COMPRESSED AIR LEAK DETECTION SURVEY

ON BEHALF OF

ON LINE VIBRATION MONITORING Ltd.
THE KEY TO MACHINE CONDITION

September 2020

ON LINE VIBRATION MONITORING Ltd.
THE KEY TO MACHINE CONDITION

CONTENTS

INTRODUCTION

Compressed air is used in many industries and is also one of the most expensive forms of motive power to produce. Large industrial users of compressed air can find it difficult to maintain their compressed air distribution systems and pneumatic machinery to a level which provides an ‘acceptable’ air loss. Consequently many users waste large amounts of compressed air (and therefore money) and as long as the compressors cope with the demand, this loss is largely forgotten.

However, as energy is becoming more expensive and industry is being forced to make progress in reducing energy usage, waste and meeting CCL targets, the reduction of compressed air wastage is for most industries an obvious ‘big win’.

It is common for the cost of the survey to be recouped in a very short period of time, thus allowing the company which commissioned the work to enjoy the benefits of lower energy usage.

In addition, it is important to note that leak reduction will not only reduce electricity costs associated with compressed air generation as this survey and report seeks to quantify, but will also reduce compressor servicing costs through the reduction of running hours.

The starting point is a survey which detects, identifies and grades the leaks. Follow up will be required to repair the leaks with the largest leaks rectified first. As systems do not remain in faultless condition indefinitely and in order to continue to benefit from minimising compressed air wastage follow up surveys would be beneficial on an annual basis.

The Survey Report contains descriptions of the locations of the leaks, quantified losses (numerically and graphically) by leak and by area, and supporting pages with images of the leak sites for identification purposes.

BACKGROUND

The survey was carried out at **On Line Vibration Monitoring Ltd on the 17th & 18th September 2020** using an ultrasonic leak detection instrument. Digital images of leak sites were taken for positive identification purposes. The whole site was surveyed including production plants, distribution systems and services.

Details of the leaks found were input into a software package which quantifies leaks in terms of cfm air loss, KW loss and monetary loss. In order to do this, certain assumptions or calculations are made such as system running hours (not plant running hours), energy cost per kWh, compressed air generation efficiency, and grading of leaks.

These are as follows :–

- Running hours = 8760 hrs/annum
- Generation efficiency = 15.62 kW/100cfm
- Generation pressure = 8.2 BarG
- Energy cost = 12 p/kWh

Air loss (leak) grades have been applied conservatively so as to avoid overstating losses. If recalculation is required in the light of more accurate data variables, it can be done quite readily, however the figures employed should provide acceptable accuracy.

For the purposes of the survey the site was divided into six sections:-

- Line A
- Line B
- Line C
- Line D
- Rice
- Services & Ancillaries

For each of the above sections, the subsequent pages contain the following compressed air leak details:

- Leak ID number
- Location of leak
- Nature/ description of leak
- Severity of leak
- Estimated maximum cfm loss
- Estimated maximum annual cost of leak
- Photo of the leak

A summary sheet and graphs are also provided. Larger digital images of the leak sites can also be found in the leak photo library at the rear of this report. Leak ID numbers correspond with photo numbers.

GENERAL

There were audible leaks evident on some assets which could not be fully identified due to the equipment being in production. These assets are also fitted with safety air dump valves which shut off the air when the guards are opened. A safe method of by-passing this system would be required to accurately identify leaks on these assets.

Examples of these assets are box erecting machines, rice plant Cama carton filler, rice plant robot cells and rice plant TT9 pouch filler. Where possible the estimated size of these leaks and approximate location have been included in our leak data.

If you have any questions or comments regarding this report or the service provided please contact me on one of the following;

Mobile: 07816 662420
Email: steve@onlinevibration.co.uk

Steven Hurst (Director)
On Line Vibration Monitoring Ltd

REPORT SUMMARY

The site compressors were monitored when all plants were running. An average air consumption of around 14 m3/min (Approx. 500cfm) of compressed air was observed on the compressor HMI screen. The leaks quantified in this survey total approximately **133cfm** or **27%** of the average site consumption at the time of the survey. This equates to a leakage cost of approximately **£25k per annum** in excess energy usage (24KWh).

Inappropriate use of compressed air (Using air hose lines to blow onto the product sheet) account for around 35% (approx. £9k) of the losses.

The site currently generates air at 8.2 Bar (119psi). Similar industries generate compressed air at around 7 Bar (100psi). Reducing the generation pressure will have a significant effect on the amount of energy used in the production of the sites compressed air.

For an average annual load of 500cfm at a generation pressure of 8.2 bar and an energy cost of £0.12 per KWh the annual cost would be approximately £94k. Reducing the generation pressure to 7 Bar would give a potential saving of around 16% (Approx. £15k per annum)

DATA SUMMARY

Calculations Based on the following:

Annual Running Hours:	8760 hours
Unit Electricity Cost:	12 p/kWh
Generation Efficiency:	15.62 kW/100cfm

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	Area	Number Of Leaks	CFM	Estimated Cost Of Leakage p.a
	Noodle Line A	17	38.76	£ 7,319
	Noodle Line B	15	25.81	£ 4,874
	Noodle Line C	8	36.39	£ 6,871
	Noodle Line D	5	10.86	£ 2,051
	Micro Rice	11	13.91	£ 2,627
	Services & Ancillaries	7	7.37	£ 1,392
TOTALS		**63**	**133.1**	**£ 25,133**

SUMMARY OF LEAKS BY SIZE

Severity Scale	Number of Leaks	% of Total Leak Volume	Leakflow	TotFlow	Leak KWh	Tot KWh	Leak £	Tot £
1	20	7.1%	0.47	9.4	0.08	1.7	£ 89	£ 1,775
2	24	21.1%	1.17	28.1	0.21	5.0	£ 221	£ 5,302
3	10	13.1%	1.75	17.5	0.31	3.1	£ 330	£ 3,304
4	2	4.4%	2.92	5.8	0.52	1.0	£ 551	£ 1,103
5	4	14.0%	4.66	18.6	0.84	3.3	£ 880	£ 3,520
6	1	5.3%	7.00	7.0	1.26	1.3	£ 1,322	£ 1,322
7	0	0.0%	11.66	0.0	2.09	0.0	£ 2,202	£ -
8	1	13.1%	17.50	17.5	3.14	3.1	£ 3,304	£ 3,304
9	1	21.9%	29.14	29.1	5.23	5.2	£ 5,502	£ 5,502
10	0	0.0%	58.30	0.0	10.47	0.0	£ 11,009	£ -
Totals	**63**	**100%**		**133.10**		**23.91**		**£ 25,133**

Total Cost of Leakage	**£**	**25,133**
Leakage Flow (CFM)		**133.1**
Power for Leakage (KW/yr)		**209441**

LEAK DATA

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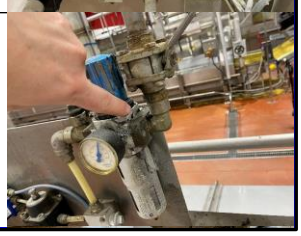
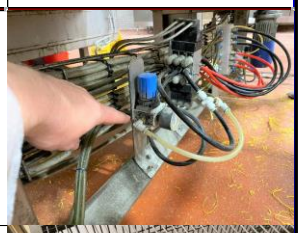
	Calculations assume:	Running hours:	8760	hrs/p.a.
		Electricity Cost:	12.00	p/kW/hr
Department: Noodle Line A		Generation Efficiency:	15.62	kW/100cfm

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
1	Ingredient mezzanine area upper level - Line A flour hopper fluidiser - Pressure regulator	Air passing from base of adjuster knob	2	1.2	220.93	
2	Ingredient mezzanine area - Line A premixer fluidiser air supply	Air leaking from threaded connection between brass fitting and flow regulator inlet	1	0.5	88.75	
5	Line A Kansui Pump Skid - Hand valve feeding yellow air line hose	Air passing from valve stem seal	1	0.5	88.75	
6	Line A Kansui Pump Skid - Air pipework	Air leaking from connection between push-fit tee fitting and clear air pipe	3	1.8	330.45	
7	Line A Kansui Pump Skid - Pressure Regulator	Air leaking from connection into inlet manifold	2	1.2	220.93	
8	Line A calibration roller 5 - Air gun hose line	Improper use of compressed air line to blow air onto product sheet (2.5 - 3mm open end)	8	17.5	3304.47	
9	Line A Pasteuriser - Infeed end steam system air supply - Pressure Regulator	Air passing from base of adjuster knob	1	0.5	88.75	
10	Line A Pasteuriser - Outfeed end steam system air supply - Pressure Regulator	Leak from joint between black inlet block and aluminium regulator body	5	4.7	879.93	

		Calculations assume:	Running hours:	8760	hrs/p.a.	
			Electricity Cost:	12.00	p/kW/hr	
Department: Noodle Line A			Generation Efficiency:	15.62	kW/100cfm	

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
11	Line A Nester - Air system under cutter	Leak from threaded connection on pressure regulator infeed (Clear Pipe)	1	0.5	88.75	
12	Line A Dryer Roof - Loader Flap Cylinder (Wall Side)	Leak from cylinder top push-fit connection into flow regulator	1	0.5	88.75	
13	Line A Dryer Roof - Air supply set	Leak from push-fit connection into top Spirax Sarco IPC4 converter unit inlet (bottom connection)	1	0.5	88.75	
14	Line A Dryer Roof - Air supply set	Leak from push-fit connection into bottom pressure regulator	1	0.5	88.75	
15	Line A Dryer Roof - Air supply set	Air passing from base of adjuster knob	2	1.2	220.93	
16	Line A Dryer Roof - Unloader flap control valve (Line B side)	Leak from Festo 5 port valve bottom outgoing push fit connection	2	1.2	220.93	
17	Line A Dryer Roof - Unloader flap control valve (Wall side)	Leak from Festo 5 port valve bottom outgoing push fit connection	1	0.5	88.75	
19	Packing Room - Line A Box Erector - Low level flap cylinder - LHS (mixing side)	Leak from cylinder top push-fit connection (Pipe number 14)	5	4.7	879.93	

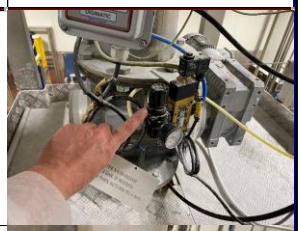
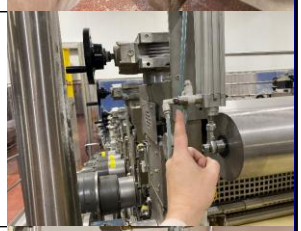
	Calculations assume:	Running hours:	8760	hrs/p.a.
		Electricity Cost:	12.00	p/kW/hr
Department: Noodle Line A		Generation Efficiency:	15.62	kW/100cfm

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
20	Packing Room - Line A Box Filler - Pressure regulator	Leak form push fit connection on regulator inlet (Blue pipe)	3	1.8	330.45	

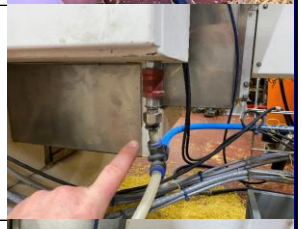
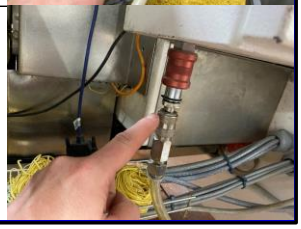
		Calculations assume:	Running hours:	8760	hrs/p.a.	
			Electricity Cost:	12.00	p/kW/hr	
Department: Noodle Line B			Generation Efficiency:	15.62	kW/100cfm	

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
3	Ingredient mezzanine area upper level - Line B flour hopper fluidiser - Pressure regulator	Air passing from base of adjuster knob	2	1.2	220.93	
4	Ingredient mezzanine area - premixer egg control valve actuator	Air passing from small port at the base of the actuator when calling egg. Note: the severity of this leak has been de-rated by 85% due to the leak only occurring when egg is calling	1	0.5	88.75	
18	Line B Box Erector - Raise lower cylinder	Cylinder top threaded connection (Labelled C15). Note: Leak is behind an interlocked guard so severity is estimated based on the audible noise of the leak	5	4.7	879.93	
21	Line B Kansui pump skid - Air supply system	Leak from threaded connection between stainless steel tee and air regulator unit	1	0.5	88.75	
22	Line B - Air pipework above Kansui tank	Leak from threaded connection on stainless steel tee (leg feeding push-fit fittings)	1	0.5	88.75	
23	Line B - Low level pipework on calibration roller platform leg (Line A side) adjacent to HMI panel	Leak from hole in airline	4	2.9	551.38	
24	Line B - Calibration roller 1 - Infeed top roller raise / lower cylinder (Line C side)	Air leaking from cylinder bottom 90 degree fitting	3	1.8	330.45	
25	Line B Pasteuriser - Infeed end steam system air supply - Pressure Regulator	Air passing from base of adjuster knob	2	1.2	220.93	

	Calculations assume:	Running hours:	8760	hrs/p.a.	
		Electricity Cost:	12.00	p/kW/hr	
Department: Noodle Line B		Generation Efficiency:	15.62	kW/100cfm	

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
26	Line B Dryer Roof - Air supply set	Air passing from base of adjuster knob	2	1.2	220.93	
27	Line B Dryer Roof - Air supply set	Air leaking from bottom pressure regulator inlet push-fit connection	1	0.5	88.75	
28	Line B Dryer Roof - Air supply set	Leak from push-fit connection into top Spirax Sarco IPC4 converter unit inlet (bottom connection)	2	1.2	220.93	
29	Packing Room - Line B box closer machine	Leak from split in clear blue airline feeding first bag lift cylinder on RHS	5	4.7	879.93	
44	Packing room - Line B - Air gun hose on column between flow wrappers	Air leaking from hose joint - Threaded connection between the brass & stainless steel fittings (Yellow hose side)	2	1.2	220.93	
45	Packing room - Line B - Flow wrapper line 2 - Incoming air supply	Leak from push-fit connection into quick release connector under control panel	4	2.9	551.38	
46	Packing room - Line B - Flow wrapper line 1 - Incoming air supply	Leak from quick release connector under control panel	2	1.2	220.93	

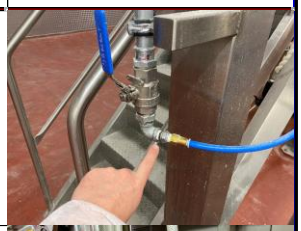
Calculations assume: Running hours: 8760 hrs/p.a.
Electricity Cost: 12.00 p/kW/hr
Department: Noodle Line C Generation Efficiency: 15.62 kW/100cfm

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
30	Line C - Air line feeding air hose reel adjacent to kneader sheeter 2 (Line B side)	Leak from isolation hand valve bottom push-fit connection	1	0.5	88.75	
31	Line C Cutter	Improper use of compressed air lines (2off) to blow air onto product sheet (2.5 - 3mm x 2 open ends). Note: There is also a large leak from the threaded connection into the air gun on the black hose	9	29.1	5502.42	
32	Line C Pasteuriser - Infeed end steam system air supply - Pressure regulator outlet manifold	Leak from bottom threaded connection between push-fit fitting and reducer bush	1	0.5	88.75	
33	Line C Pasteuriser - Outfeed end steam system air supply - Pressure regulator	Air passing from drain port in the base of the pressure regulator	2	1.2	220.93	
34	Line C dryer roof - Air system mounted on hand rail above dryer loader elevator drive	Air passing from RHS solenoid valve coil stem	2	1.2	220.93	
35	Line C dryer roof - Air system mounted on hand rail adjacent to the dryer loader elevator drive	Leak from Festo 5 port valve inlet threaded connection	1	0.5	88.75	
36	Line C dryer roof - Air system mounted on hand rail near to the dryer unloader elevator drive	Leak from Festo 5 port valve bottom outlet push-fit connection	3	1.8	330.45	
37	Packing Room - Line C box filler - Pressure regulator	Leak for air regulator outlet push-fit connection (Black pipe)	3	1.8	330.45	

		Calculations assume:	Running hours:	8760	hrs/p.a.	
			Electricity Cost:	12.00	p/kW/hr	
Department: Noodle Line D			Generation Efficiency:	15.62	kW/100cfm	

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
39	Line D Air gun hose reel supply adjacent to calibration roller 1 (Rice side)	Leak from threaded connection between elbow outlet and reducer bush	1	0.5	88.75	
40	Line D Air gun hose reel under platform adjacent to pre-dryer (Line C side)	Leak from threaded connection into air gun	6	7.0	1321.79	
41	Line D - Platform at pre-dryer infeed (Line C side) - Traywork behind 4 rung steps. Note: Steps need moving out of position to gain access	Leak from top connection of straight through push-fit fitting	2	1.2	220.93	
42	Line D - Pick & Place unit platform - Air gun hose reel adjacent to 90 degree outfeed bend	Leak from threaded connection into air gun	3	1.8	330.45	
43	Packing Room - Line D - Markem box label applicator - Box stop cylinder 5 port control valve	Leak from box stop cylinder 5 port valve top outgoing threaded connection	1	0.5	88.75	

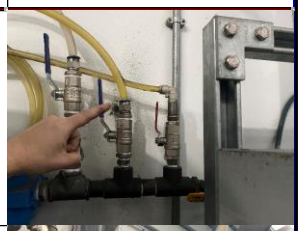
		Calculations assume:	Running hours:	8760	hrs/p.a.	
			Electricity Cost:	12.00	p/kW/hr	
Department: Micro Rice			Generation Efficiency:	15.62	kW/100cfm	

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
48	Rice Plant - TT8 Pouch Filler - Pressure regulator set behind guard under control panel	Air passing from ports in base of regulator	2	1.2	220.93	
49	Rice Plant - Markem carton label applicator	Air passing from open port on label applicator arm	3	1.8	330.45	
50	Rice Plant - Air gun hose on column adjacent to Cama carton filler outfeed	Air leak from threaded connection into air gun	2	1.2	220.93	
51	Rice Plant - TT9 Pouch Filler - Fluid dispensing system - Inside stainless steel cover housing rotary cylinders.	No access due to interlocked guarding - audible leak requires further investigation. Leak severity estimated based on audible noise	2	1.2	220.93	
52	Rice Plant - Retort 3 - Air pressure regulator on top of retort adjacent to main door hinge assembly	Air passing from base of regulator adjuster knob	2	1.2	220.93	
53	Rice Plant - Retort 2 - Air pressure regulator above main drive	Leak from threaded connection on inlet to pressure regulator	2	1.2	220.93	
54	Rice Plant - Retort 2 - Air pressure regulator above main drive	Air leaking from joint between lubricator body and clear plastic cap	3	1.8	330.45	
55	Rice Plant - Retort 2 - Air system above main drive - supply pipework to clamp down valve	Air leak from threaded connection on fitting feeding valve	2	1.2	220.93	

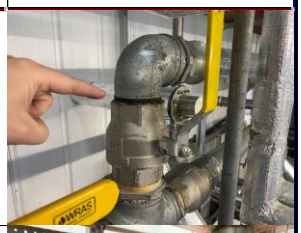
	Calculations assume:	Running hours:	8760	hrs/p.a.
		Electricity Cost:	12.00	p/kW/hr
Department: Micro Rice		Generation Efficiency:	15.62	kW/100cfm

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
56	Rice Plant - Air supply pipework behind air receiver (Adjacent to silo 3 control panel)	Leak from push-fit connection on middle hand valve	3	1.8	330.45	
57	Rice Plant - Air supply pipework feeding air gun hose adjacent to Retort 1	Leak from push-fit connection on inlet to hand isolation valve	1	0.5	88.75	
59	Rice Plant - Nitrogen generation system	Leak from pipe union connection on system outlet (after inline filters) Note: This is a nitrogen leak so the leak cost will be greater than compressed air alone.	2	1.2	220.93	

		Calculations assume:	Running hours:	8760	hrs/p.a.	
			Electricity Cost:	12.00	p/kW/hr	
Department: Services & Ancillaries			Generation Efficiency:	15.62	kW/100cfm	

Departmental Leak Detection Survey

Leak No.	Location of Leak	Nature of Leak (Location, Description)	Severity of Leak (1-10)	Estimated Leak Size (cfm)	Estimated Max Cost (£)	Photo
38	Engineering Workshop Mezzanine - Main air distribution pipework above Flour Blower 2	Leak from threaded connection between hand valve and 90 degree elbow	2	1.2	220.93	
47	Debox Room - Tank A discharge valve	Air continuously passing from bottom exhaust port	2	1.2	220.93	
58	Flour Silo 1 Base - Air system fitted to rotary valve	Leak from threaded connection on inlet to 3 port valve controlling the fluidiser for rotary valve MS-02	1	0.5	88.75	
60	Mezzanine Area above production - Line B flour hopper - Filter reverse jet pressure regulator	Air passing from base of adjuster knob	2	1.2	220.93	
61	Mezzanine Area above production - Flour system diverter valves - 5 port control valve for DV4 (B108)	Air continuously passing from bottom exhaust port	3	1.8	330.45	
62	Mezzanine area above rice hall - Air distribution pipework in centre of mezzanine floor.	Leak from union connection with stainless steel pipe (Adjacent to Norgren pressure regulator)	1	0.5	88.75	
63	Mezzanine area above rice hall - Air pipework on cable tray adjacent to JB R8 junction box	Leak from push-fit connection with 6mm airline	2	1.2	220.93	

LEAK ANALYSIS GRAPH PLOTS

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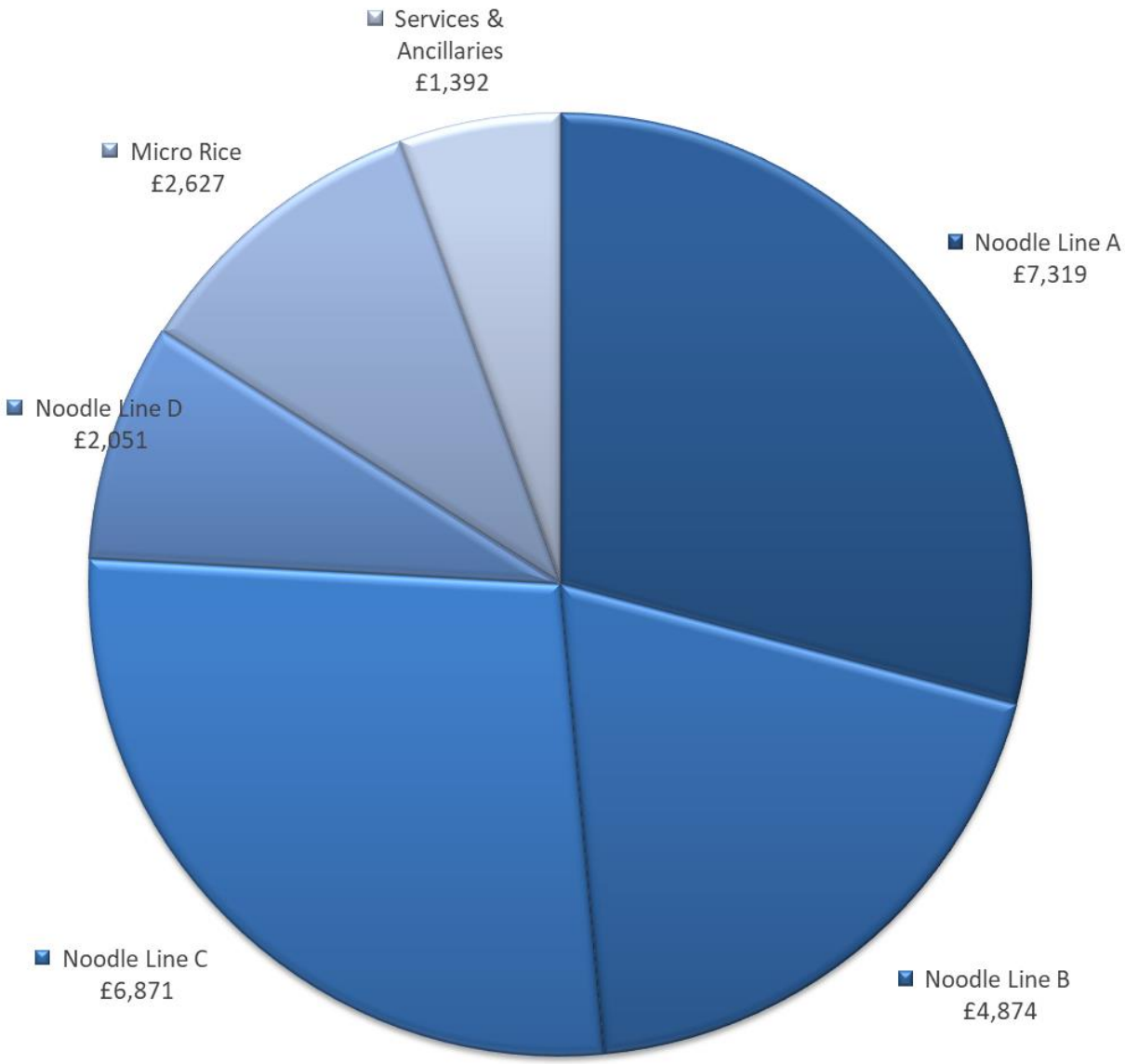
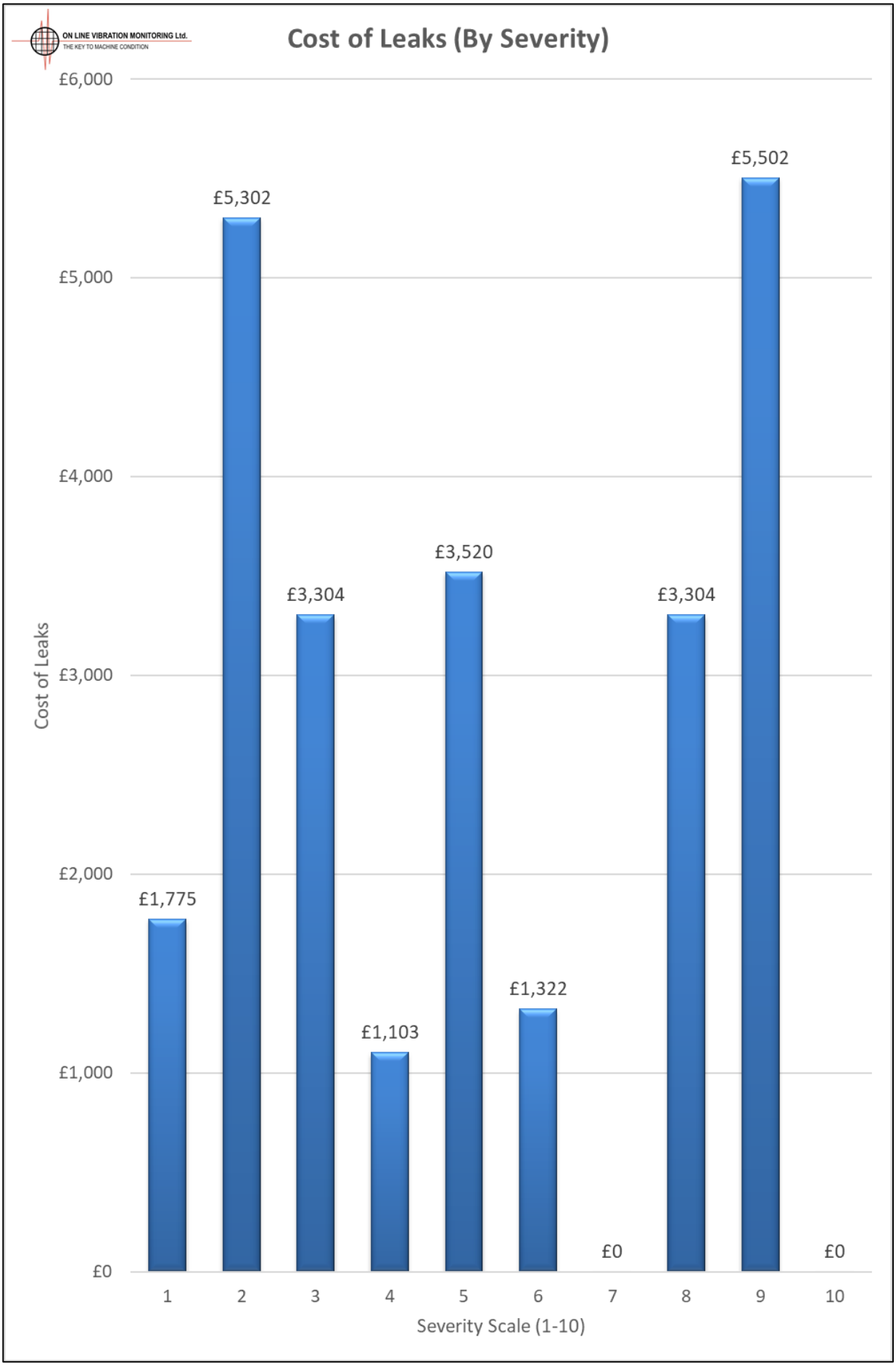
Cost of Leaks (By Area)

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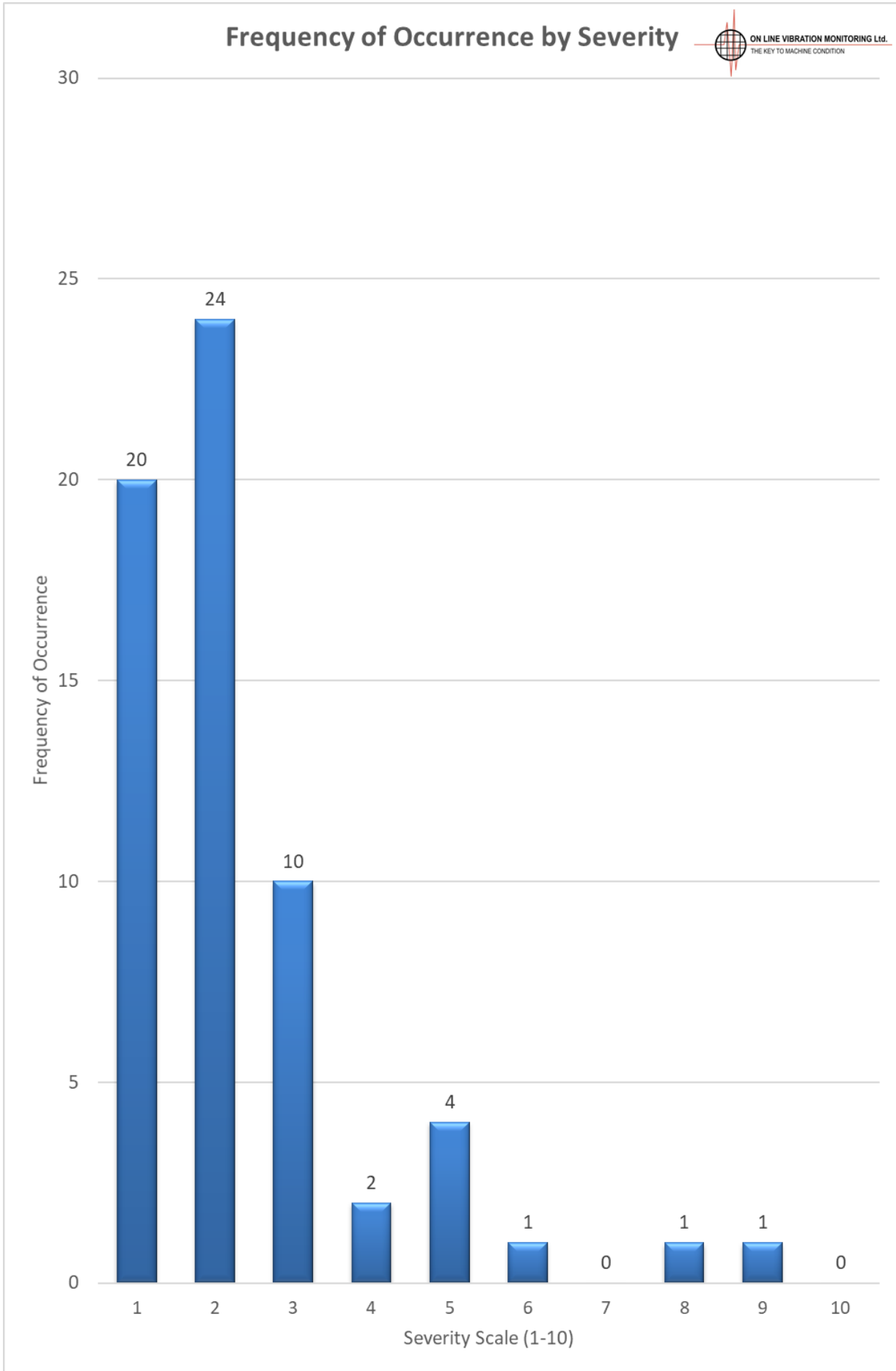
Cost of Leaks (By Severity)
£6,000
£5,000
£4,000
£3,000
£2,000
£1,000
£0
Cost of Leaks
£1,775
£5,302
£3,304
£1,103
£3,520
£1,322
£0
£3,304
£5,502
£0
1
2
3
4
5
6
7
8
9
10
Severity Scale (1-10)


Frequency of Occurrence by Severity
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THE KEY TO MACHINE CONDITION
Frequency of Occurrence
Severity Scale (1-10)
0
5
10
15
20
25
30
1
2
3
4
5
6
7
8
9
10
20
24
10
2
4
1
0
1
1
0

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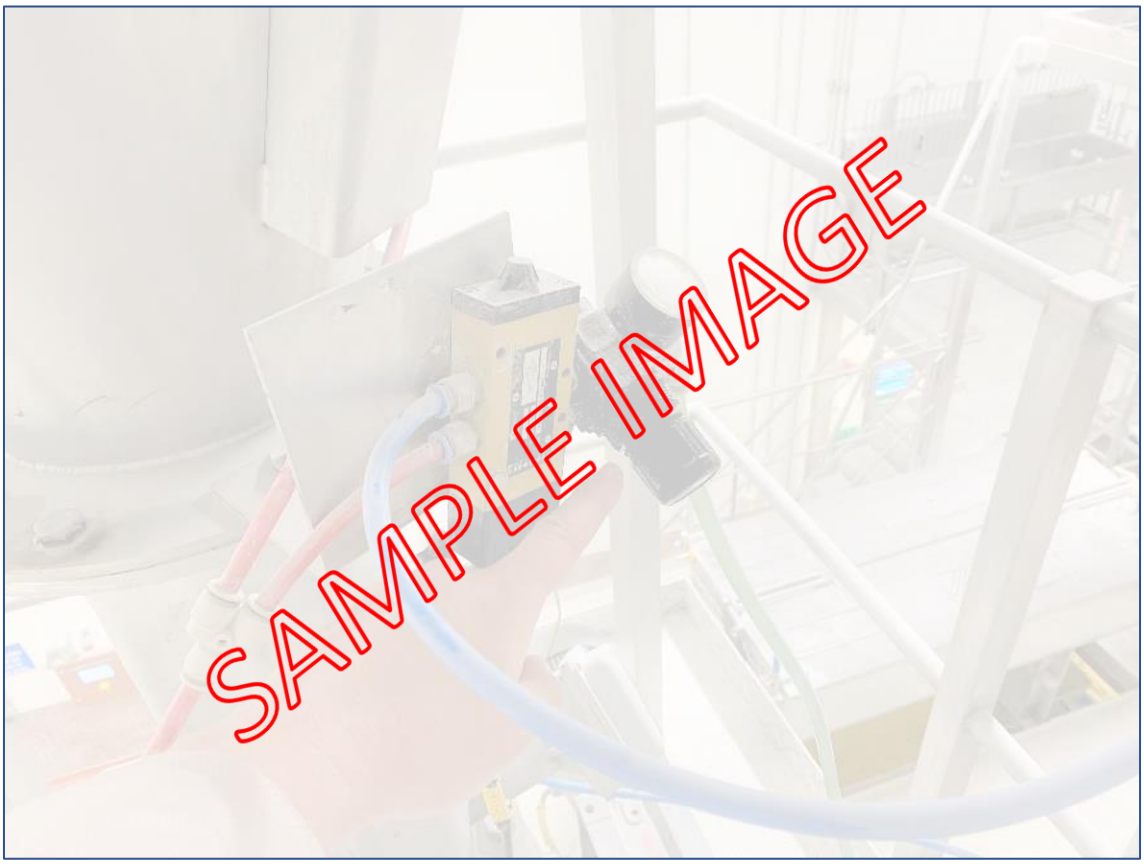
THE KEY TO MACHINE CONDITION

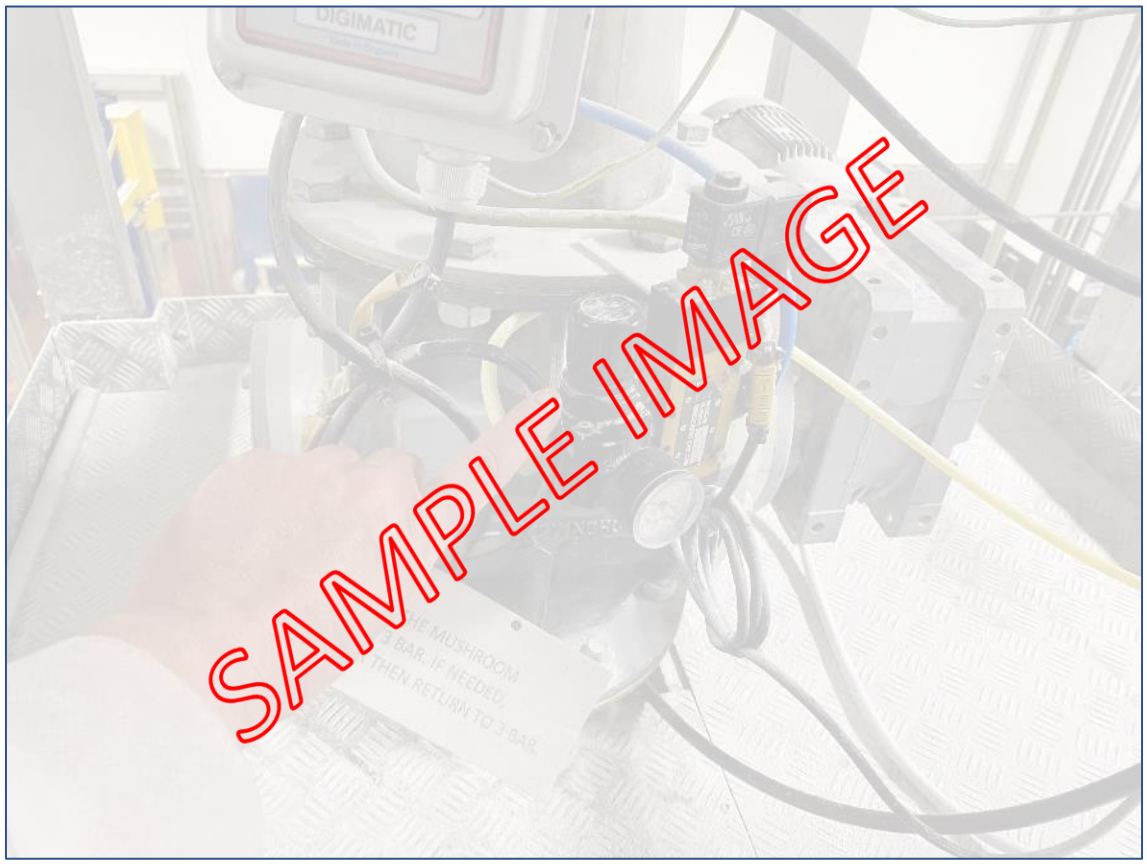
ON LINE VIBRATION MONITORING Ltd.
THE KEY TO MACHINE CONDITION

Leak No.1



Leak No.2

Leak No.3



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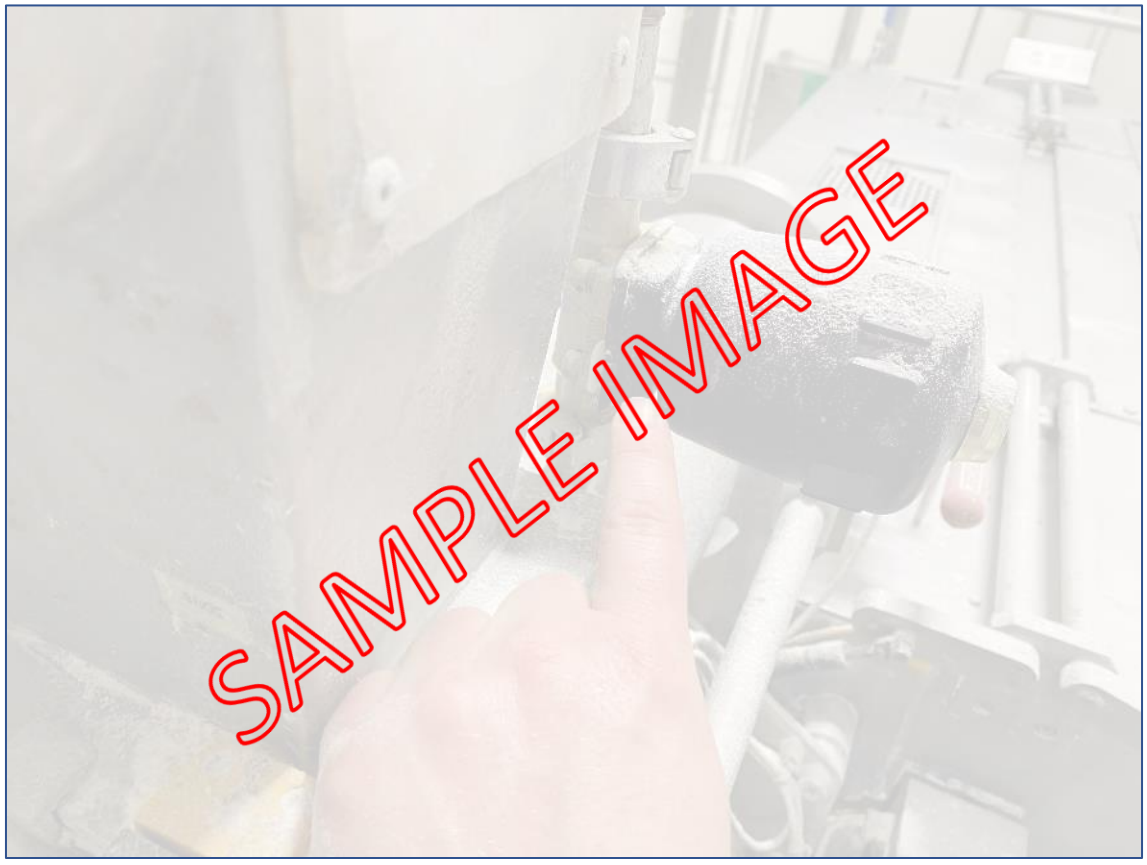

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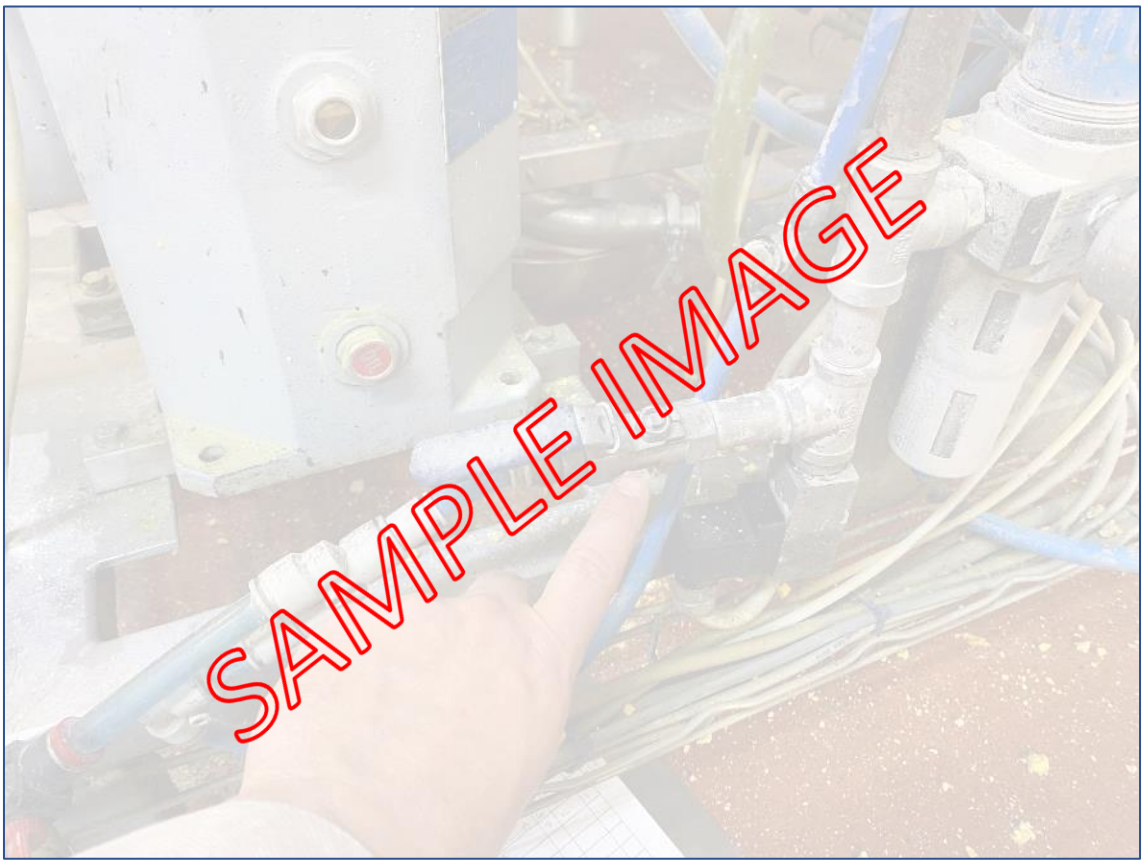

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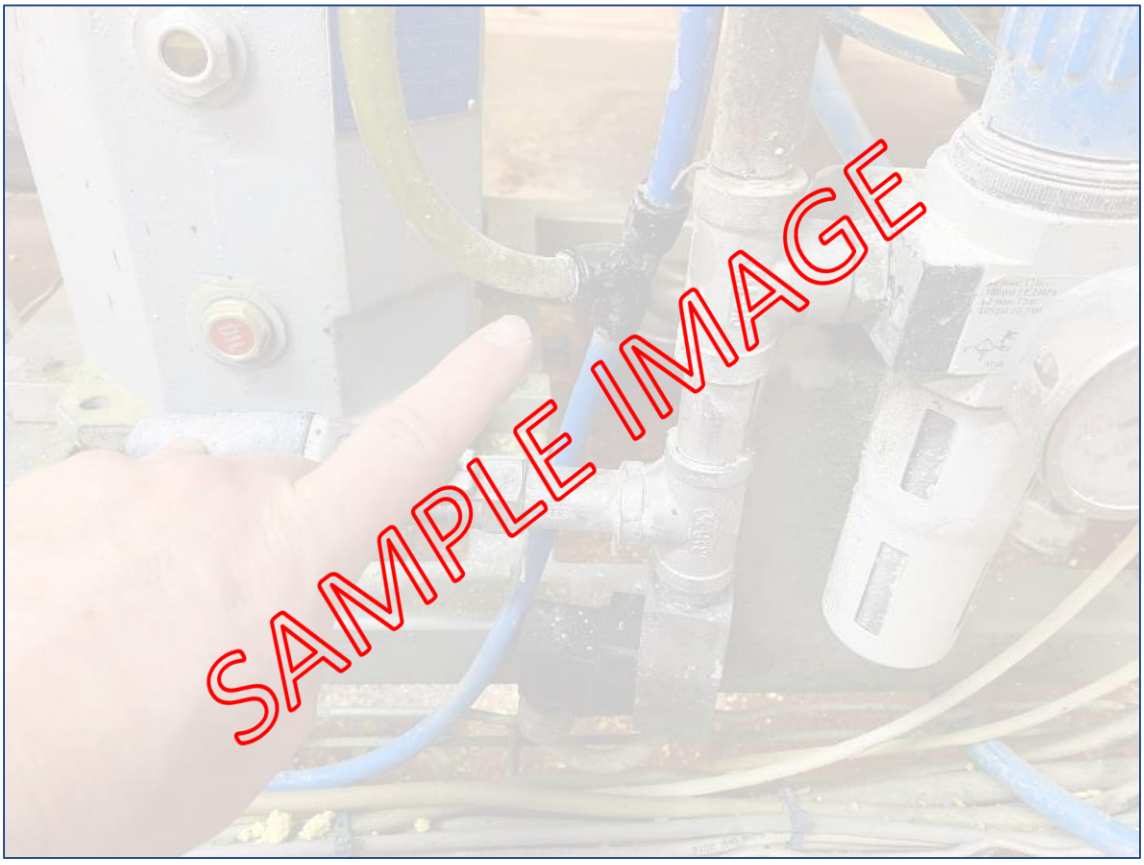

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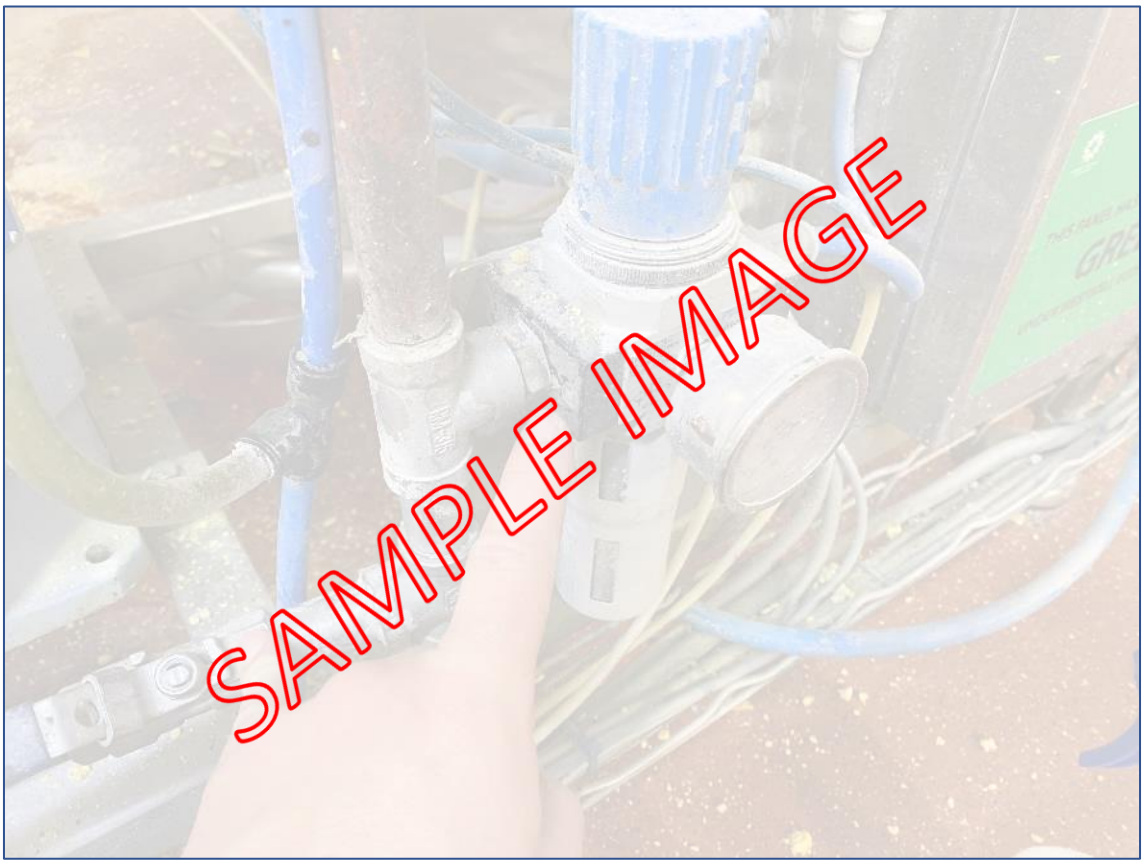

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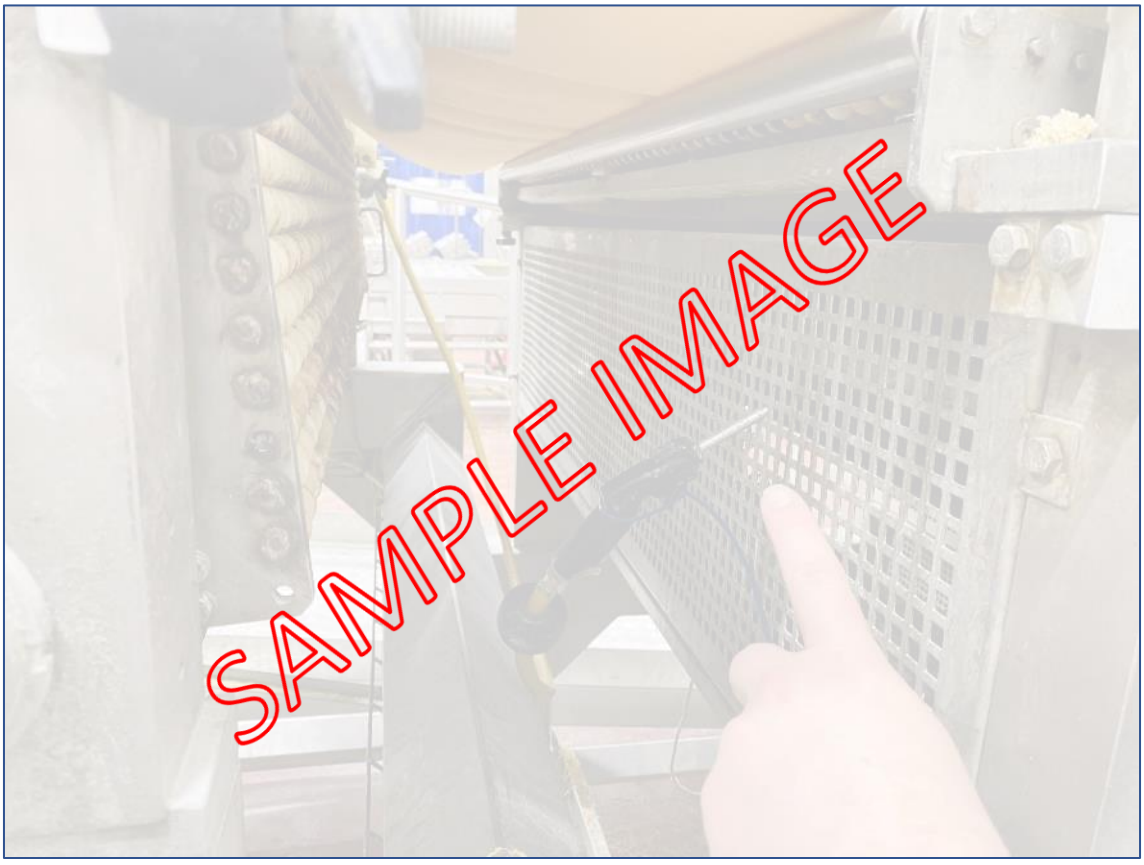

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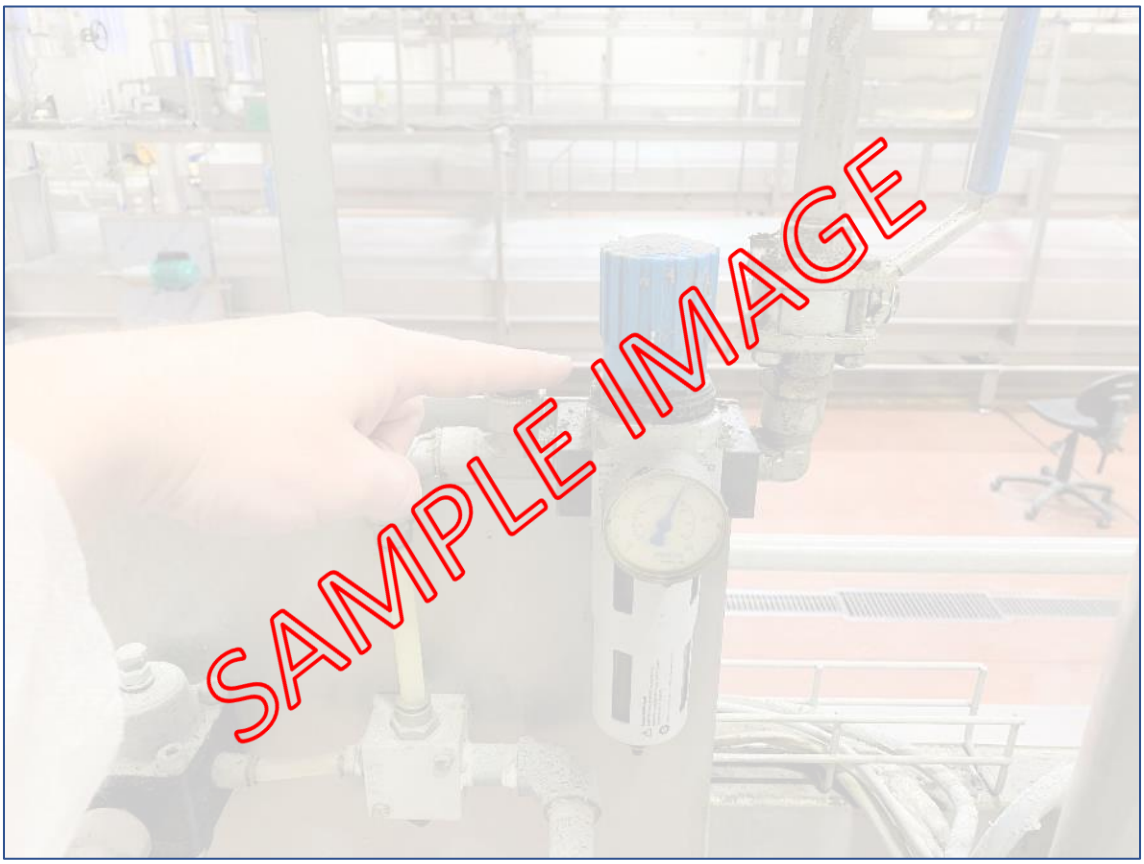

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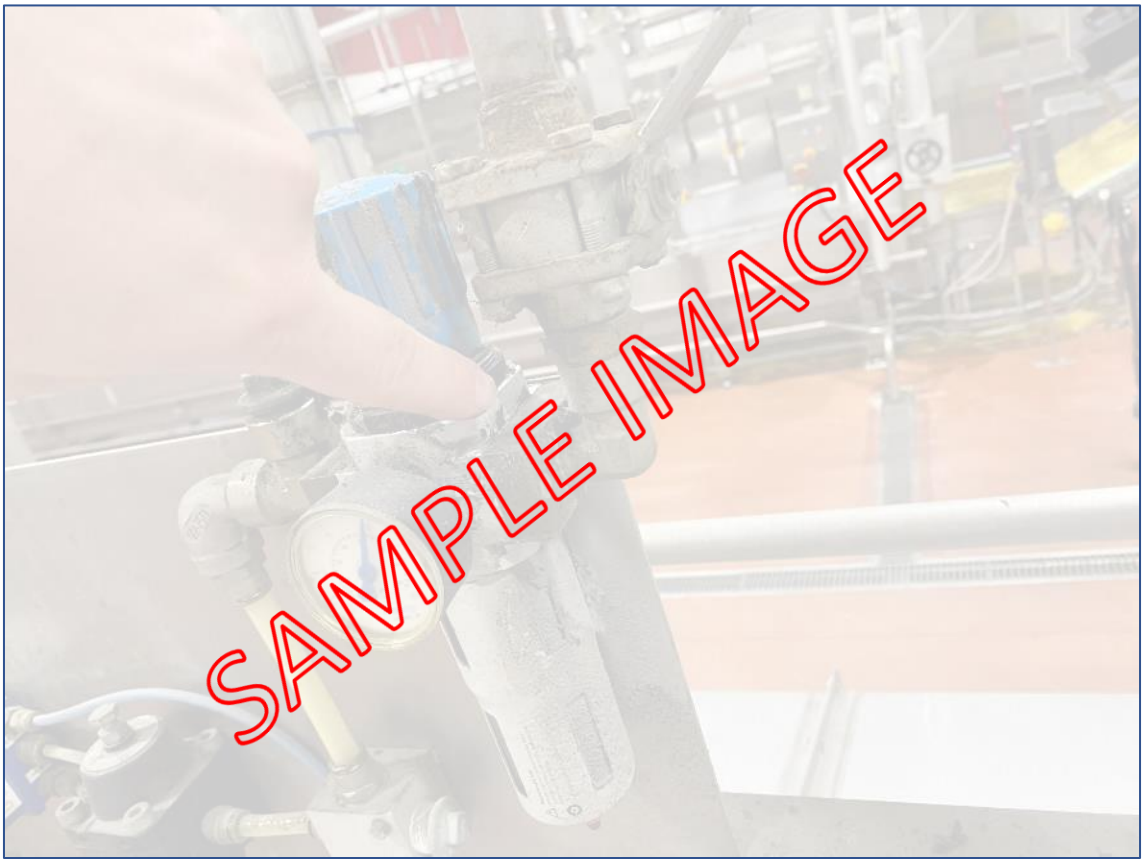

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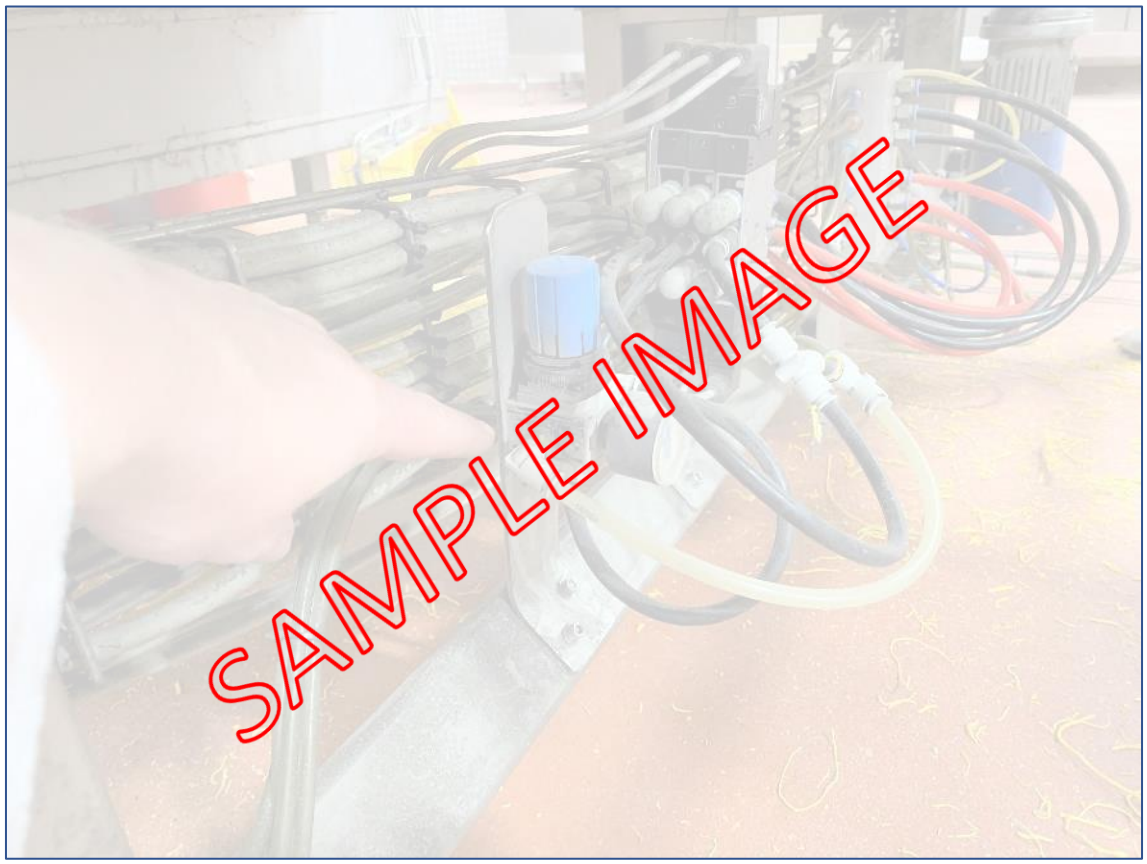

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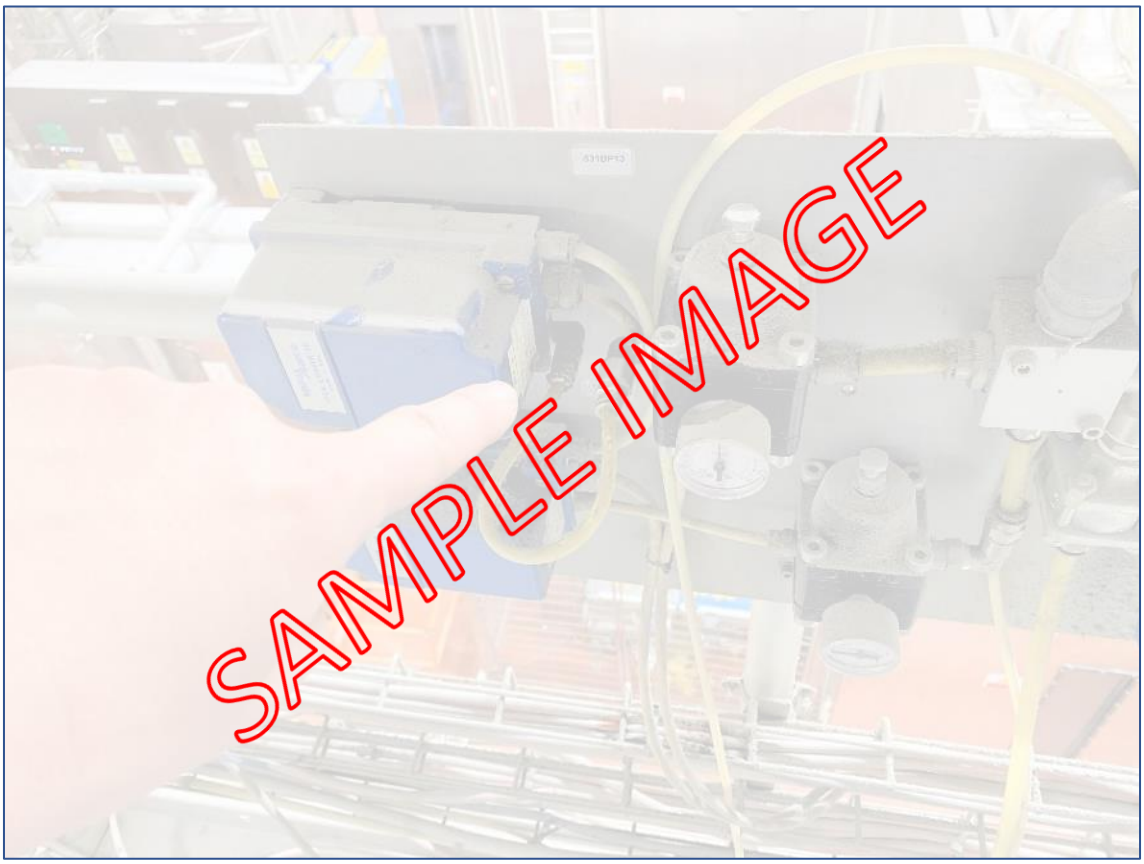

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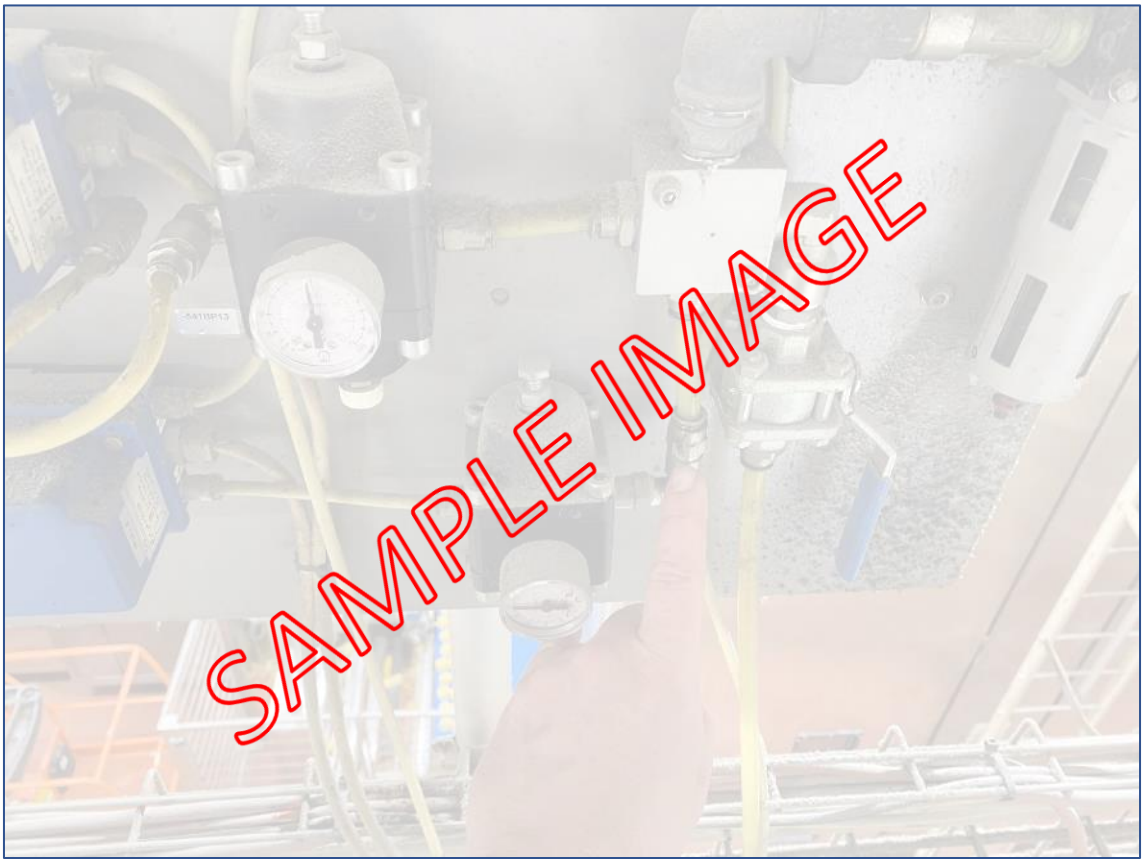

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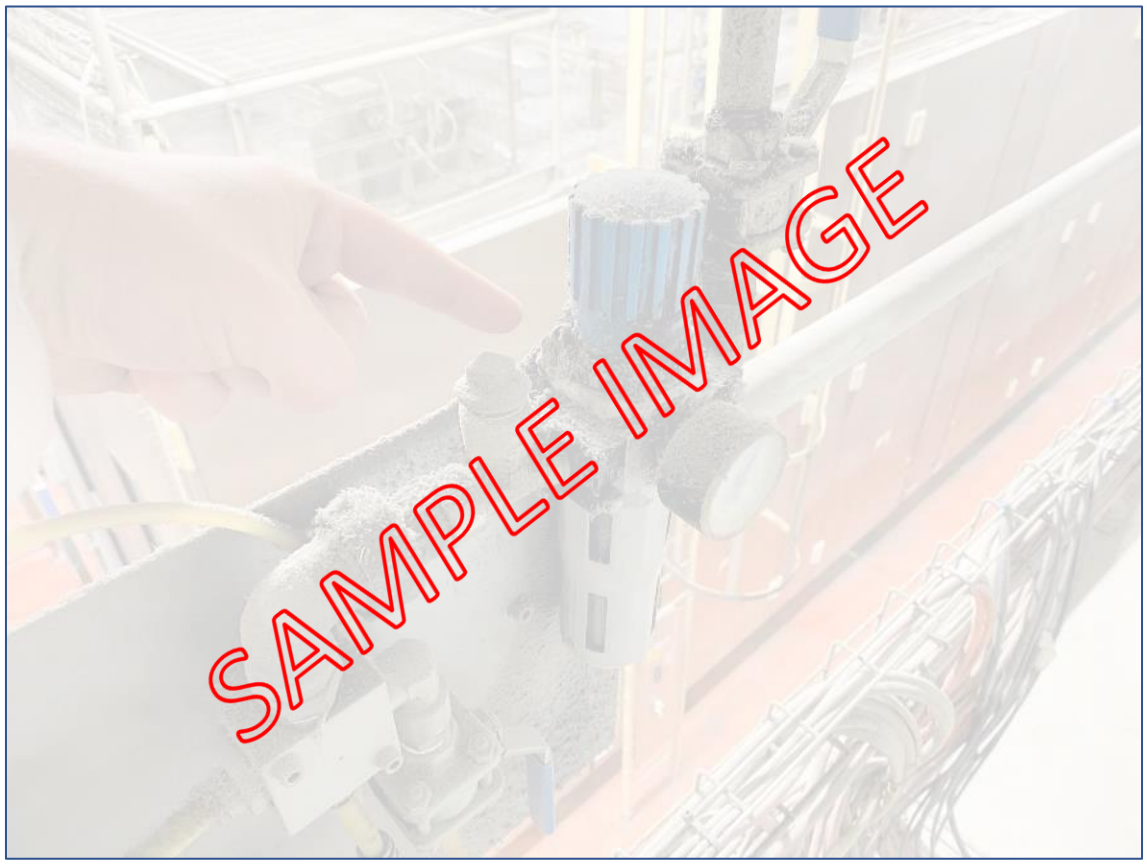

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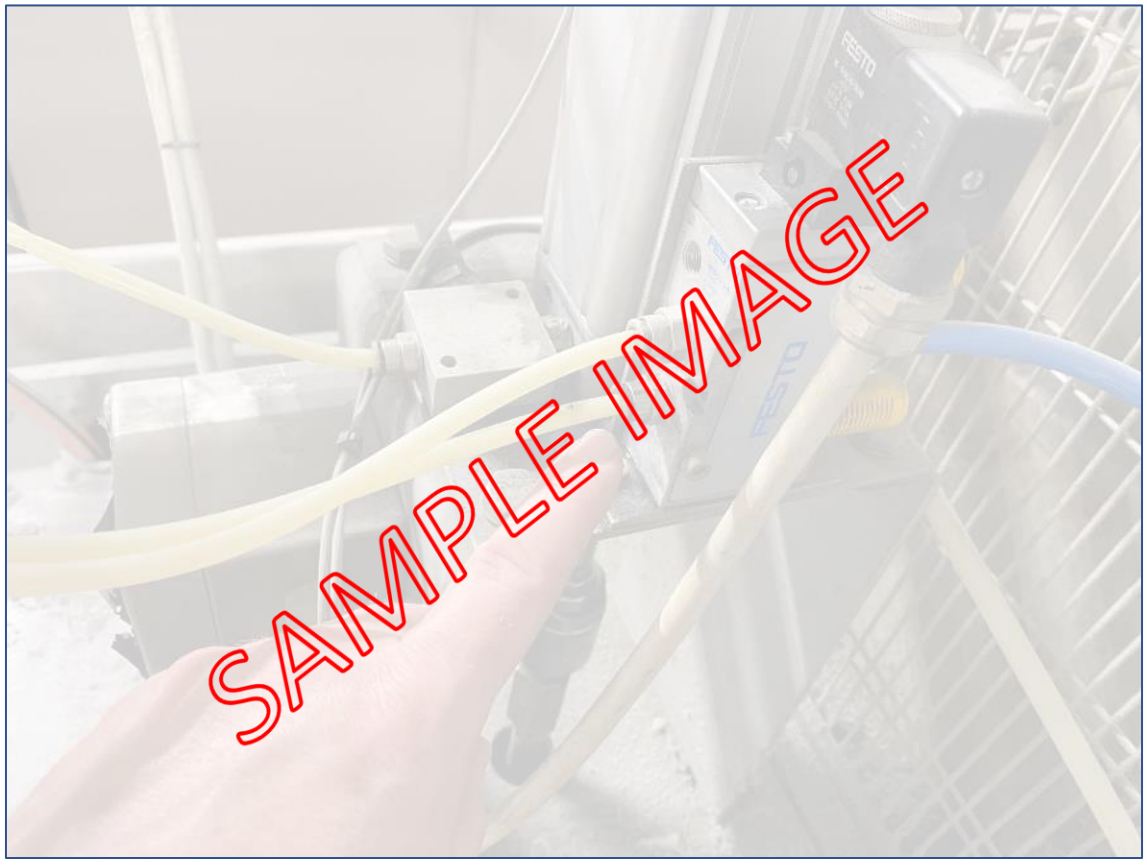

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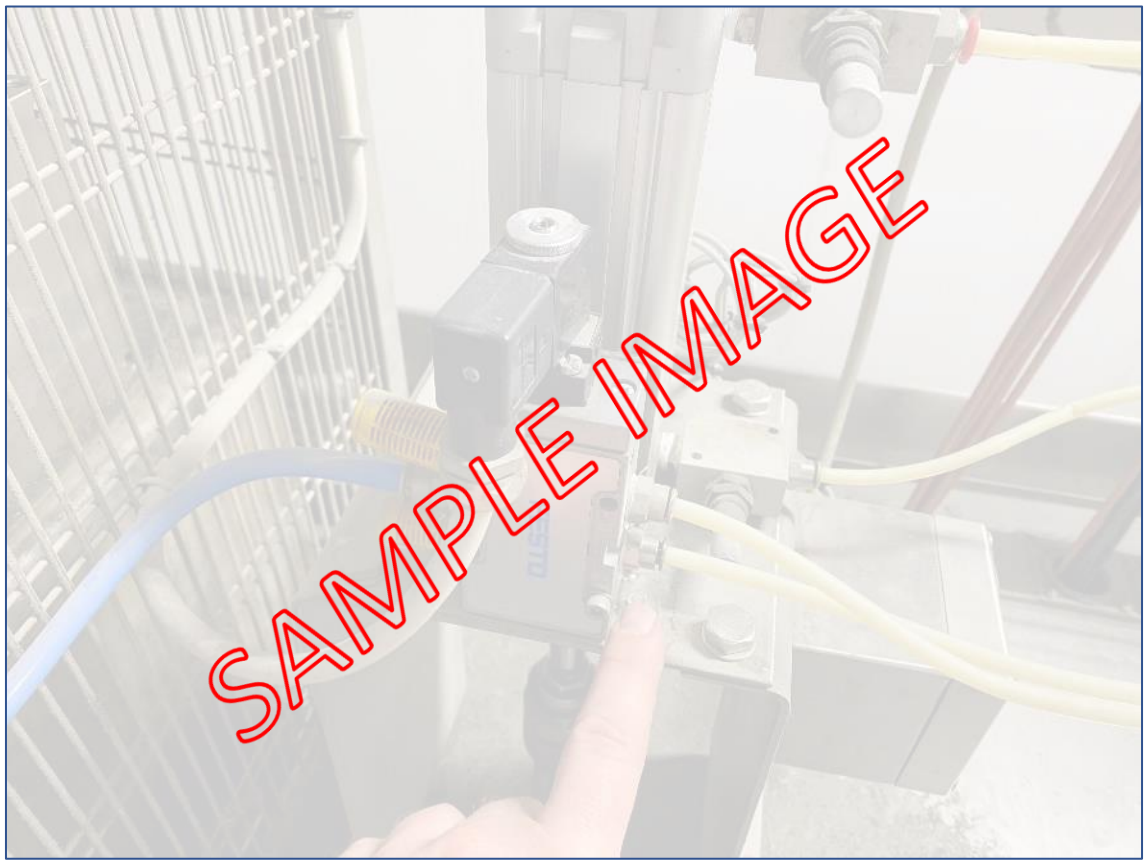

Leak No.18

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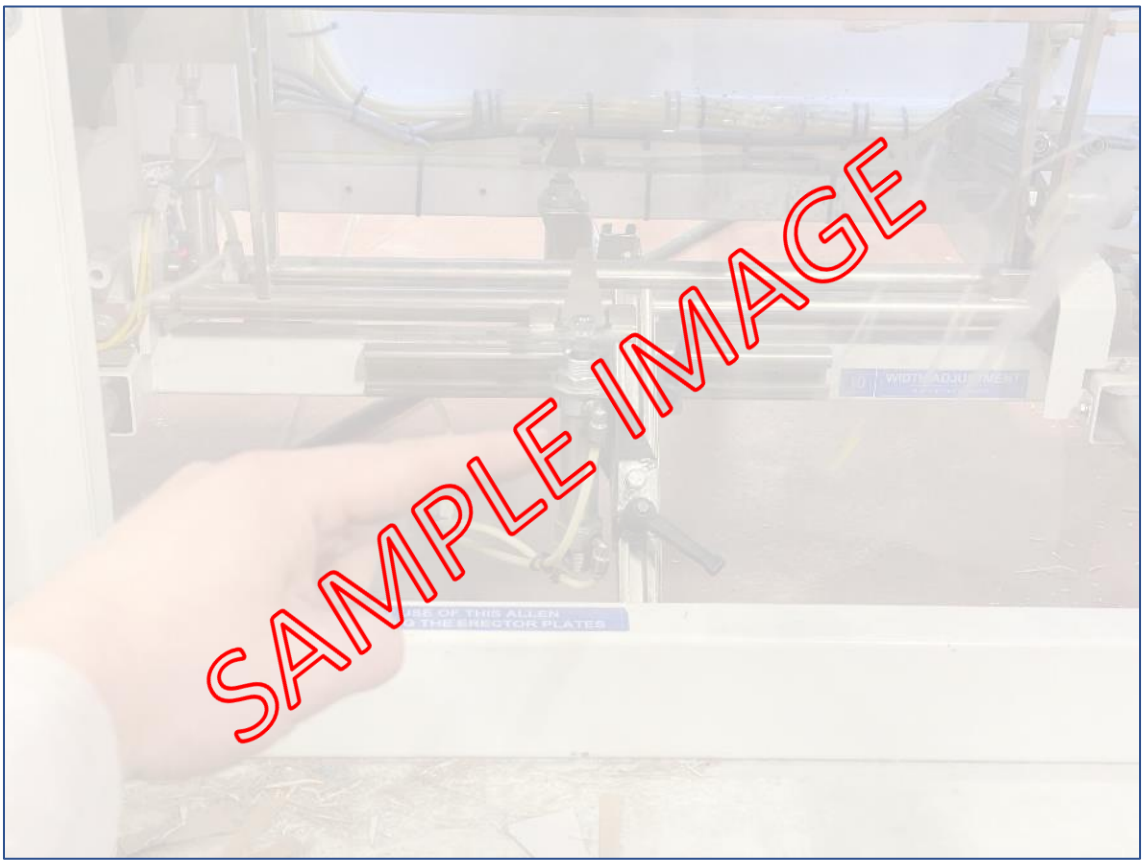

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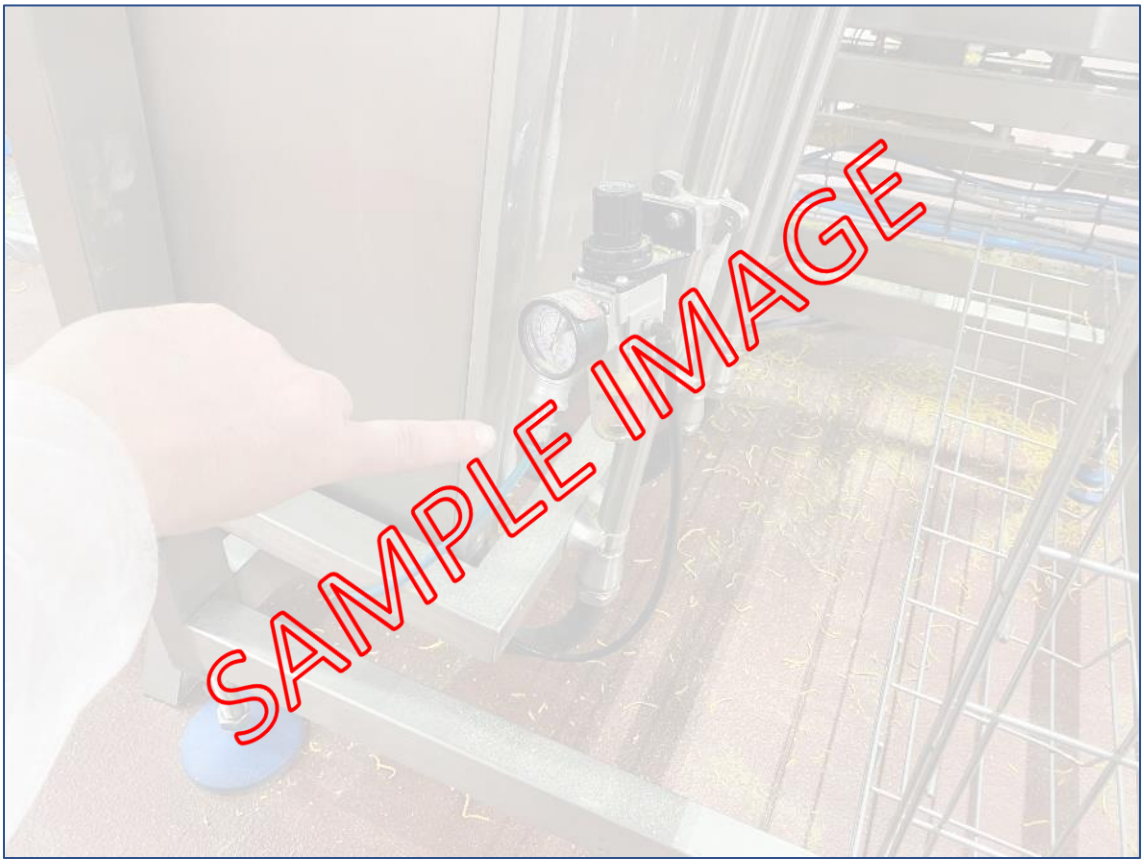

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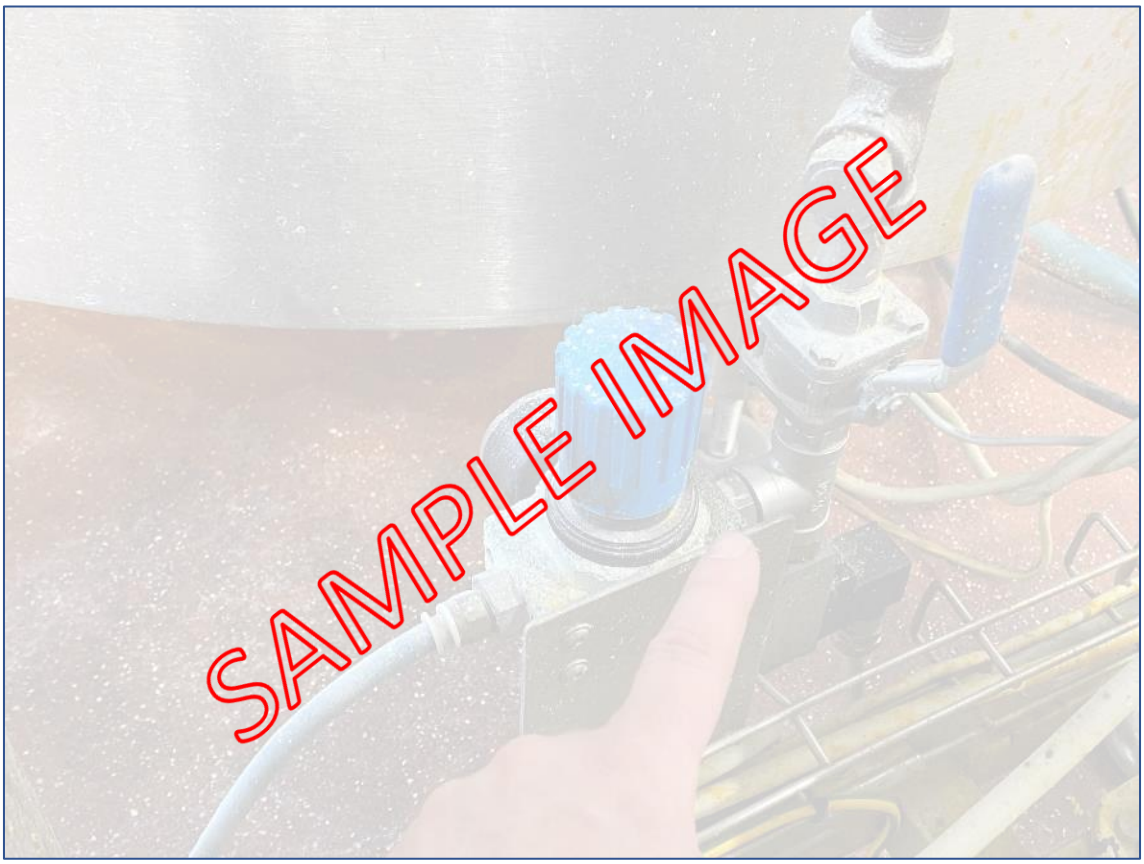

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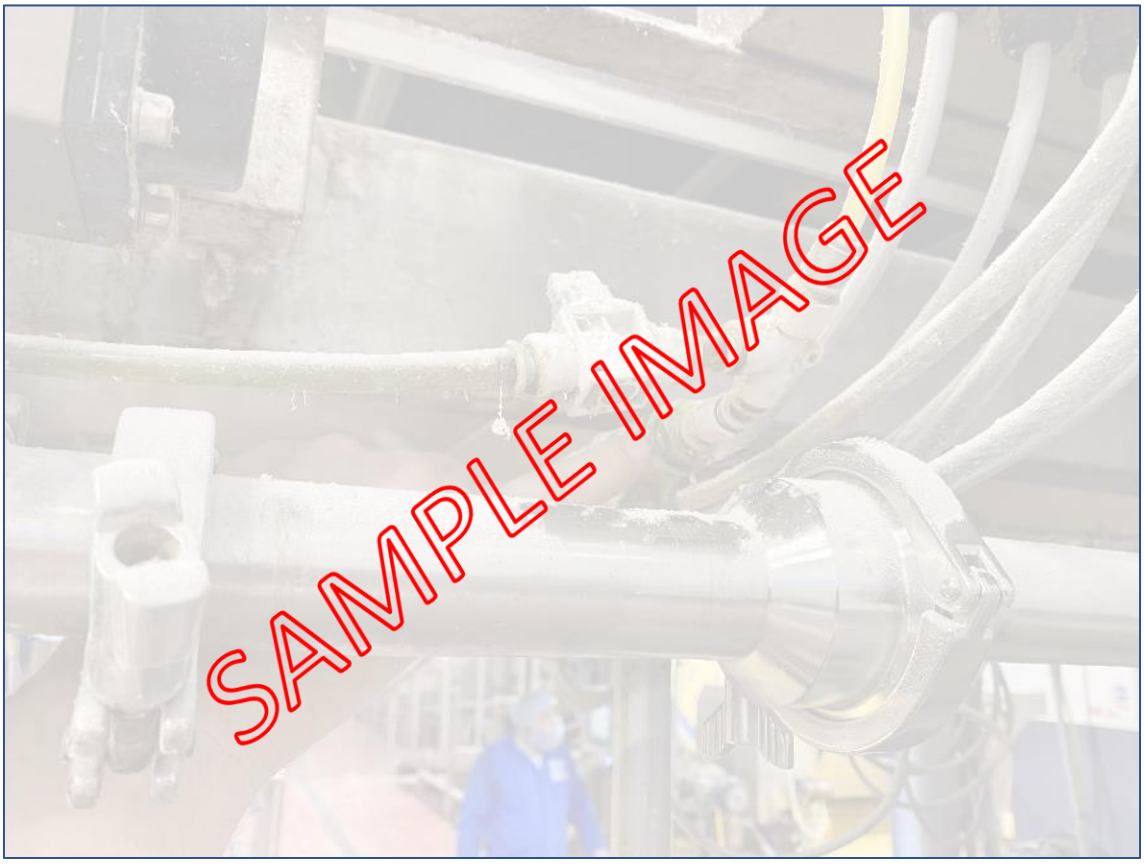

Leak No.23

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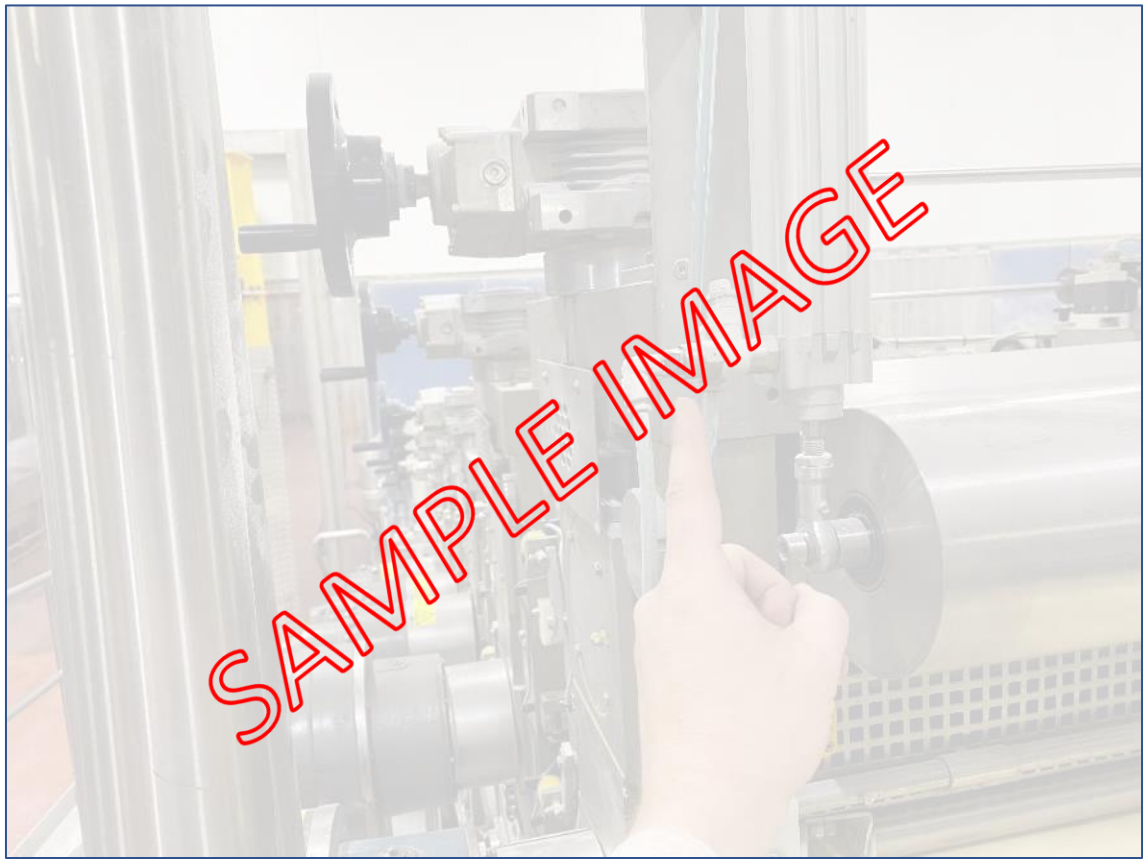

Leak No.25

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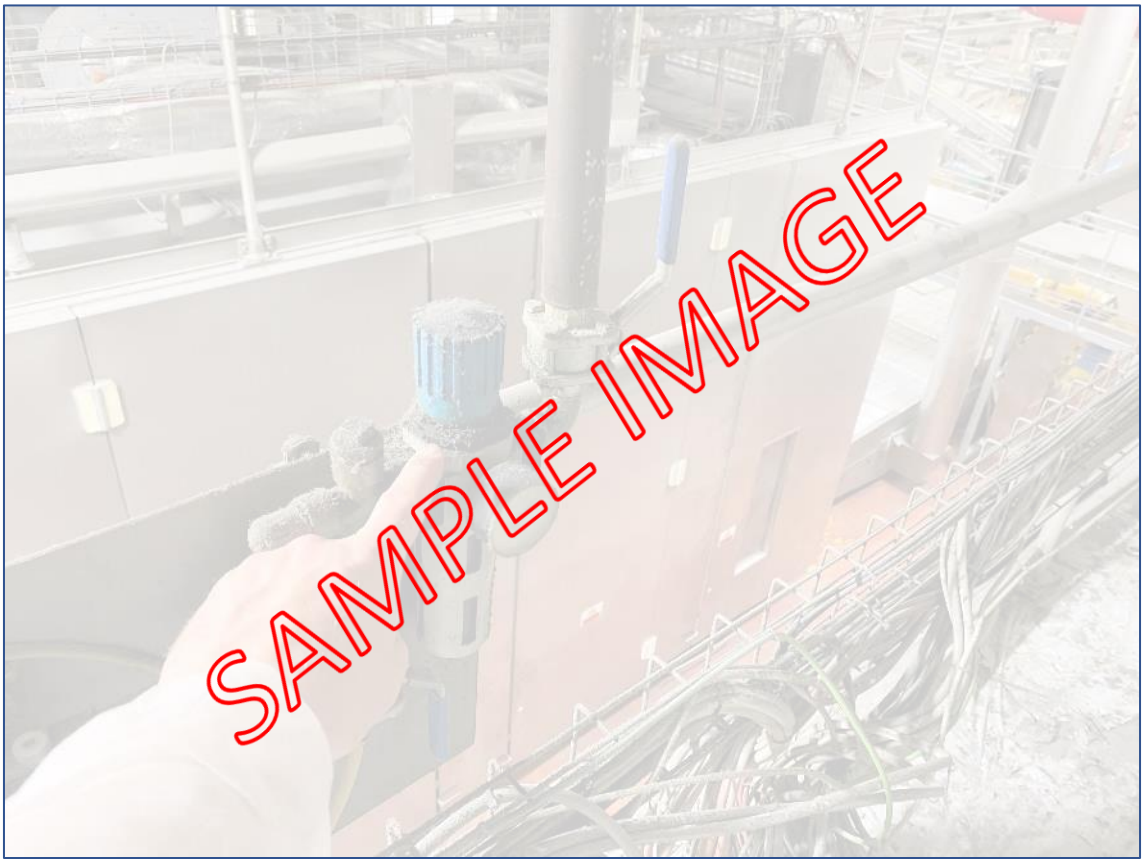

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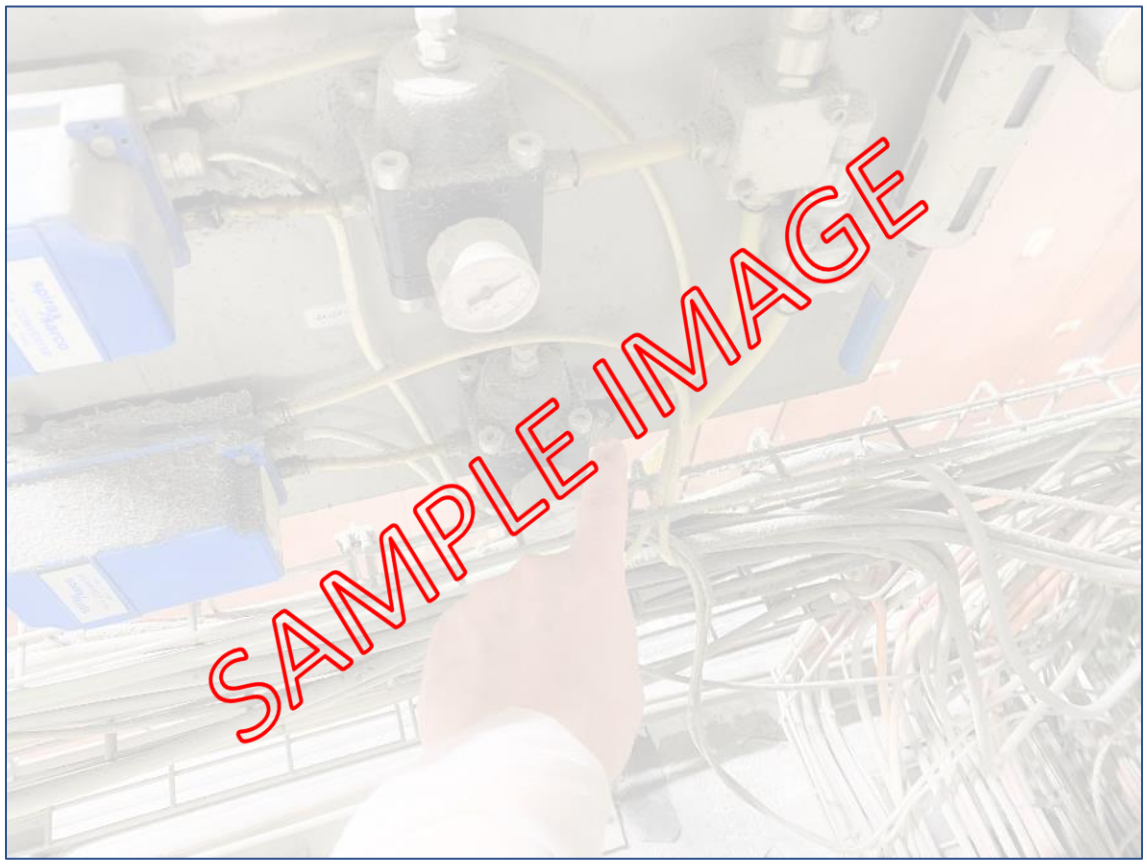

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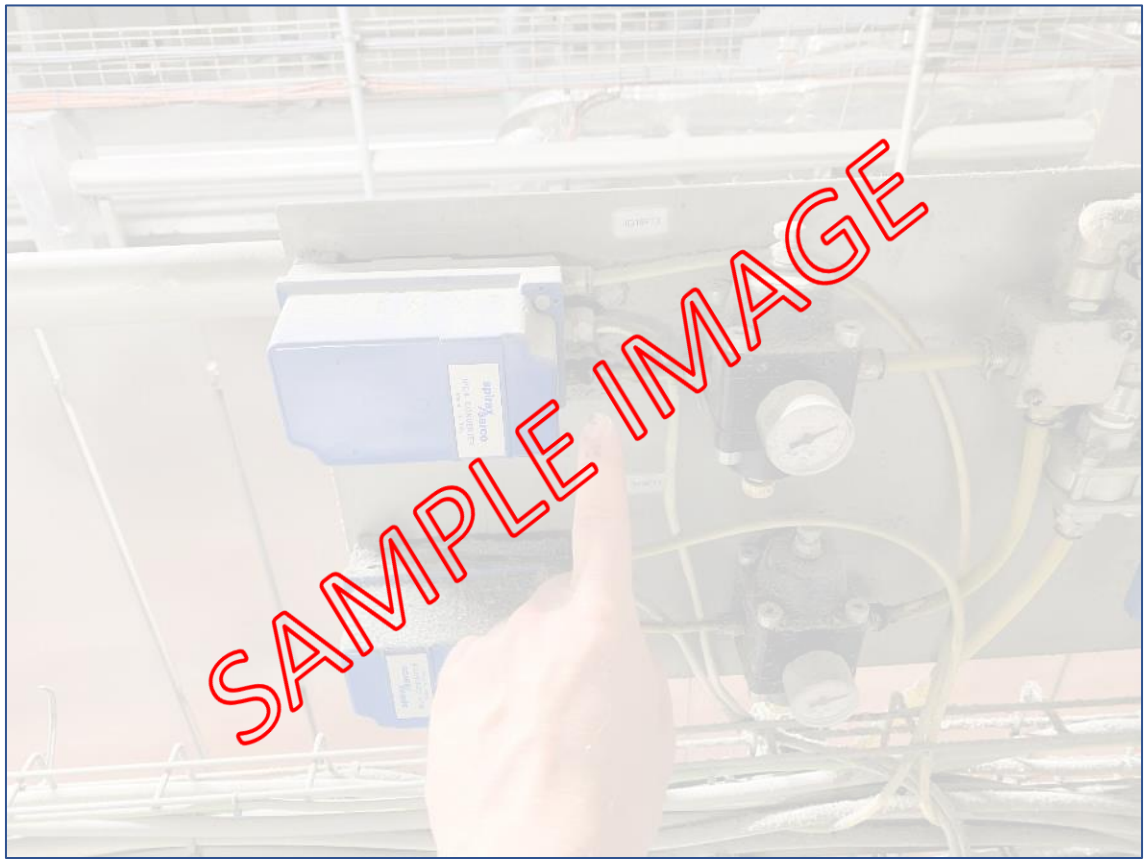

Leak No.29

Leak No.30