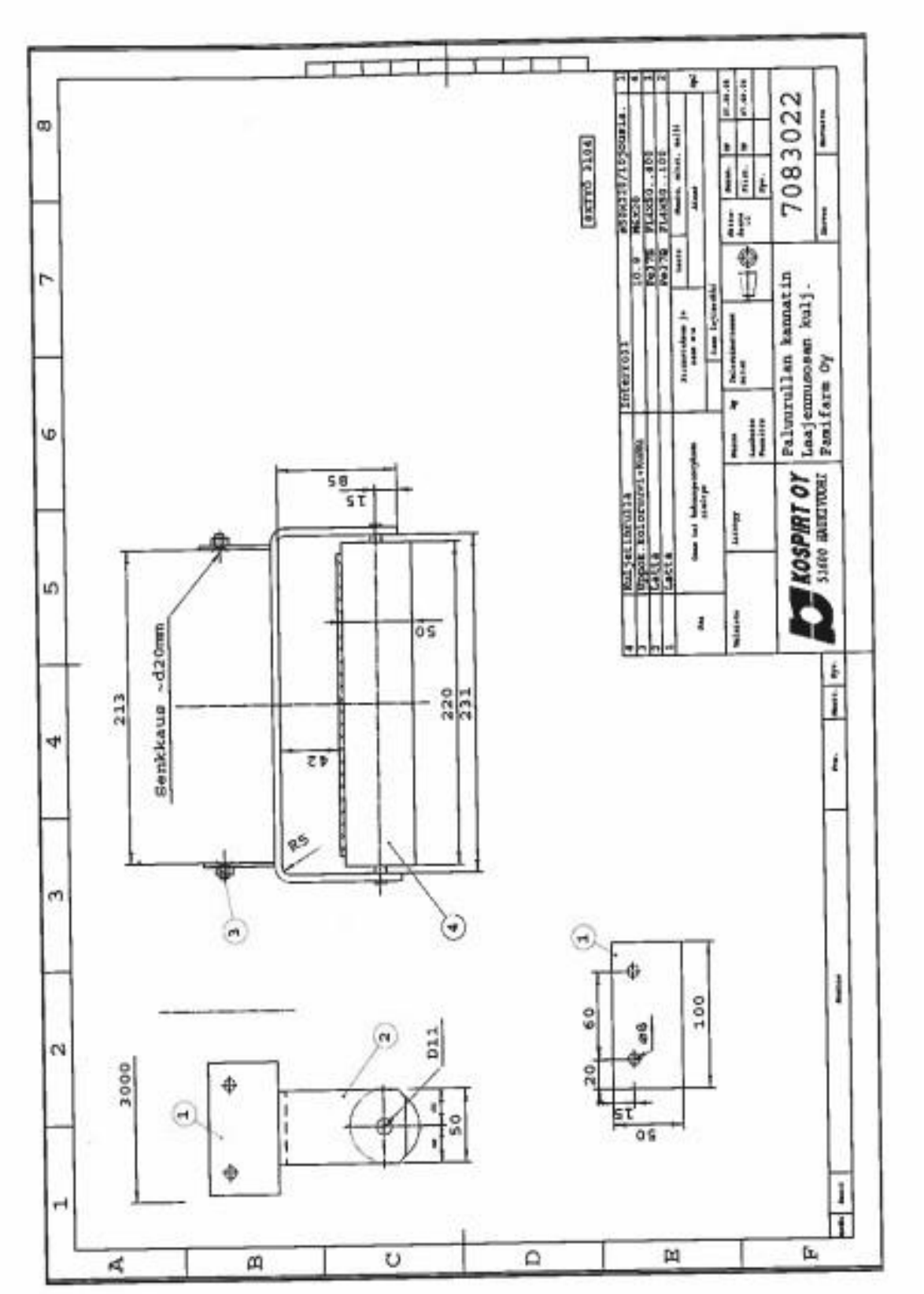
APPENDIX 1


Senkkaus -d20mm
213
220
231
42
50
85
15
R5
3000
D11
50
60
20
100
ø8
KOSPART OY
51600 SAVONRANTA
Palurullan kannatin
Lastenmuosen kulj-
Panifarm Oy
7083022

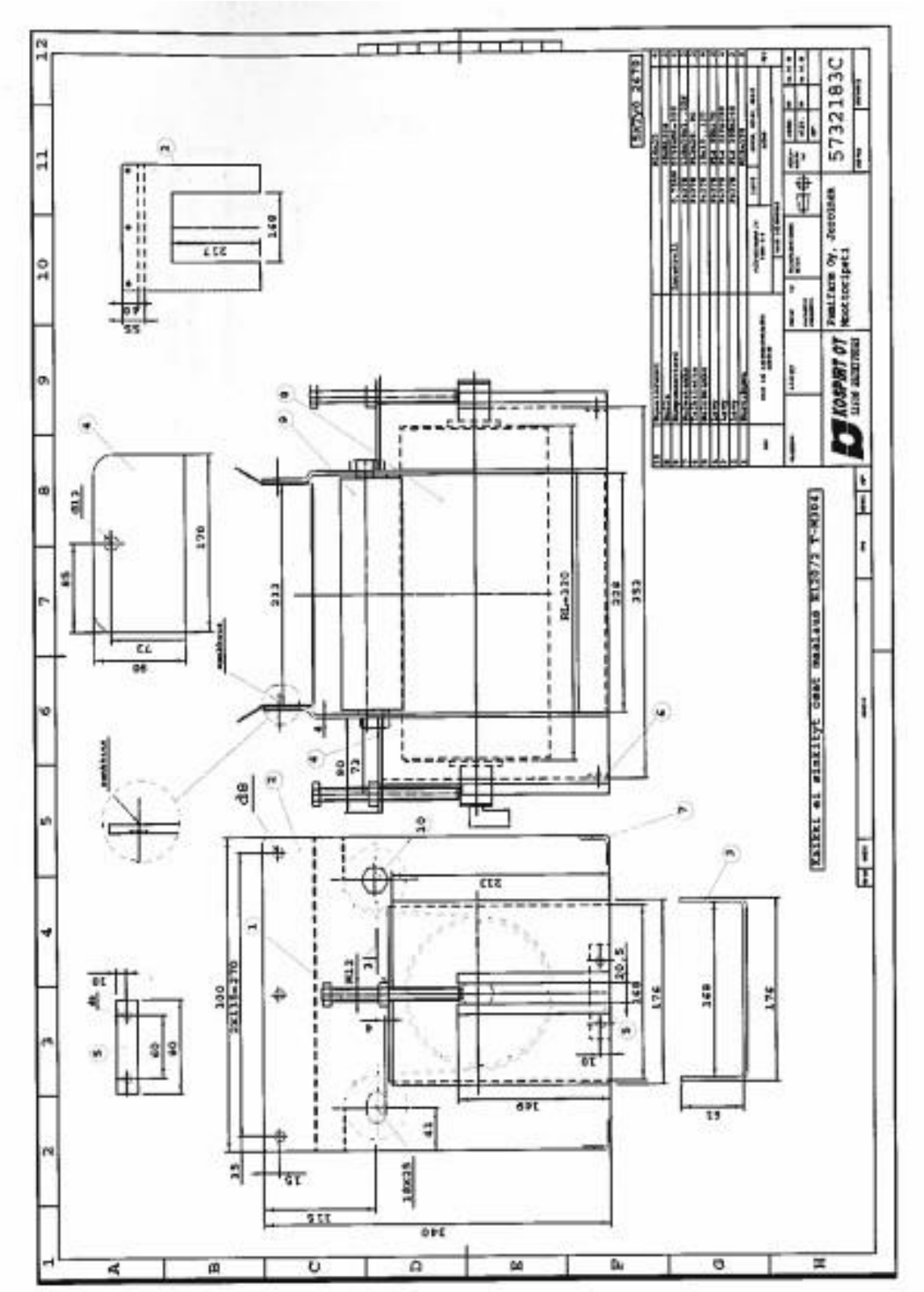
APPENDIX 2


7083020b
KOSPIRT OY
Taittotele
Laajennusosan kulj.
Panifarm
235
130
100
220
228
213
Ø60
50
35
15
d8

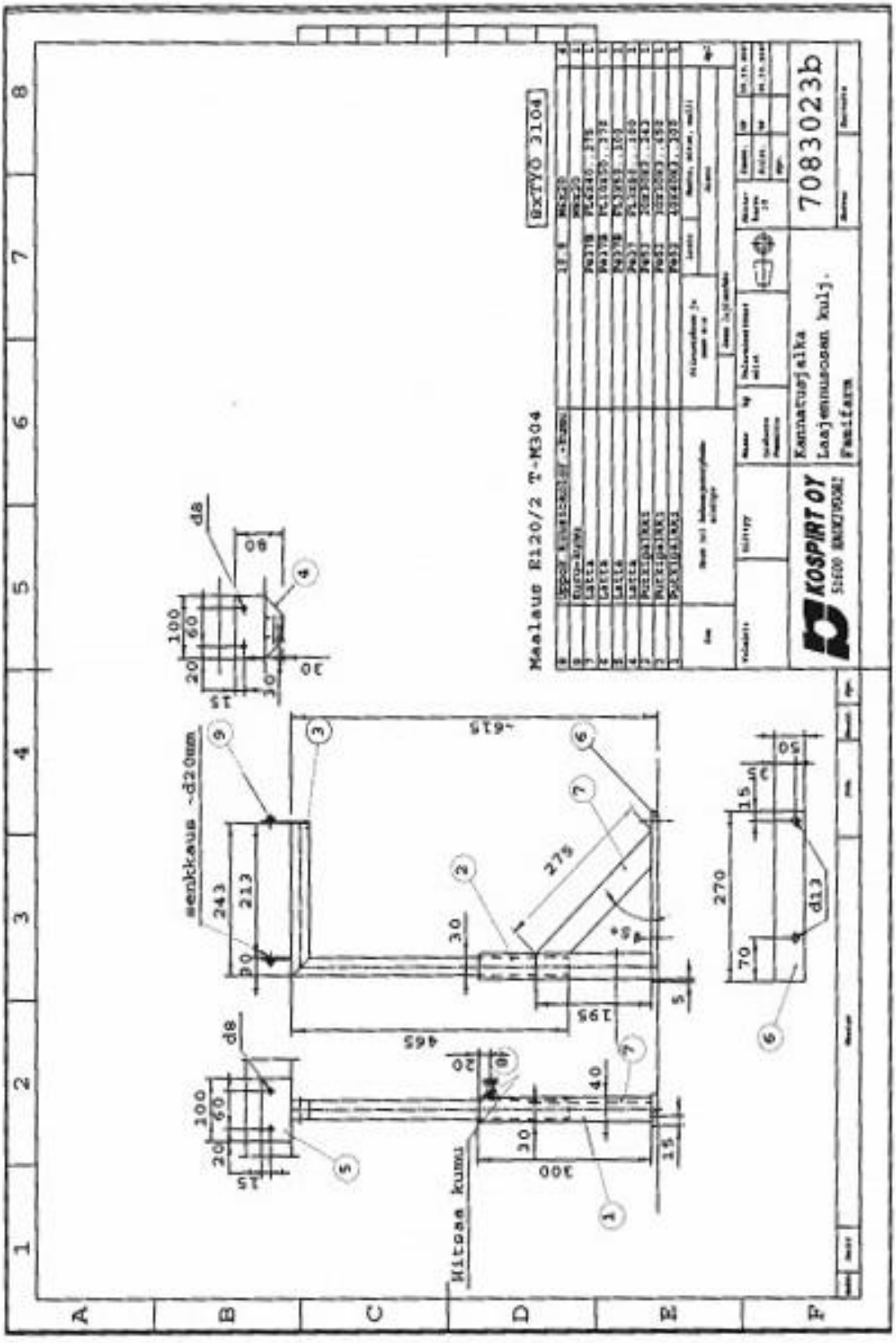
APPENDIX 3


7083022
Palvurullan kannatin
Laajennusosan kulj.
Panifarm Oy
KOSPIRT OY
Senkkaus ~d20mm
213
220
231
3000
D11
100
60
20

APPENDIX 4



APPENDIX 5


70830236
Kanavajalka
Laajennuksen kulj.
Pasifarm
KOSPIRT OY
Maalaus E120/2 T-M304
EXTYÖ 3104
senkkaus ~d20mm
Hitsaa kumm

APPENDIX 6

Site Inspection Report Nr.....						**Customer**.....
Interroll.....						**Address**.....
Inspector.....						**Contact**.....
Tel.....**Date**...../...../.....	Product Make.....					**Tel**.....**E-Mail**.....
Position Number.....	Product Type.....					**Serial Number**.....
Drum motor;	**Good**	**Fair**	**Bad**	**Accept**	**Failed**	**Detail**
General Condition						
Noise Level						
Shaft Condition						
Shell Condition						
Lagging / Sprockets Condition						
Shaft Seals						
Bearing condition						
Cable / Terminal Box Condition						
Cable / Terminal Box Seal						
Gearbox						
Motor						
Motor Current (Amp)						
Brake/Encoder						
Thermal control Continuity						
Thermal control Connected						
Earth Check						
Application						
Additional Infromation.....						
Next Action.....						
.....						
Idler Pulley;	**Good**	**Fair**	**Bad**	**Accept**	**Failed**	**Detail**
General Condition						
Noise Level						
Shaft Condition						
Shell Condition						
Lagging / Sprockets Condition						
Shaft Seals						
Bearing condition						
Application						
Additional Infromation.....						
Next Action.....						
.....						