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A Case Study of Availability of Eastman-Blue Streak II Model 629X Machine Based on Maintenance Schedule

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Abstract:

In garment manufacturing, the cutting room sets the pace for every process that follows, so an unexpected machine stoppage can delay the entire production line. This paper studies the availability of the Eastman Blue Streak II Model 629X straight knife cutting machine in relation to its maintenance schedule. It reviews the machine's working principle and technical specifications, along with the preventive and corrective maintenance activities carried out on it. Operating records covering running time, scheduled maintenance and breakdown time are collected and analysed to see how the maintenance schedule affects the machine's readiness for production. The study aims to give cutting-room managers and maintenance engineers a practical basis for planning maintenance so that cutting operations stay productive.

Keywords - **Straight Knife Cutting Machine, Planned Maintenance, Uptime, Down time, Availability**

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I. INTRODUCTION

Cutting is the stage of apparel production. Cutting accuracy and cutting speed directly affect how much fabric is used, the quality of the garment and when the garment is delivered. The straight knife machine is the widely used cutter for fabric lays and Eastman's Blue Streak II (Model 629X) is one of the best-known examples. The manufacturer describes it as the world's popular and most versatile straight knife cutting machine.

The Model 629X is a hand-guided cutter with a motor-driven vertical knife. It comes in eight sizes, four strokes and a range of specifications and its motor is single-speed as standard with dual-speed, as an option. An automatic sharpener keeps the blade in cutting condition. The power-to-weight ratio supports precise handling. Its low-profile baseplate is designed to reduce friction and distortion in the lay, whatever the number of plies .



Fig. 1 Straight Knife Cutting Machine- Eastman Blue Streak II model 629X

The 629X runs for hours in the cutting room so its knife, sharpener, motor and baseplate wear, with use and a stoppage delay sewing and finishing downstream. Its availability, the share of scheduled time it's ready to cut therefore depends on how well these parts are maintained. This paper studies the

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availability of the Eastman Blue Streak II Model 629X in light of its maintenance schedule.

II. MAJOR COMPONENTS

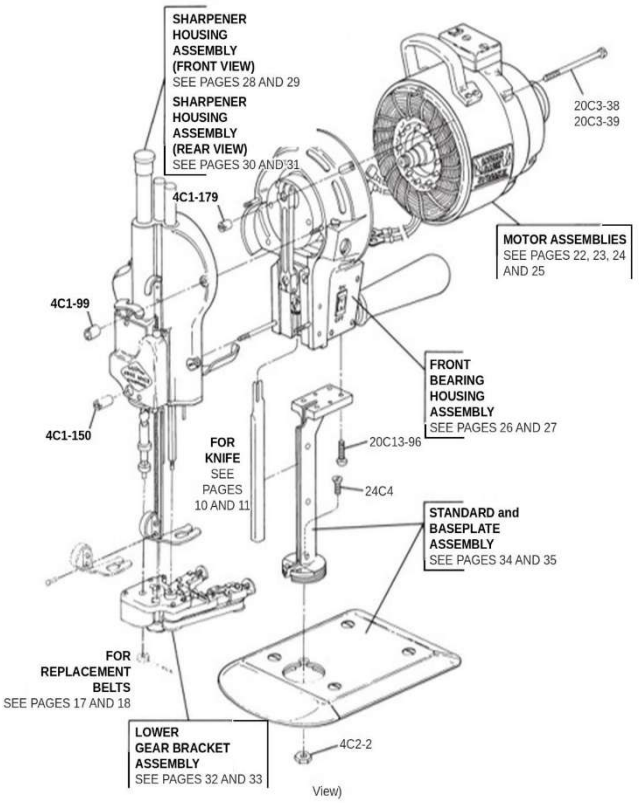


Fig. 2 Straight Knife Cutting Machine Components Breakdown

A. Motor

The motor is the power source of the machine. It is built from a stator with band, a rotor and shaft, a rotor fan with fan cover, a rear bearing housing, a clutch, and a cutout switch, and it carries the carrying handle and the turning knob. There is single-phase and three-phase versions, each in single-speed and dual-speed form, for different voltages and frequencies, so the electrical rating on the machine's label must be checked before use. The fan cools the motor, and lint and dust inside the motor cover are listed as a cause of overheating.

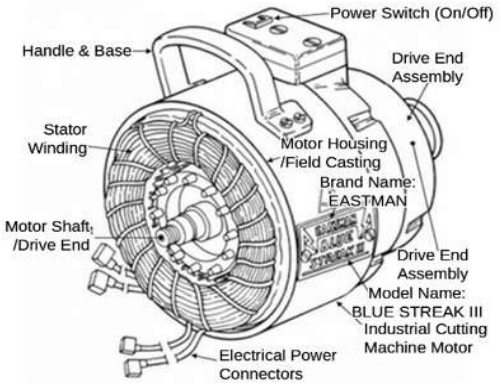


Fig. 3 Motor

B. Front Bearing Housing with Oiler

This assembly converts the rotary motion of the motor into the up-and-down motion of the knife. A crank on the motor shaft turns on a ball bearing and moves a connecting rod, which drives the crosshead through a wrist pin.

The crosshead slides up and down in the guides and carries the knife. The crank comes in four stroke lengths (1-1/8", 1-1/4", 1-1/2" and 1-3/4"), and the connecting rod and oiling device are matched to the stroke.

Felt pads and an oiler tube carry oil to the crosshead and wrist pin, and a wrist pin installed with its notch off the top center cuts off the oil flow to its bearing. This is the most heavily lubricated and most heavily worn part of the machine. The tight crosshead and guides, and a bent standard, as causes of the motor slowing in a certain position.

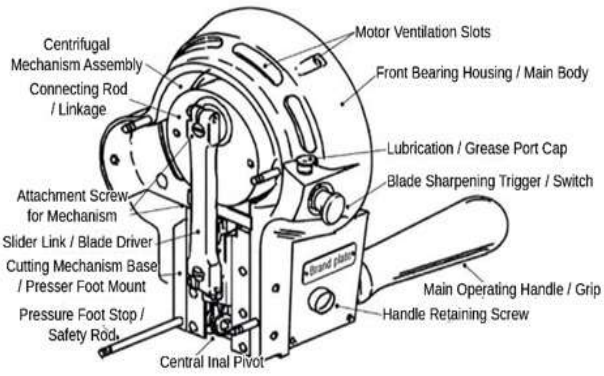


Fig. 4 Front Bearing Housing

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C. Knife (Blade)

The knife is the cutting element, running within the standard and secured by a knife lockbolt. Sizes run from 4" to 13" in carbon steel or high-speed steel, with saw-tooth, round-tip, and angle-tip variants. We are using two main blade types depending on material behavior: straight-edge knives for everyday fabric cutting and wave-edge knives to prevent slipping or fusing in synthetic and loosely woven materials.

Wave knives require special shoes and related parts, and Eastman states its limited warranty is invalid if non-Eastman knives are used. Knife changing is a routine job: the knife is removed through the bottom of the standard, the slot is cleaned with the slot cleaner, and the new knife is set tightly against the lockbolt.

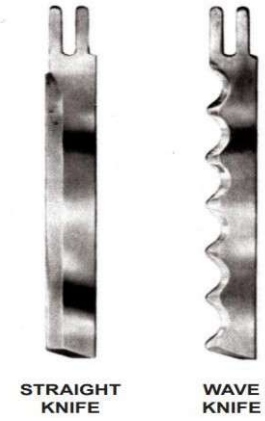


Fig. 5 Various types of knifes in the machine.

D. Standard and Baseplate

The standard is the vertical column that carries the knife-on-knife slides, with throat plates at the bottom, and it is bolted to the baseplate with a plate bolt and nut. The baseplate is the flat plate that slides under the fabric lay, and it rides on rubber-mounted rollers with roller shells.

The rollers must not be oiled, because oil collects lint and damages them, and that worn roller shells can be pressed out and replaced. A bent standard or worn knife slides cause the knife to bind, and the manual lists badly worn knife slides as a cause of the blade's bottom corner breaking. Standards and knife slides are matched to the knife length.

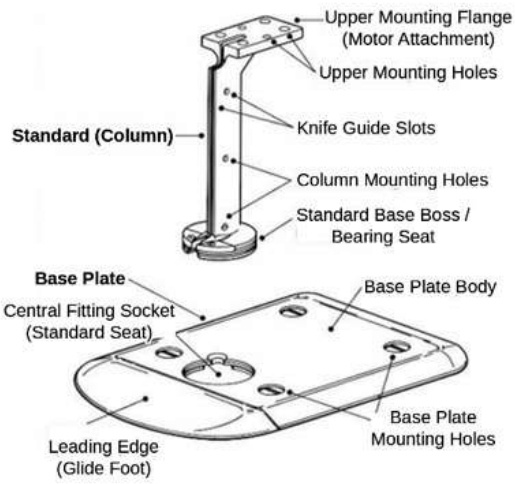


Fig. 6 Standard and base plate

E. Knife Guard and Pressure Foot

The pressure foot sits at the front of the knife and presses on the top ply to keep the lay from lifting. The same assembly includes the knife guard, which covers the exposed blade, and a pressure foot lever and lifting handle. It requires the guard to be lowered to the baseplate whenever the machine is not cutting. It lists dirt in the pressure foot lock bracket, and a broken handle spring, as causes of the rod not moving freely or not holding.

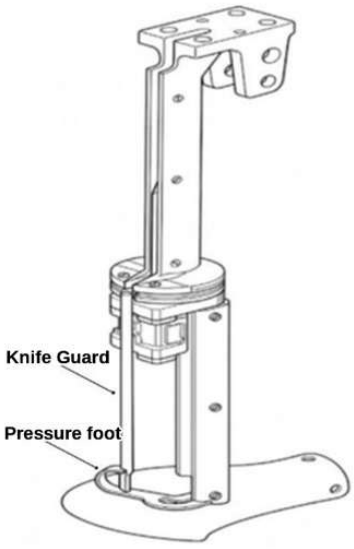


Fig. 7 Knife guard and pressure foot

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F. Sharpener Housing Assembly

The sharpener housing is mounted on the standard and holds the mechanism that moves the sharpener up and down the knife. It contains a screw shaft, square shaft, spiral and spur gears, a bell crank and a push rod. The sharpener is driven by a rubber driver pulley, which should replace whenever it looks worn or damaged. The operator engages the sharpener by pressing the sharpener lever, and the release lever and the sharpener bracket lock it in place. It must be in the locked position before cutting, otherwise the blade struggles at start-up.

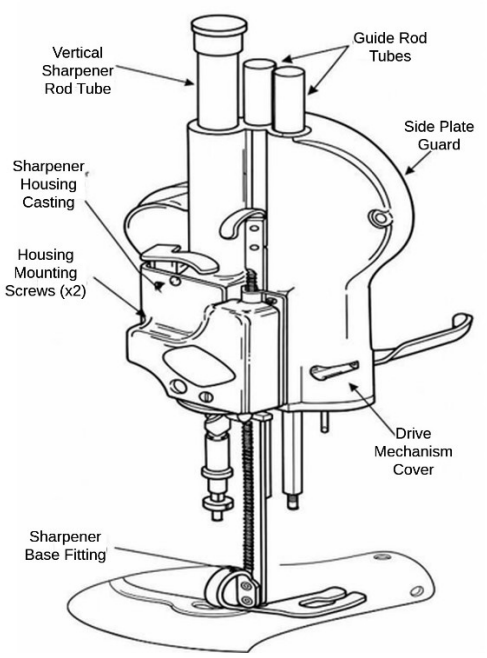


Fig.8 Sharpener Housing assembly

G. Lower Gear Bracket (Belts and Shoes)

This is the abrasive belts that actually sharpen the knife. It includes the front and rear pulleys with neoprene bands, the slide with pulley, the stabilizers, and the left and right sharpener shoes with clamping arm. The shoes are Bevel Bloc shoes, which can be adjusted to grind the bevel on the knife edge.

The factory setting is about 1/16" wide, and it normally should not be changed. Sharpener belts come in four grits (fine, medium, coarse and rough) chosen to suit the fabric being cut. Worn pulleys, a worn screw shaft and an over-tight stabilizer assembly among the causes of the sharpener running slowly, and worn shoes as the cause of a very wide bevel.

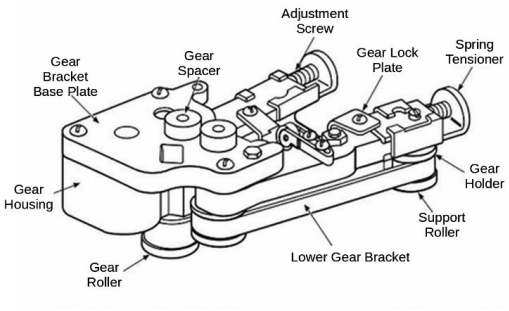


Fig.9 Lower Gear Bracket

H. Operating Handle and Switch

The operating handle is held by the operator to guide the machine, and it carries the on/off switch and the pressure foot lever beside it. An adjustable Ergo-Handle (regular or cushion) is available as an option and can be set through a 14-degree range. Check the handle tightness routinely.

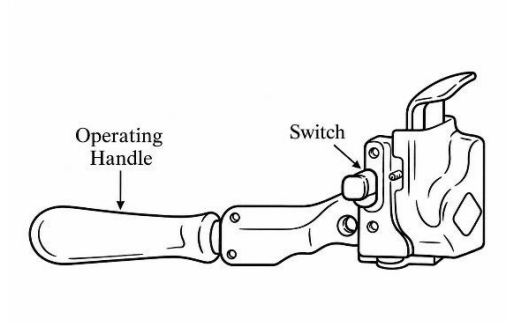


Fig. 10 Operating Handle and switch

I. Attachment Plug and Terminal Block

Power reaches the machine through an attachment plug and terminal block, which are available for 42V, 120V, 220V and 380V three-phase supplies. A ground lead must be connected to terminal “E” on the plug, and the manual states that the electrical connections must be made by a qualified electrician. A worn connector or worn terminal pins are listed as causes of the terminal block or connector overheating.

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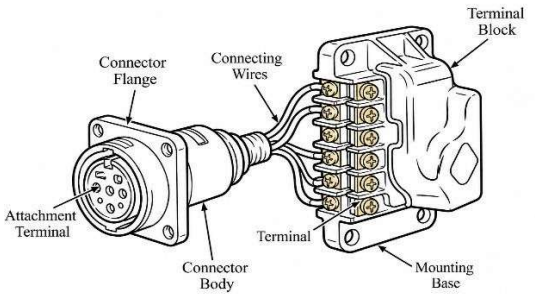


Fig.11 Attachment Plug and Terminal Block

III. SPECIFICATION

TABLE I

SPECIFICATION TABLE OF EASTMAN-BLUE STREAK II MODEL 629X, STRAIGHT KNIFE CUTTING MACHINE

S.No	Parameter	Specification
1	Model	Eastman Blue Streak II Model 629X
2	Power Supply	110 V, 1 Phase, 50/60 Hz; 220 V, 1 or 3 Phase, 50/60 Hz; 380 V, 3 Phase, 50 Hz
3	Motor Type	Standard: Single Speed; Optional: Dual Speed
4	Horsepower	0.65 hp (1 Phase); 0.93 hp (3 Phase)
5	Machine Weight	34 lbs (15.4 kg)
6	Blade Material	Carbon steel, High-Speed Steel, PTFE Coated, Wave Edge, Wave Groove, Angled Tip
7	Sharpening Belt	Medium grit, fine,coarse,rough
8	Features	Micro Fog, Plastic Master, Auto-Stop, Ergo-handle
9	Stroke Sizes	1.125, 1.25, 1.5, and 1.75 in. (2.86-4.45 cm)
10	Blade Size Range	5-13 in. (12.7-33 cm)
11	Cutting Capacity Range	3.5-11.5 in. (8.9-29.2 cm)
12	Price	Approx. $ 2,379.00

The Micro Fog system applies a fine lubricant mist to the blade, reducing friction and heat during cutting. The Plastic Master attachment is used for cutting plastic films, vinyl, and synthetic materials, while the Auto-Stop feature improves operator safety by automatically stopping the machine when released. Stroke size affects blade movement and is selected according to fabric lay thickness.

Smaller strokes (1.125-1.25 in.) are suitable for lightweight fabrics and low lays, whereas larger strokes (1.5-1.75 in.) are preferred for thicker materials and higher lays. Similarly, smaller blade sizes (5-7 in.) are used for low cutting heights, while larger blades (8-13 in.) are required for thick fabric lays and bulk cutting.

The machine can cut a wide range of materials, including cotton, polyester, denim, wool, knitted fabrics, blended fabrics, synthetic leather, and technical textiles, making it suitable for diverse garment manufacturing applications.

IV. MAINTENANCE

Maintenance is the planned activity carried out to keep machines and equipment in working condition and to prevent unexpected breakdowns. Unlike downtime maintenance is scheduled in advance making it easier to predict and manage.

Regular maintenance helps reduce machine failures improve production efficiency ensure product quality and extend the life of equipment. It includes activities such, as inspection, cleaning, lubrication, adjustment and replacement of parts. By performing maintenance at the time organizations can minimize production interruptions reduce repair costs and maintain a safe working environment.

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A. Daily maintenance

TABLE II
DAILY MAINTENANCE

S.No	Activity	Frequency	Time (min)
1	Manually check blade orientation	Once	0.25
2	Sharpening lever turned on (sharpening blade)	100-120 times	4
3	Lubricate through 2 oil holes	Once	0.25
4	Cleaning lint and dust	3-4 times	1.33
5	Dusting the body	Once	0.5
6	Remove the knife and clean slides with slot cleaner	Once	0.33
7	Check guard is fitted, moves freely and is not cracked or loose	Once	0.2
8	Check stones for uneven wear	once	0.25
		Total time	7.11 min

Total daily maintenance time in a week
=7.11x6=42.66 minutes

B. Weekly maintenance

TABLE III
WEEKLY MAINTENANCE

S.No	Activity	frequency	Time (min)
1	Snap off worn emery belt and apply new one	1	1.6
2	Blade change	3	2.25
3	Remove cover and clean lints from around screw mechanism in sharpener	1	0.33
4	Remove rollers from baseplate and clean in cleaning solvent	3	4.5
5	Dress or replace so both meet the blade evenly	1	1.5
6	Clean and lightly grease the sharpener lever and pivot	1	1
		Total time	11.18 min

Total weekly maintenance time in a week
= 11.18 minutes.

C. Half Yearly maintenance

TABLE IV
HALF YEARLY MAINTENANCE

S.No	Activity	Frequency	Time (min)
1	Verify both sharpening stones meet the blade symmetrically.	5-6 times	2
2	Change spring of spring tension to ensure correct pressure on the blade.	2-3 times	2
3	Disassemble housing cover, degrease crank pin, sliding block, and guide	once	8
4	Repack cleaned parts with fresh high-temperature industrial grease.	once	10
5	Replace both carbon brushes (always as a pair)	once	5
6	Check for roughness and noise(manually)	once	2
		Total time	29 min

Total half yearly maintenance time in a week
= 29/26 = 1.12 minutes

D. Yearly maintenance

TABLE V
YEARLY MAINTENANCE

S.No	Activity	Frequency	Time (min)
1	Replacement of winding insulation and coil	once	60
2	Rapid check of knife play; minor adjustment.	once	1.8
3	Replace screws and rubbers	once	5
4	Replace the main power cable entirely if it shows signs of inner wire fatigue. Test the primary on/off switch mechanism for mechanical fatigue.	once	25
5	Replace both motor bearings and re-grease	once	20
6	Replace crank pin, sliding block and connecting rod bushes	once	30
7	Replace worn or cracked guard and presser foot	Once	5
		Total time	146.8 min

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Total yearly maintenance time in a week

= 146.8/52 = 2.8 minutes

V. DOWN TIME

Down time is when a machine or system is not working and cannot do what it is supposed to do. This causes production to stop. To stop these problems from happening and to make the equipment longer people do maintenance work on purpose.

The schedule for maintenance is Easy to predict. Other reasons for down time are like when a machine breaks, when there are delays in paperwork or when things, outside the control of the company happen are not certain. These other reasons change depending on what the problem is.

Down time = Unplanned Maintenance + Planned Maintenance schedule + Administrative delay + External factors

Except for the maintenance planning, the rest of the causes of the downtime are unpredictable in nature. The amount of time spent on such interruptions will vary each time according to the particular case of the problem. In actual analysis, this time period is calculated based on the number of weeks, taking into account only the major problems affecting the machine's performance .

A. Unplanned Maintenance

TABLE VI
UNPLANNED MAINTENANCE

S.No	Activity	Avg. Time (min)
1	Excessive vibration / noise	3
2	Machine overheating	8
3	Blade jams	5
4	Blade breakage	5
5	Sharpener lever stuck	6
6	Sharpening belt breaks mid shift	4
7	Loose/fallen screws & parts	3
8	Oil/grease leakage	6
9	Uneven/misaligned blade	6
	Total time	40 min

B. Planned Maintenance

TABLE VII
MAINTENANCE SCHEDULE

S.No	Activity	Avg. Time (min)
1	Daily maintenance	42.7
2	Weekly maintenance	11.18
3	Half Yearly maintenance	1.12
4	Yearly maintenance	2.8
	Total time	57.8 min

C. Administrative delay

TABLE VIII
ADMINISTRATIVE DELAY

S.No	Activity	Avg. Time (min)
1	Notification lag	10
2	Technician response (10-15 min)	15
3	Stores & parts retrieval	10
4	Waiting for supervisor authorisation	5
5	Operator searching for maintenance person	5
6	Shift handover before repair	5
7	Waiting for electrician(electrical faults)	15
8	Clearing fabric lay before repair	4
9	Quality check/first piece approval after repair	5
10	Fabric supply delay	10
11	Operator absent	10
12	Spare parts unavailable	30
	Total time	124 min

D. External factors

TABLE IX
EXTERNAL FACTORS

S.No	Activity	Avg. Time (min)
1	Power supply issues (2-5 min)	5
2	Power cut / load shedding	10
3	Restart and re-check after power cut	5
	Total time	20 min

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VI. CONCLUSIONS

Machine availability is an important measure. It shows how well the equipment has been used during the time it was working. This measure looks at both planned stops like scheduled maintenance and unplanned stops like a breakdown or something, from outside.

When a company calculates machine availability the company can see how well its machines are working. The company can see the productivity of the machine during all the time.

In short machine availability tells the company what percent of the time the machine has been working well compared with all the time that could have been used.

$$Availability = \frac{Actual\ operation\ time}{Planned\ production\ time}\ x\ 100$$

OR

$$Availability = \frac{Up\ time}{Total\ time}\ x\ 100$$

Total time = 1 week = 6 days = 6 * 8 Hours
= 6 * 8 * 60 min
= 2880 min

Down time = Unplanned Maintenance+ Planned Maintenance schedule + Administrative delay + External factors

= 46 + 57.8 + 124 + 20
= 247.8 min

Up time = Total time – Down time
= 2880 – 247.8
= 2632 min

$$Availability = \frac{2632}{2880}\ x\ 100 = 91.39\ \%$$

The Eastman Blue Streak II Model 629X is planned to run for 2,880 minutes each week. The machine is available 91.4% of the time. 8.6% Of the time is not used because of downtime. The main reasons for this downtime are delays, maintenance work, machine problems and things outside the factory.

Delays are the reason, for the lost time.

This suggests that better planning, having materials better coordination of work can help make the machine more useful. Even though there is lost time the machine is still very reliable. Can be used for making products. It is important to do maintenance to stop breakdowns make the machine last longer make cutting work better and keep production running smoothly.

VII. FUTURE WORK

In work the availability of the Eastman Blue Streak II Model 629X can be improved by integrating Industrial Internet of Things technologies. Because administrative delay accounts for fifty percent of downtime (124 of 247.8 minutes per week) an Industrial Internet of Things–based andon system that sends automatic mobile alerts and a computerised maintenance management system can cut notification lag reduce the time the Eastman Blue Streak II Model 629X technician spends searching for parts and shorten approval delays.

RFID-tagged spare-parts inventory can cut the delay that occurs when the Eastman Blue Streak II Model 629X lacks a part. To cut breakdowns low-cost sensors such as accelerometers, temperature sensors and current sensors can be mounted on the Eastman Blue Streak II Model 629X and connected to an ESP32 microcontroller that transmits data via MQTT to a dashboard allowing the Eastman Blue Streak II Model 629X to be monitored for condition and to support predictive maintenance.

Runtime-based scheduling can replace fixed-interval maintenance and power-quality monitoring with a UPS can reduce stoppages for the Eastman Blue Streak II Model 629X. Real-time calculation of availability, MTBF and MTTR throughthe dashboard would let the Eastman Blue Streak II Model 629X be continuously improved.

A pilot trial on one cutting machine comparing availability before and, after the Eastman Blue Streak II Model 629X implementation is recommended to confirm the improvement.

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