Matsushima Measure Tech Co., Ltd.

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Countermeasures
for trouble on
Belt Conveyor operation

PRECAUTIONS for the webinar

Your microphone is muted during the webinar.

Please use the Q&A column on the right side of the screen if you have any question.

Questions are welcome at any time.
You can send a text on the Q&A column at any time.

We will have the Q&A session at the end to reply to your questions.

If we don’t have enough time to reply to your question, we’ll send an answer later by separate email.

Who is Matsushima Measure Tech?

Company name	**Matsushima Measure Tech Co., Ltd.**
Founded	**1946**
Products and services	**Level Sensing** Radar level transmitter, Various level switches, Customized level measuring systems for harsh applications. **Dust Sensing** Various dust monitoring sensors for industrial dust collector, piping, stack, open workplace, clean room, etc. **Safety Sensing** Safety switches for belt conveyor, conveyor belt automatic adjusting carrier, belt tear detector, belt cleaner, etc. **Robot System** COBOT (Human Collaborative Robot) system, automation engineering, etc. **Others** Actuators, Position sensors, etc.
Network	**Subsidiaries** in: China and South Korea **Distributors** in: Taiwan, Indonesia, India, Thailand, Malaysia, Vietnam, Philippines, Australia, Mongolia, Russia and US
Reference	Steel, Cement, Power, Metal, Fertilizer, Chemical, Food, Mining, etc.

Today's topics

1. **Countermeasures for trouble on belt conveyor operation**
   (Mr. Mamoru OMURA, Regional Sales Manager at MMT)
   a. Typical troubles / accidents
   b. General countermeasures

2. **Introduction of safety and protection devices**
   (Mr. Mamoru OMURA, Regional Sales Manager at MMT)
   a. Safety devices against each accident
   b. Technical advice for each device

3. **Proposal from Matsushima Measure Tech Japan**
   (Mr. Kazuhito MAEDA, Marketing Manager at MMT)
   a. Belt Tear Detector
   b. Conveyor Power Generator

4. **Question and Answer** session

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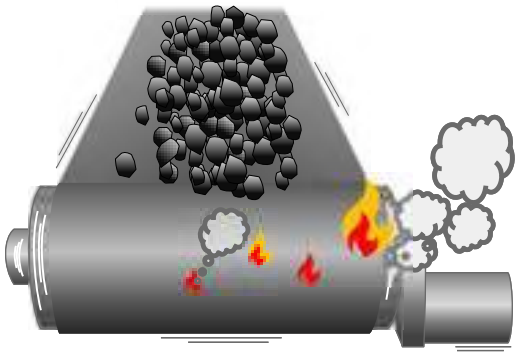
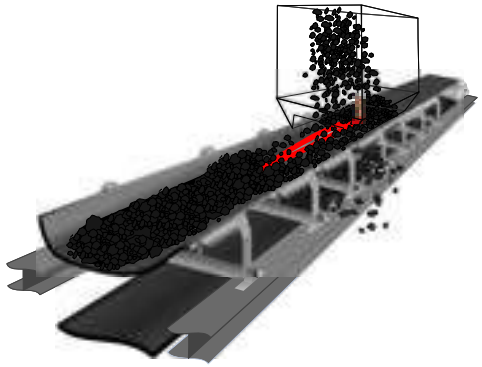
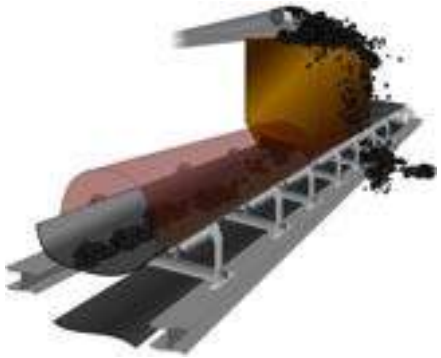
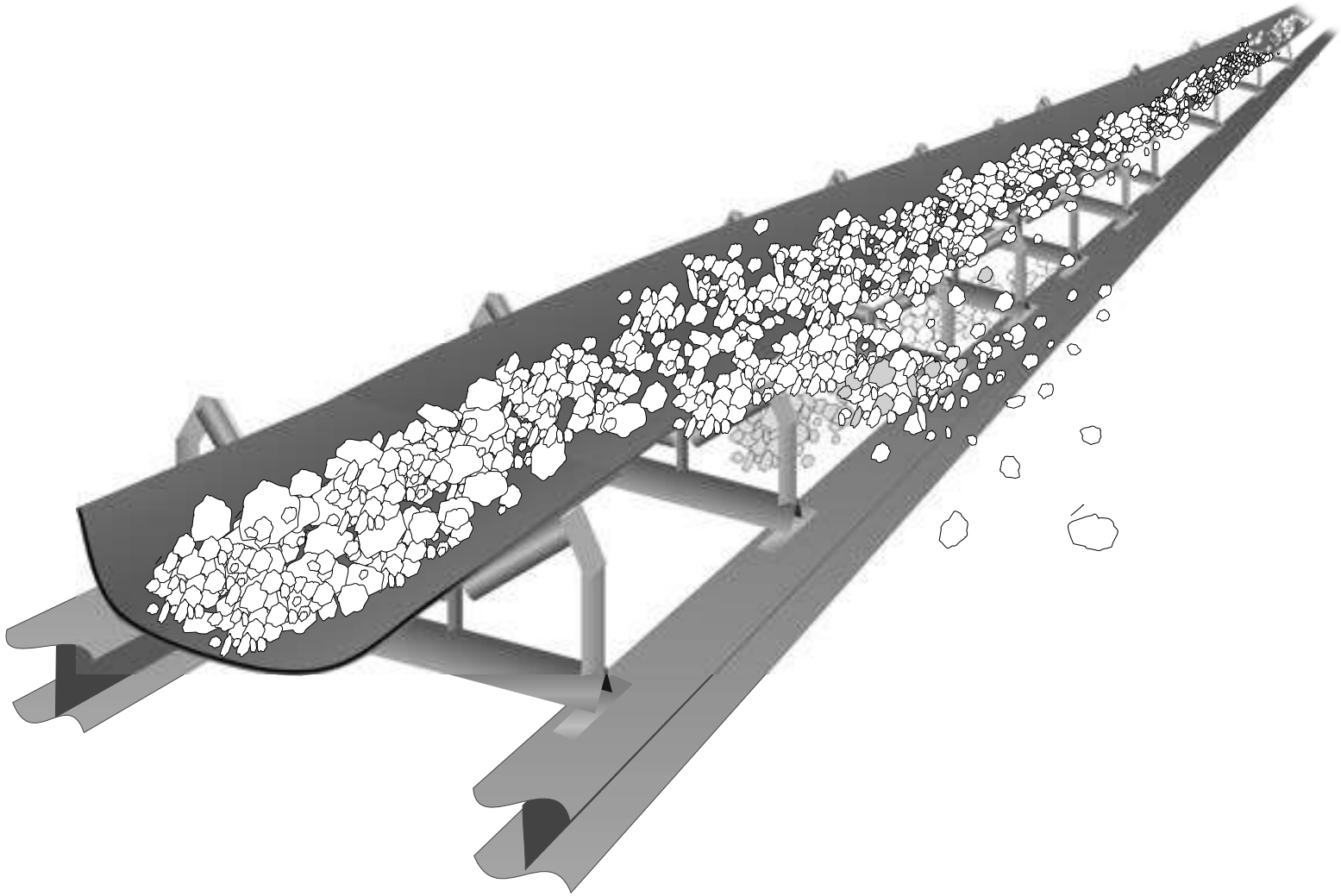
Typical troubles and accidents

Material drop	Fire accident	Belt tear accident
		
Belt cut break	**Blocking chute**	**Being caught in machine**
		

1. Material drop



Main causes (for material drop)

1. Pulley or roller has got dirt, build-up, adhesion, etc.
2. Roller is not rotating properly or broken.
3. Transporting material is changed. (loaded on side, etc.)
4. Skirt rubber is damaged or load material is bitten inside.
5. Conveyor belt is damaged.
6. Environmental situation change (heat, wind, moisture...)

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Conveyor belt snaking or misalignment

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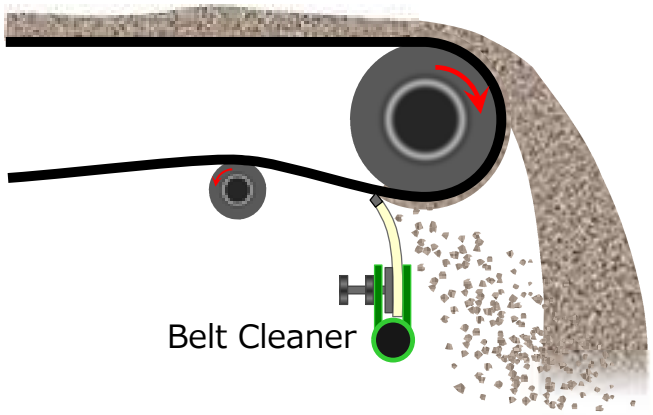
Material drop

↓

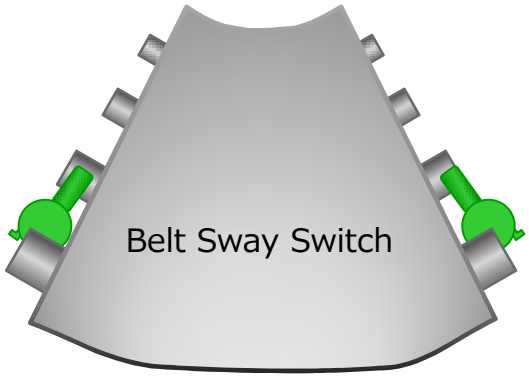
Production loss, Maintenance cost raise

Countermeasures (for material drop)

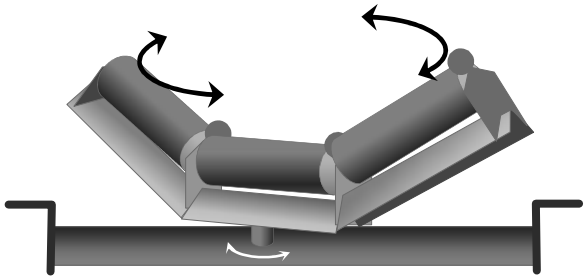
Remove build-up material



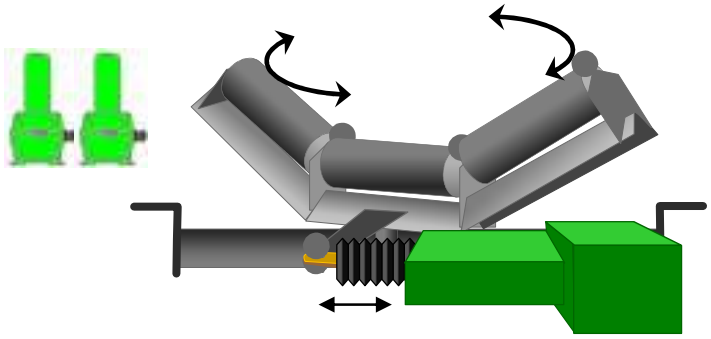
Detect misalignment and stop



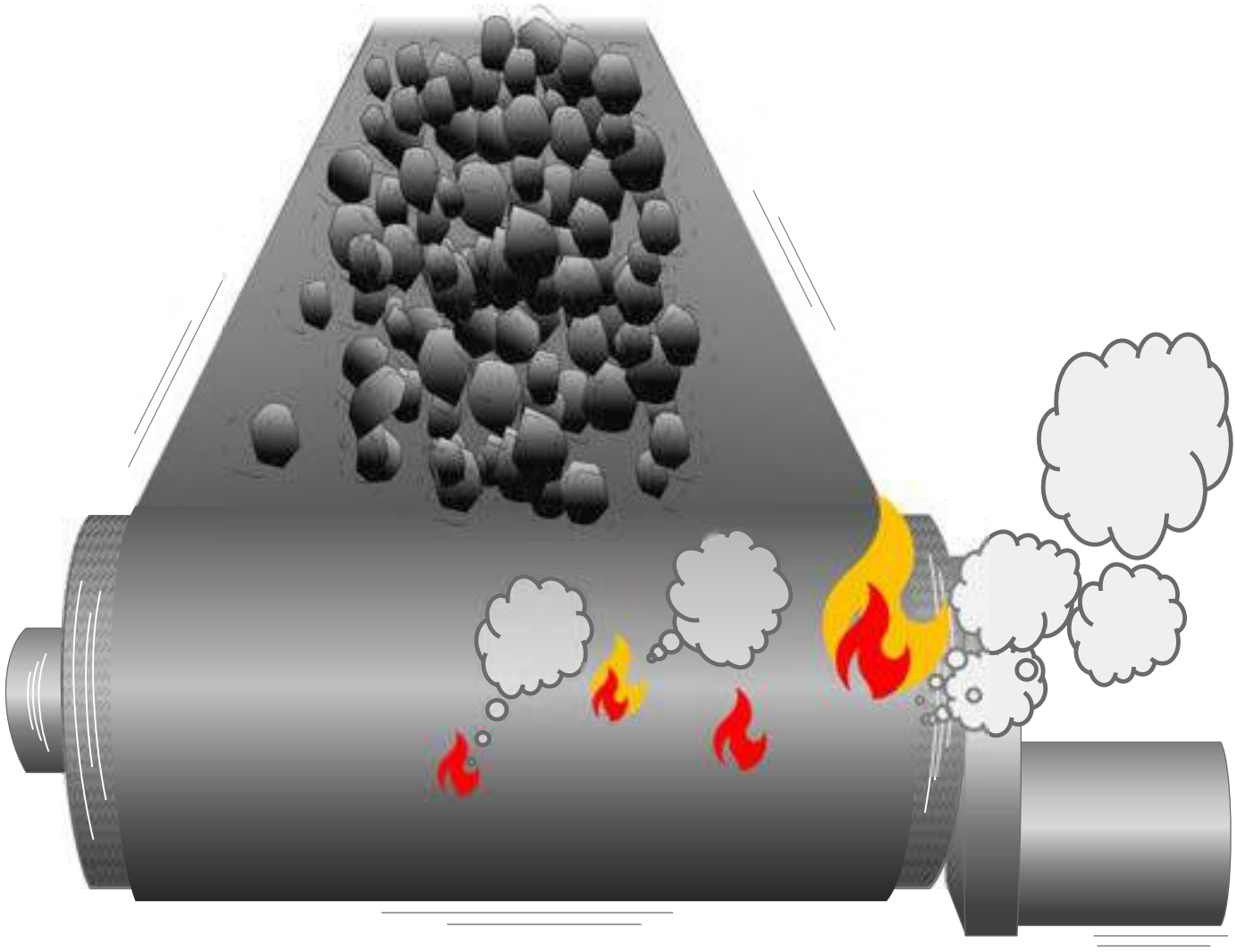
Self-aligning mechanical carrier



Motor-operated Adjusting Carrier



2. Fire accident



Main causes (for fire accident)

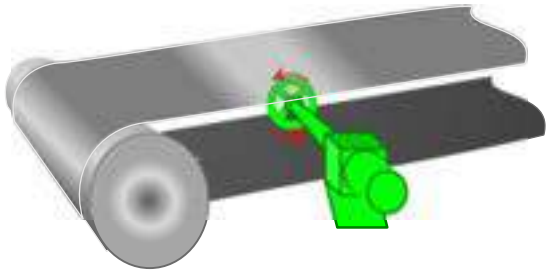
1. Belt slip between conveyor belt and drive pulley.
2. Heat due to malfunction of rotating parts (bearing, etc.).
3. Friction heat between misaligned belt and frame.
4. Heat generated from accumulated dust at roller stand, etc.
5. Ignition from the site work using fire.

Fire accident

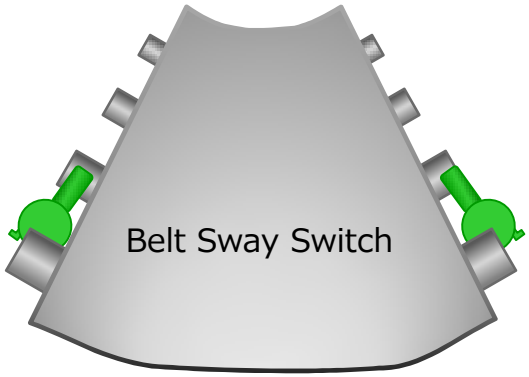
Production loss, Maintenance cost raise,
Human injury, Health damage, Air pollution

Countermeasures (for fire accident)

Detect slip and stop



Detect misalignment and stop



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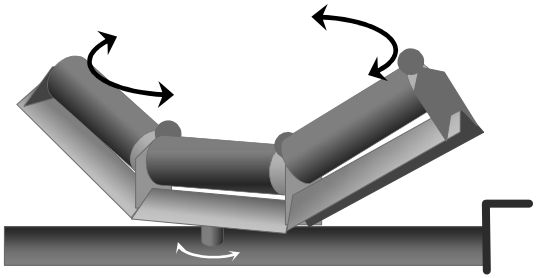
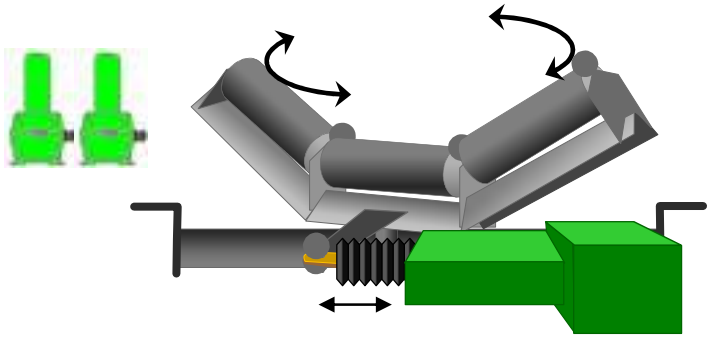
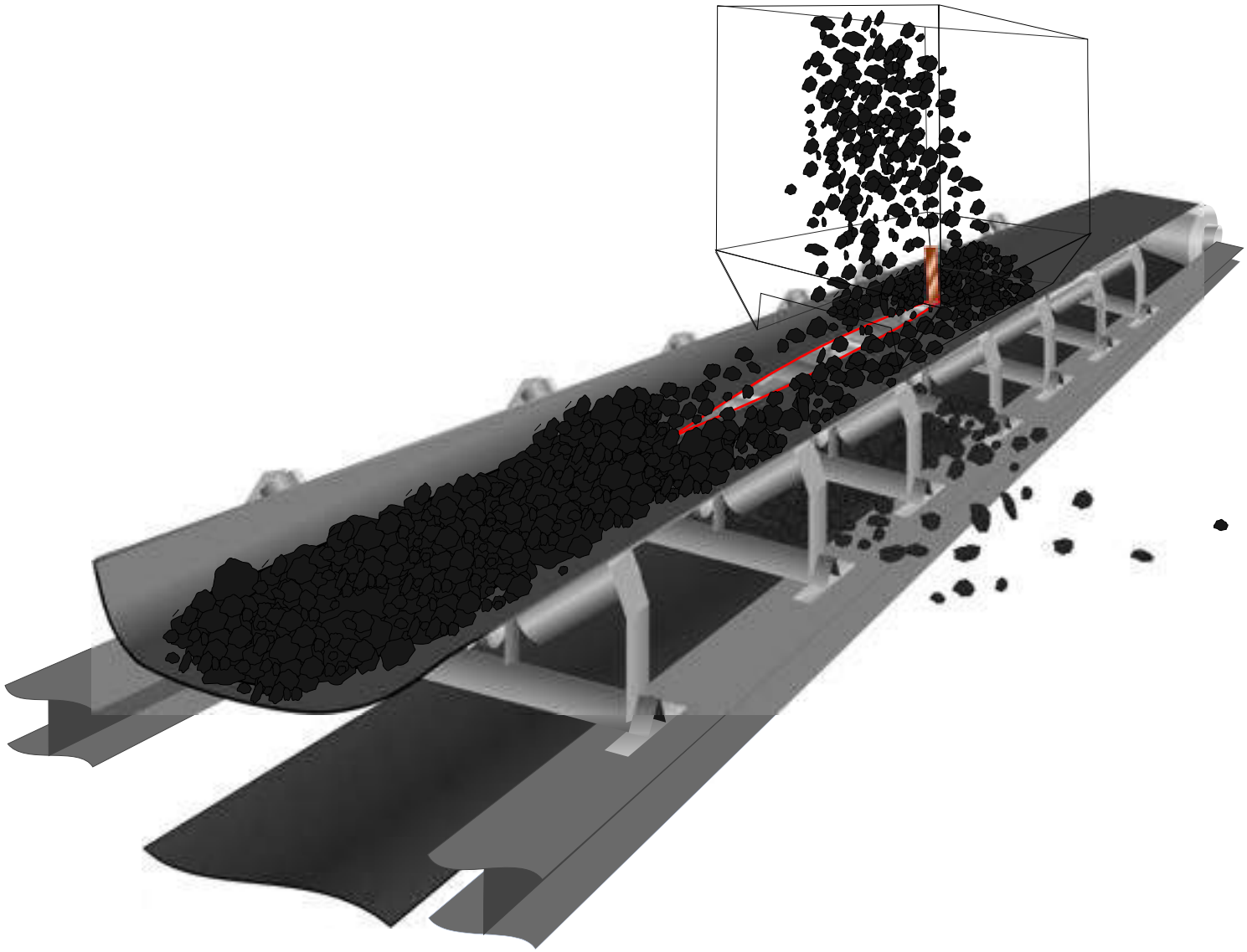


Motor-operated Adjusting Carrier



3. Belt tear (rip) accident



Main cause (for belt tear accident)

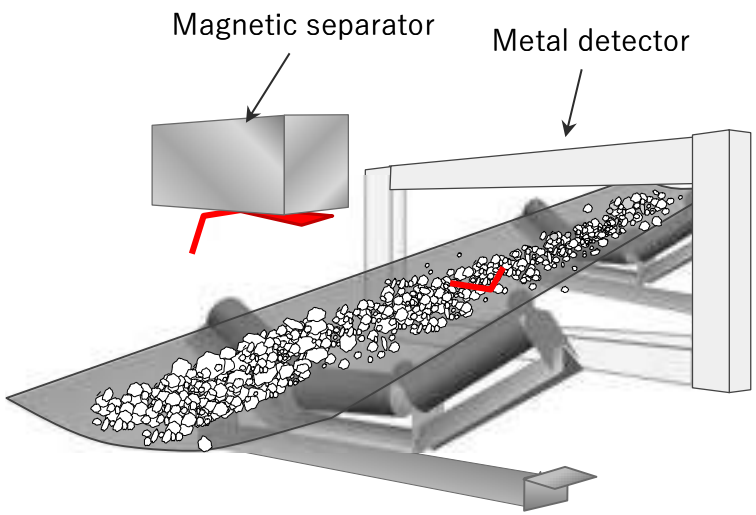
The main cause is ;
Wrong material or obstacles like sharp solid or metal mixed in the transporting material sticks through the conveyor belt and stuck in the impact roller just below the transferring chute.

Belt tear accident

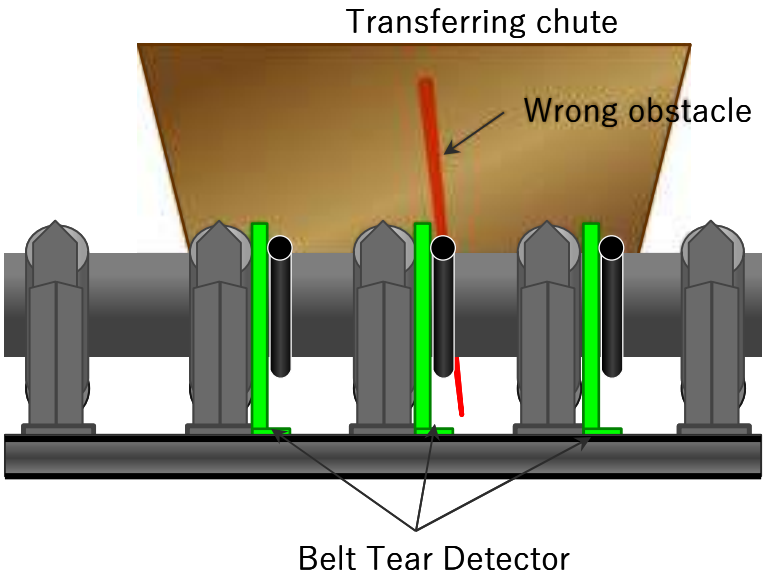
Production loss, Maintenance cost raise

Countermeasures (for belt tear accident)

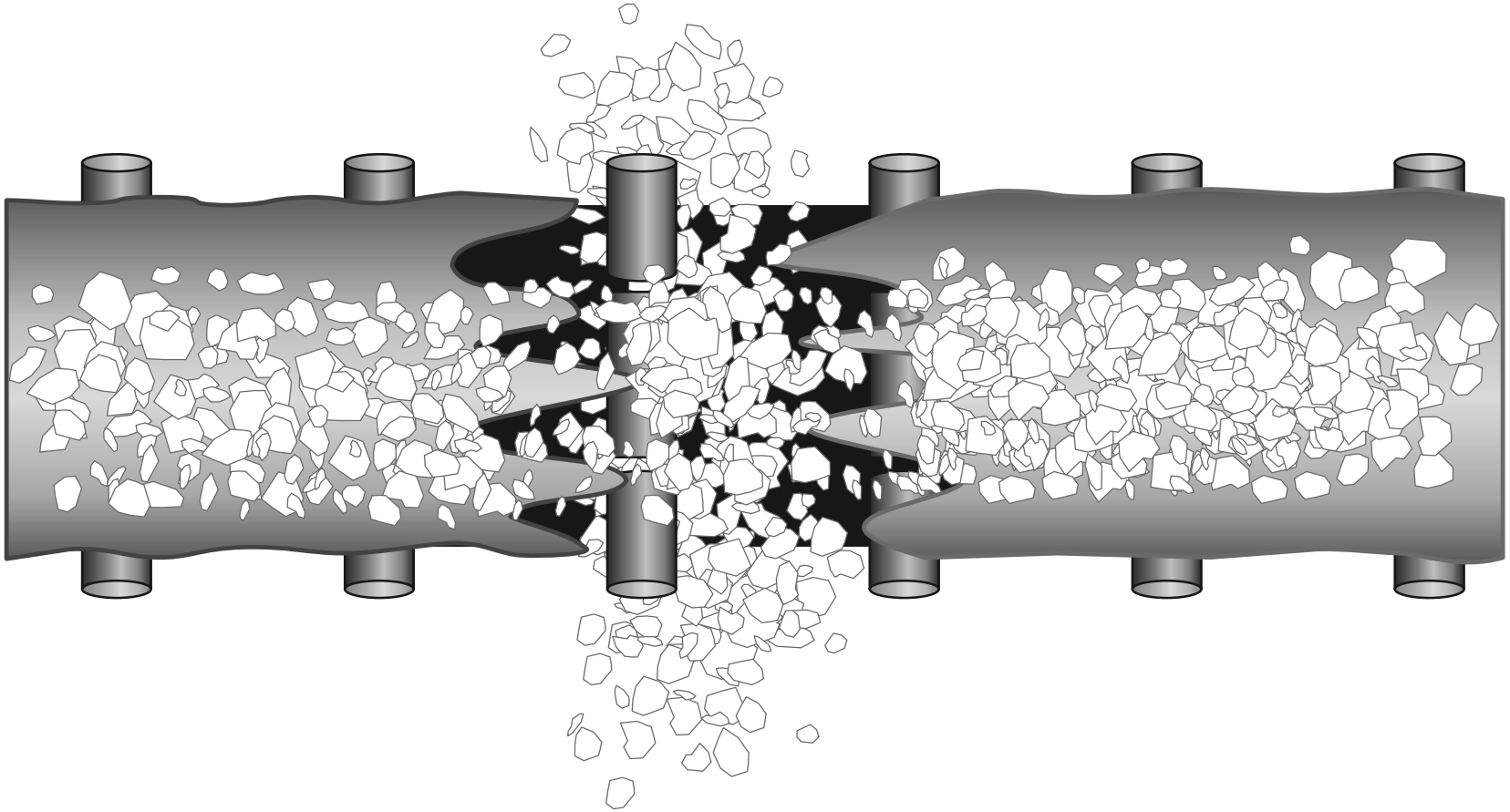
Detect metal material and remove them by separator



Detect the stuck situation and immediately stop the conveyor



4. Belt cut break accident



Main causes (for belt cut break accident)

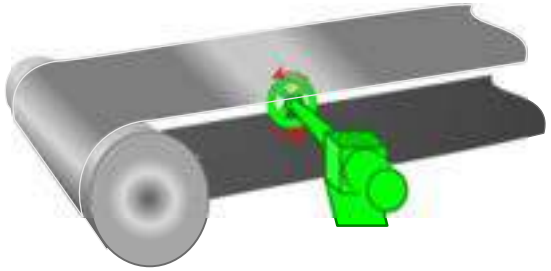
1. Frequent belt slip between conveyor belt and drive pulley.
2. Rubber of belt surface is worn and the fabric is exposed.
3. Crack or scratch on the inner fabric observed (10% over).
4. Belt tear damage or scratch.
5. There are many repair portions.

Belt cut break accident

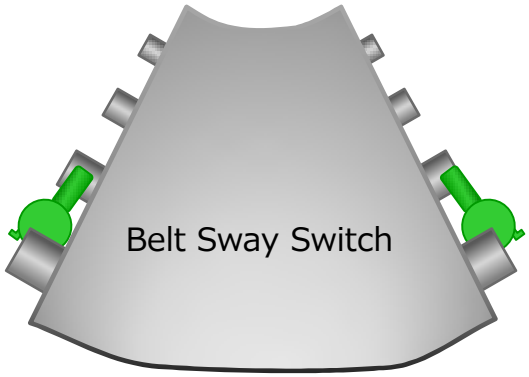
Production loss, Maintenance cost raise,
Serious human injury accident

Countermeasures (for cut break accident)

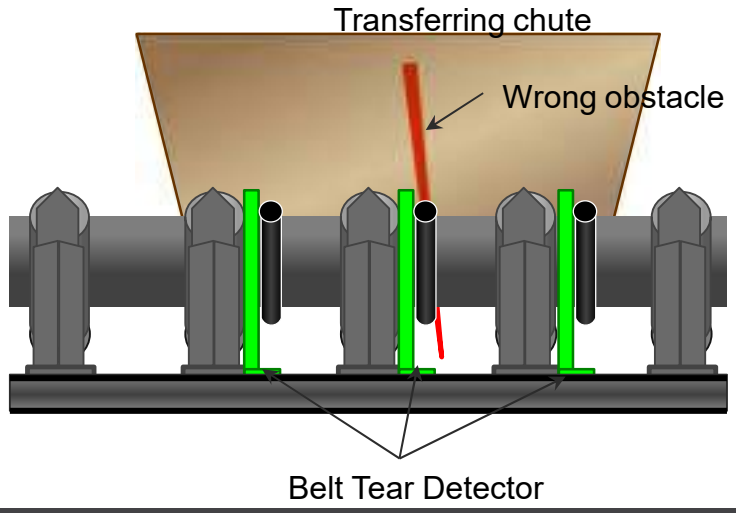
Detect slip and stop



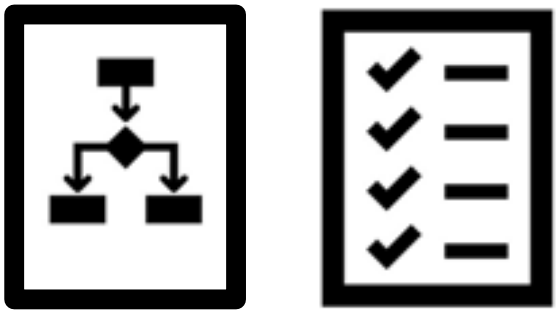
Detect misalignment and stop



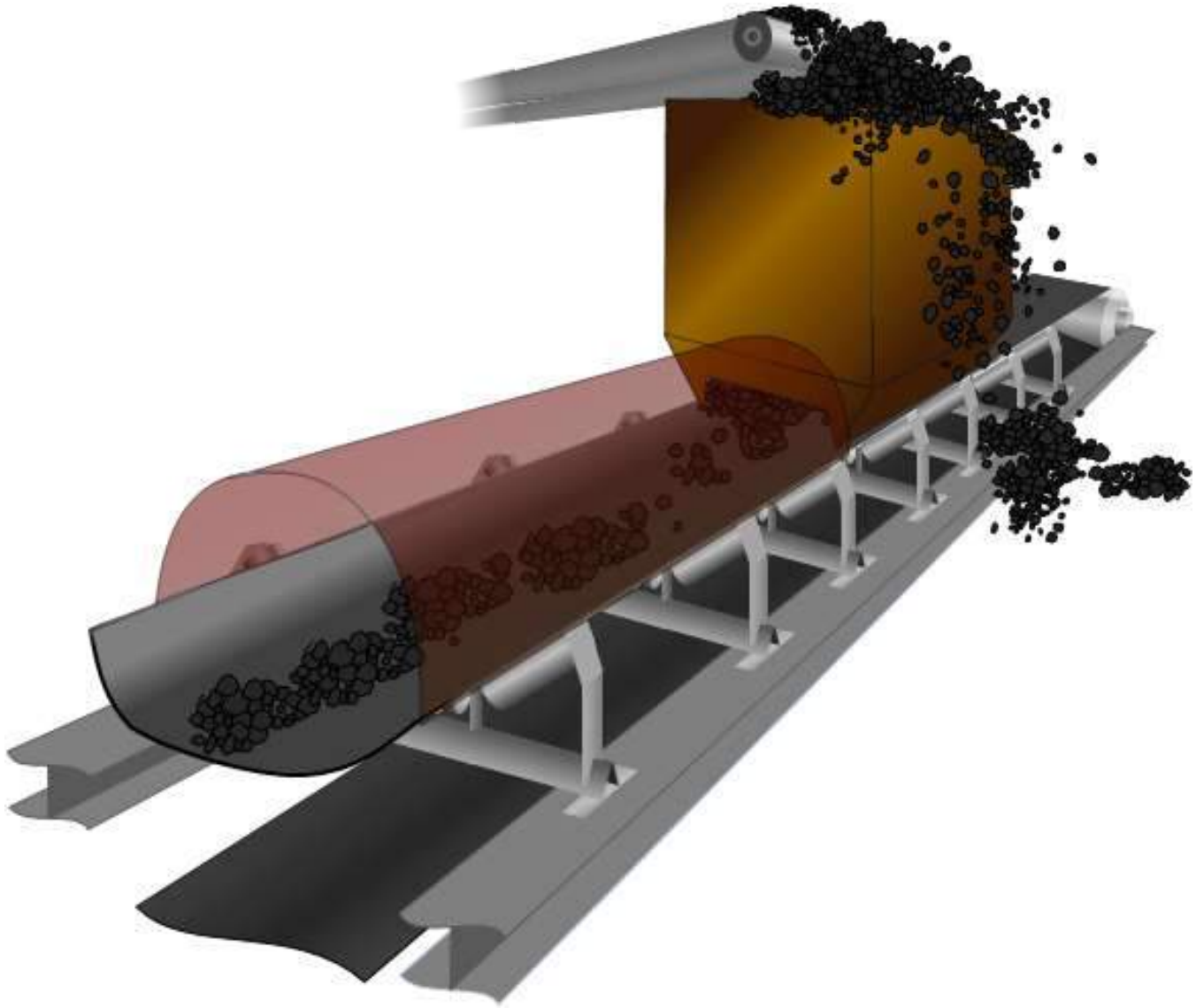
Detect the stuck situation and immediately stop the conveyor



Establish criterion to replace belt



5. Blocking chute



Main causes (for blocking chute)

1. Conveyor belt is slipping, load material is not going forward and stay below the transferring chute.

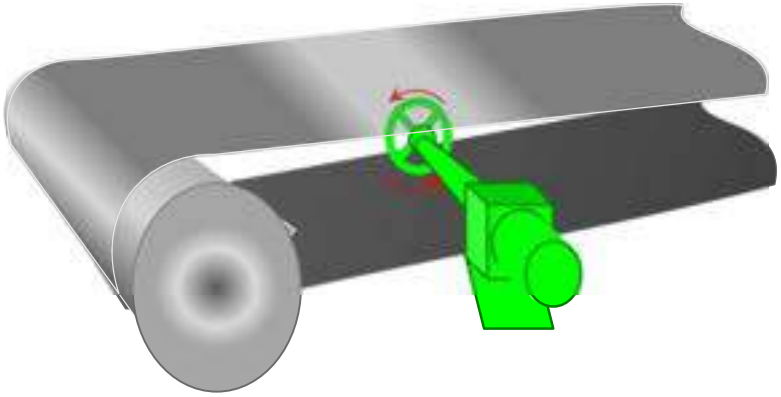
2. Transporting material is stuck in the transferring chute and not charged on the belt conveyor.

Blocking chute accident

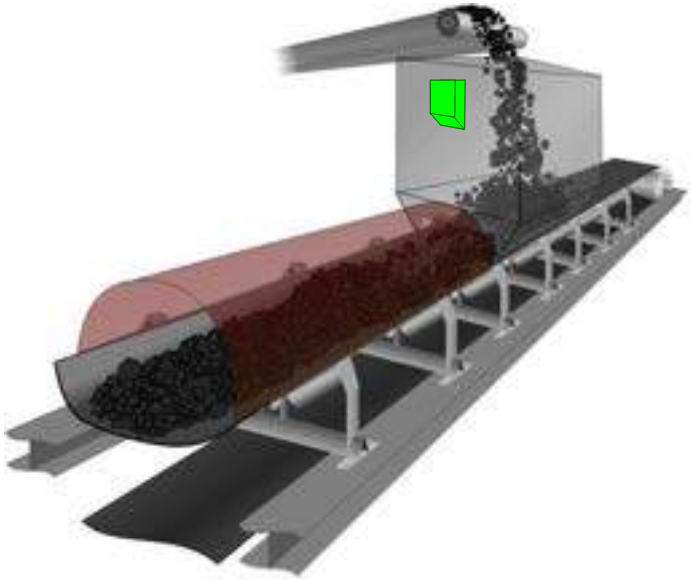
Production loss, Maintenance cost raise, Environmental pollution

Countermeasures (for blocking chute)

Detect slip and stop



Detect the blocked situation and immediately stop the conveyor



5. Caught in machine

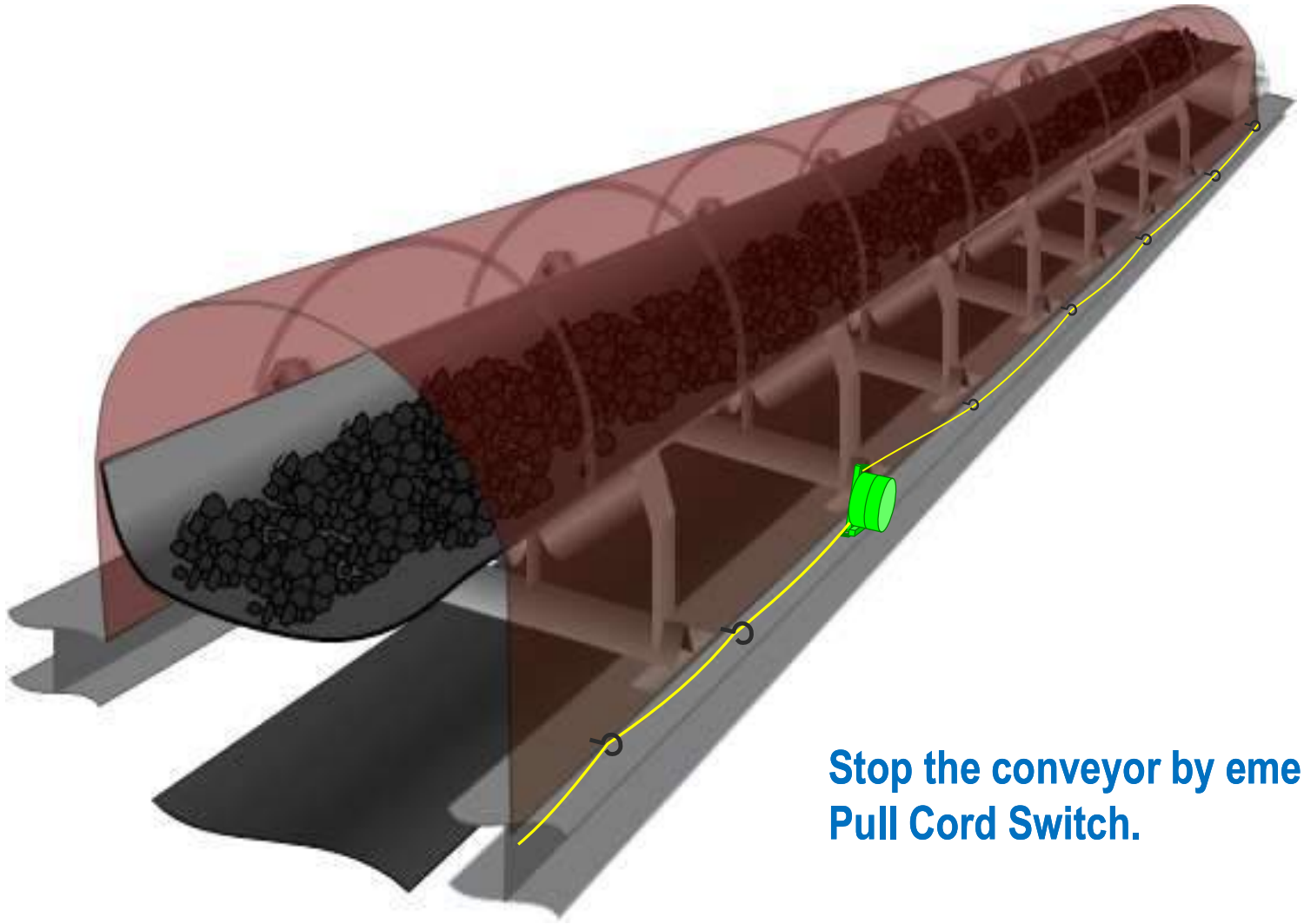
Main causes (for being caught in machine)

1. Someone started the conveyor during the repair work.
2. Self-driving system started the conveyor during the repair work
3. Did the build-up removing work without stopping the conveyor.
4. Unintentionally touched with rotating pulley at the conveyor not having safety cover.

Human caught in machine

Serious human injury
Production loss

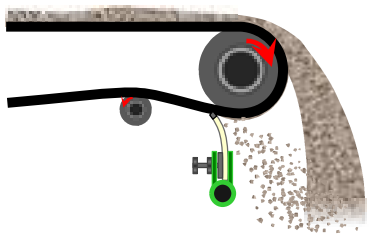
Countermeasures (for being caught in machine)



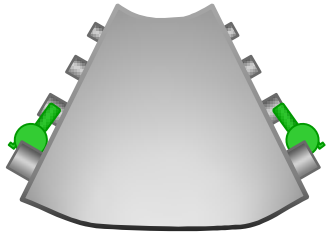
Stop the conveyor by emergency Pull Cord Switch.

Countermeasures for those troubles

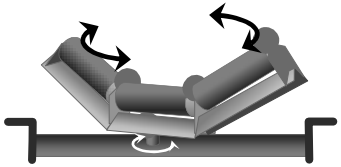
Remove build-up material



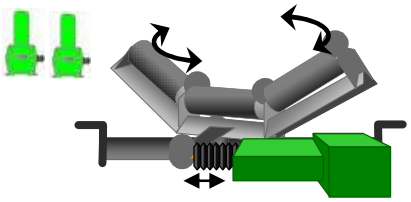
Detect belt sway and stop conveyor



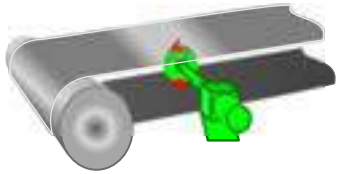
Self-aligning mechanical carrier



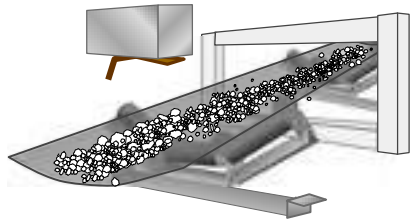
Motor-operated Adjusting Carrier



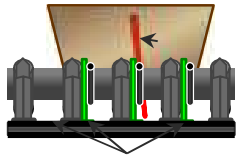
Detect slip and stop conveyor



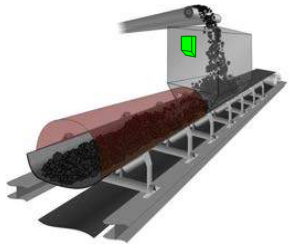
Detect metal and remove it



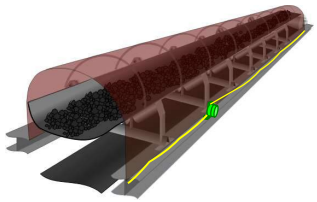
Immediately detect stuck obstacle and stop conveyor



Detect blocked situation



Emergency stop Pull Cord Switch



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4. **Question and Answer** session

① : Remove build-up material

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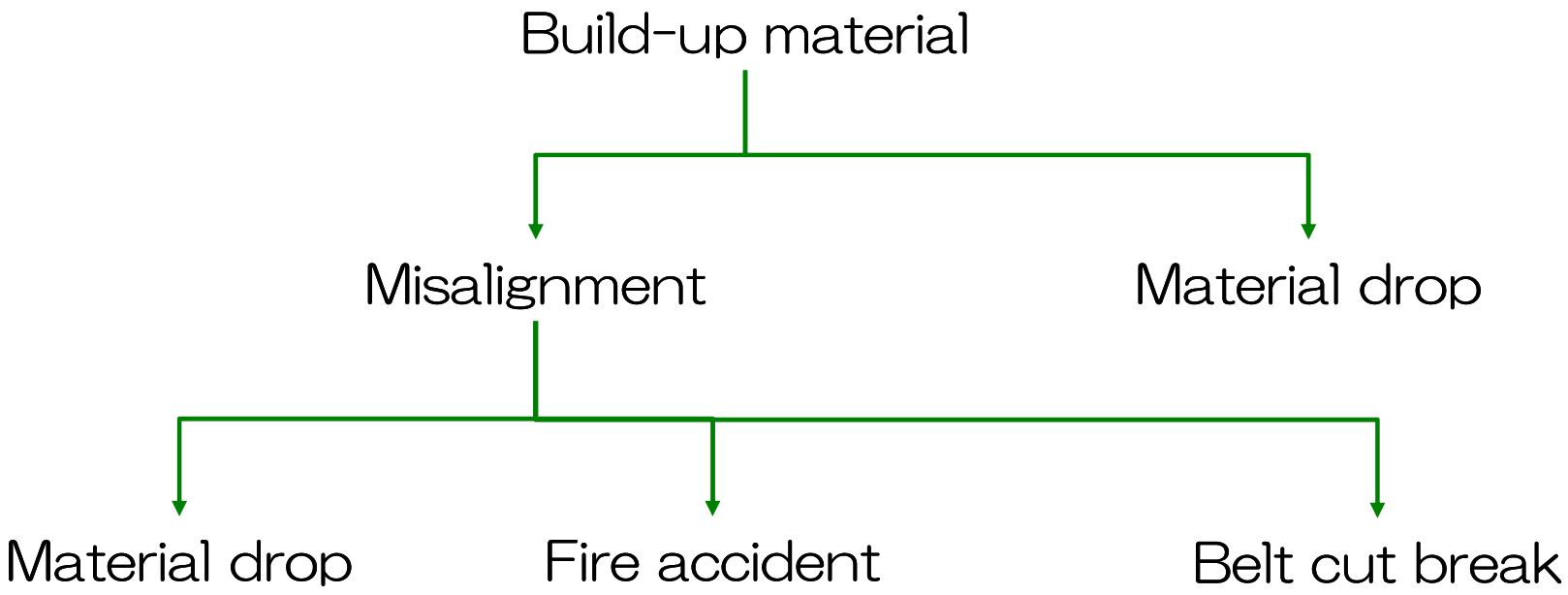
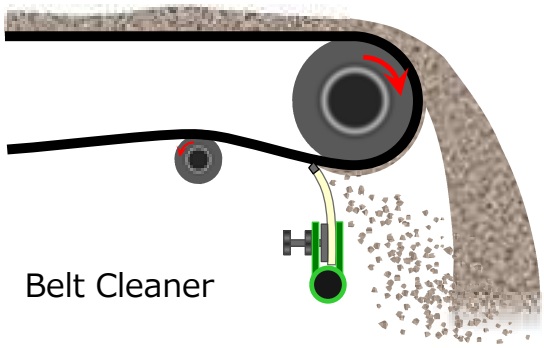


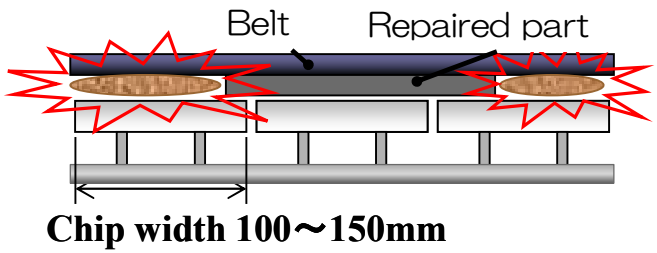
Removing build-up material with Belt Cleaner.



① : Remove build-up material

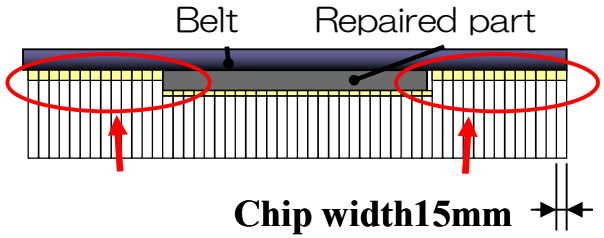
Point① Wide cleaning chip vs Narrow cleaning chip

Wide chip



Repaired part or uneven part leaves a gap between cleaning chip and belt.

Narrow chip

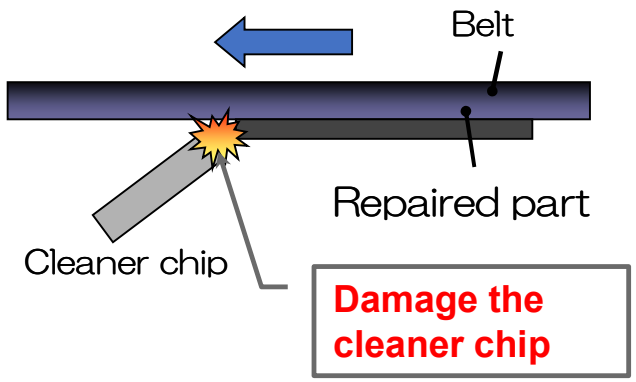


Strip-shaped chips independently scrape the belt.

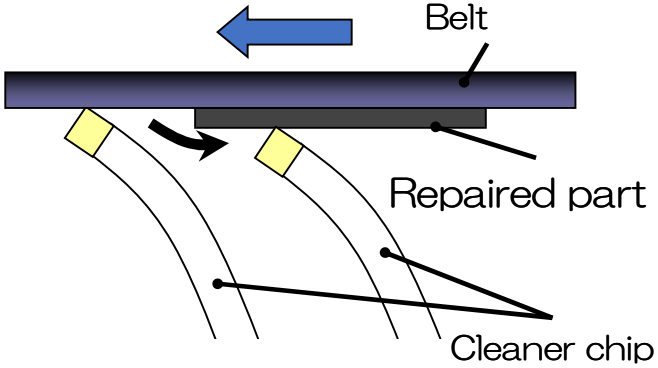
① : Remove build-up material

Point② Cleaner chip direction

AGAINST
the conveyor operating direction



FOR
the conveyor operating direction



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② : Detect belt sway and stop the conveyor

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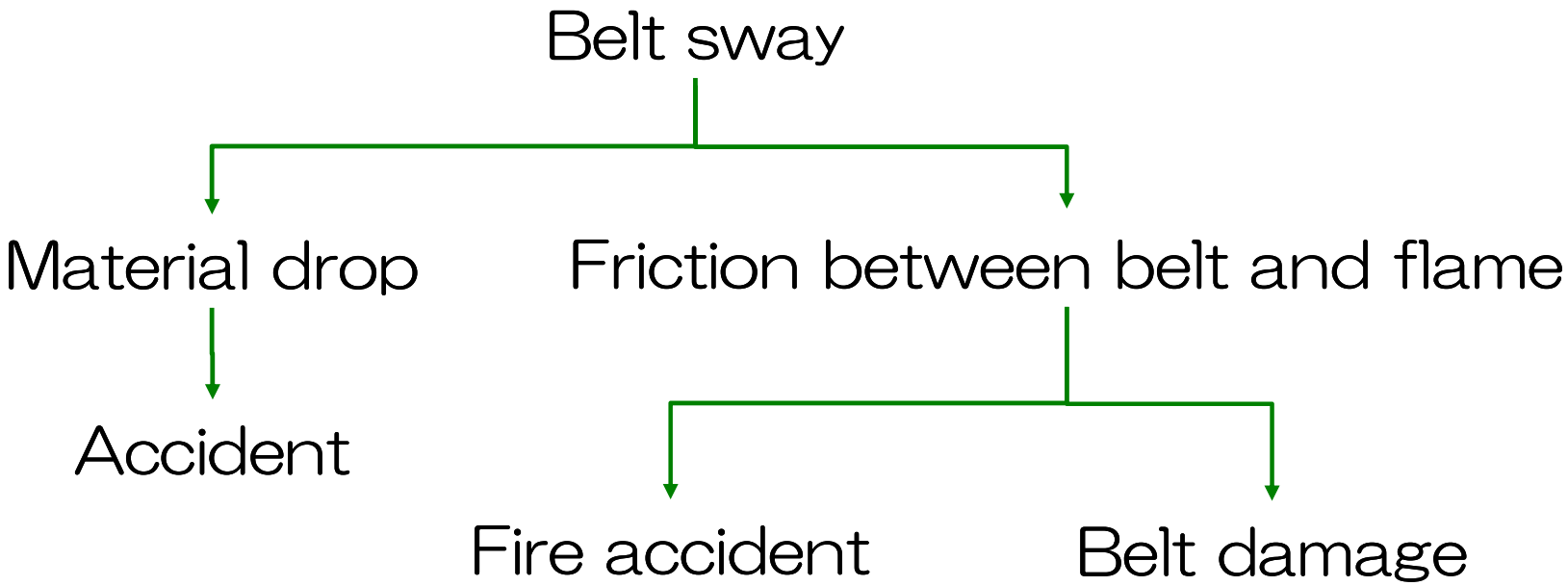
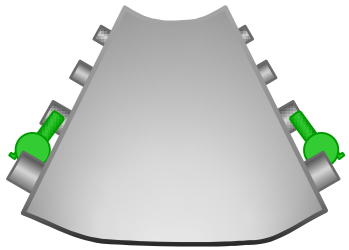


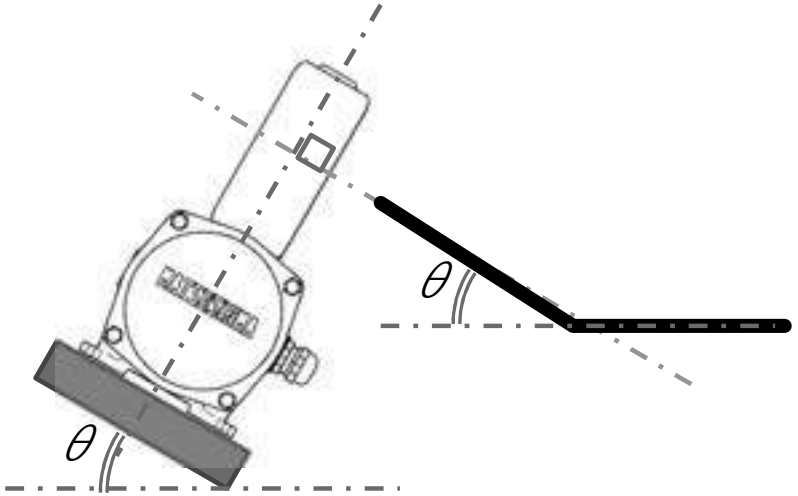
Detect the misalignment and stop the conveyor with Belt Sway Switch



② : Detect belt sway and stop the conveyor

Point for installation ①

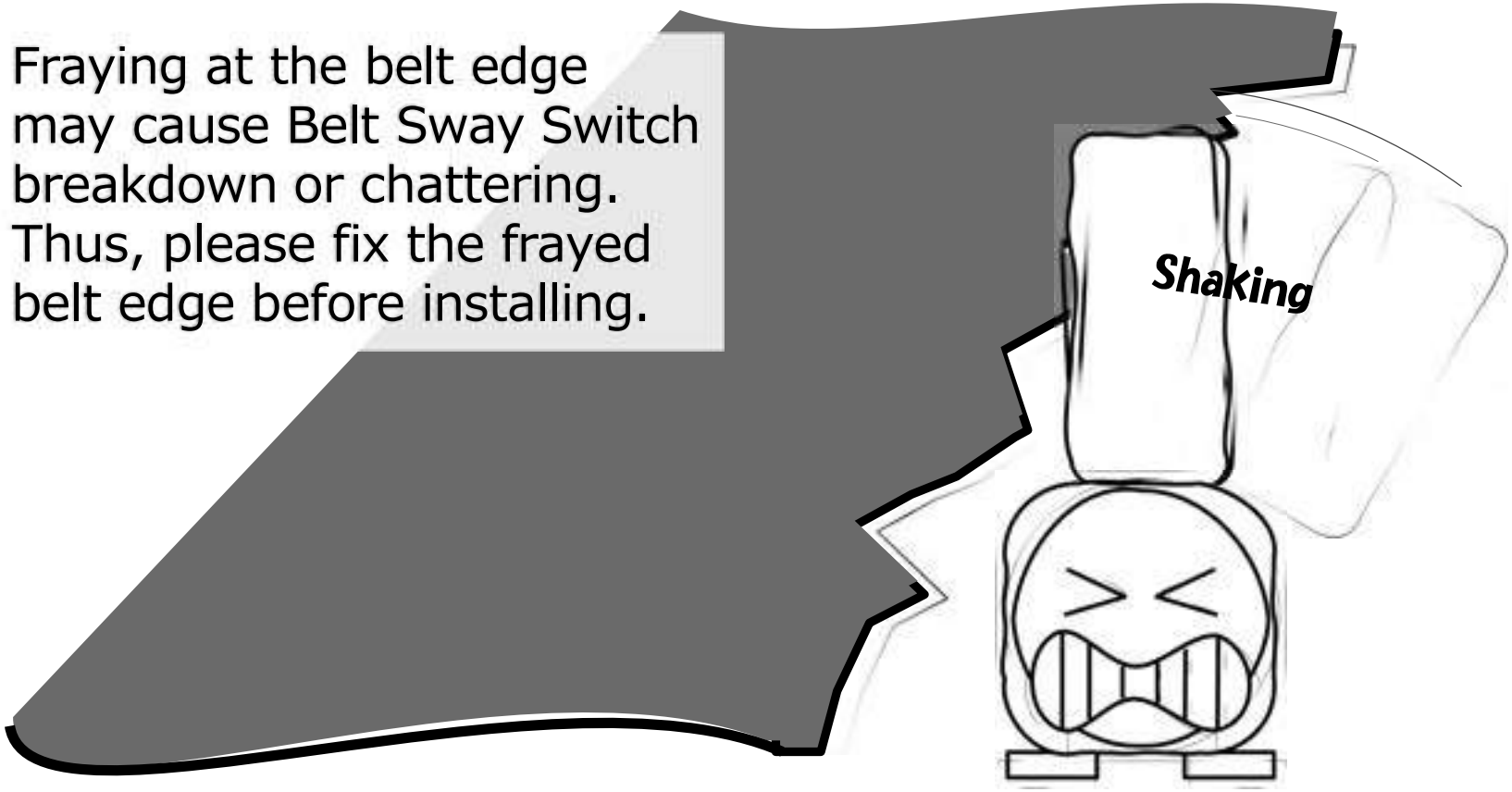
Mount the Belt Sway switch so that touch roller is located at vertical position against the belt edge.



② : Detect belt sway and stop the conveyor

Point for installation ②

Fraying at the belt edge may cause Belt Sway Switch breakdown or chattering. Thus, please fix the frayed belt edge before installing.



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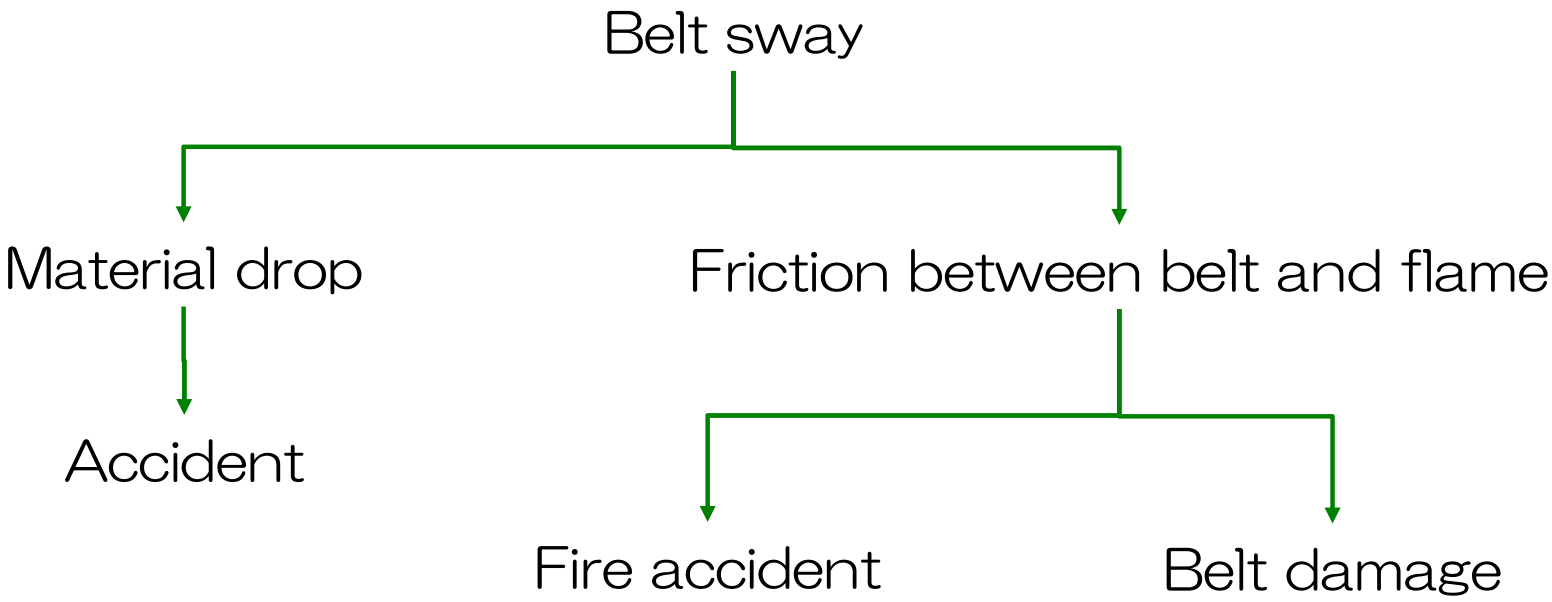
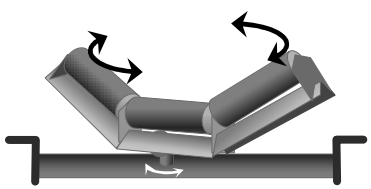
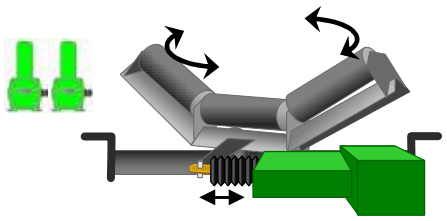
③④ : Fix the belt sway

③④ : Fix the belt sway



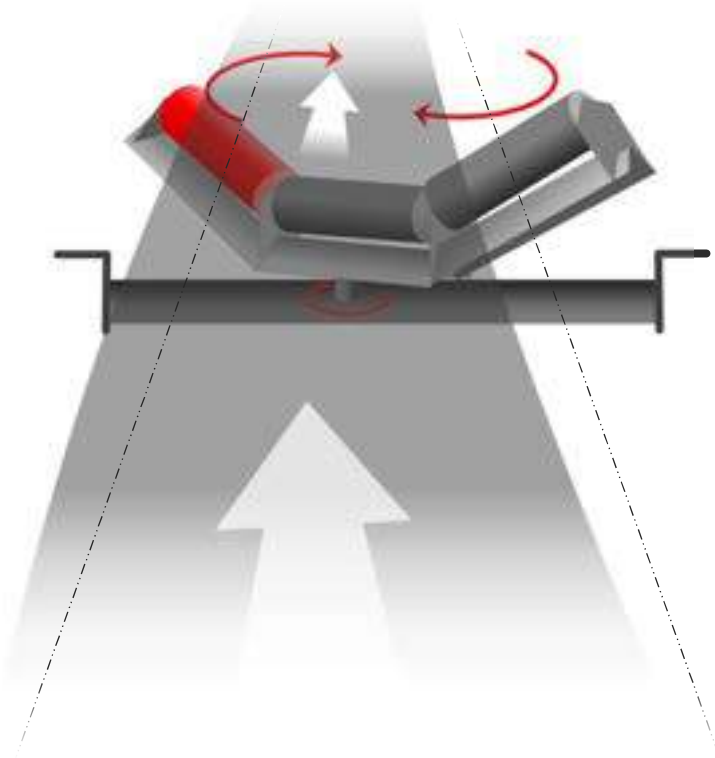
Fix the belt sway with Self-aligning Mechanical Carrier and Motor-operated Adjusting Carrier





③④ : Fix the belt sway

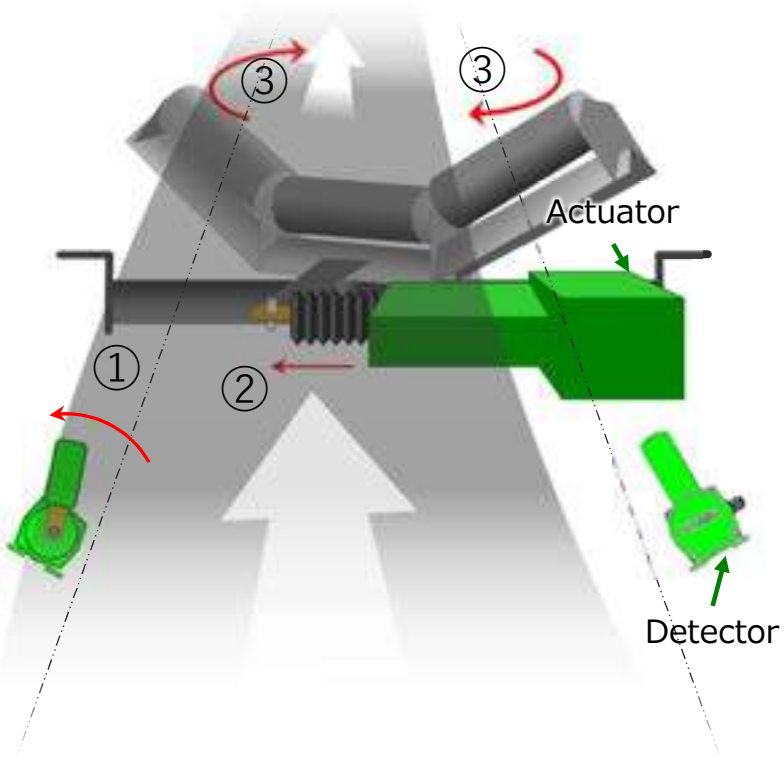
Self-aligning mechanical carrier corrects the belt sway by weight shift.



When the belt is misaligned, its center of gravity shifts to the roller on the misaligned side. That roller is driven to conveyor's running direction, thereby the self-aligning mechanical carrier rotates to fix the misalignment.

③④ : Fix the belt sway

Motor-operated Adjusting Carrier detects the belt sway and automatically corrects it by motor power.

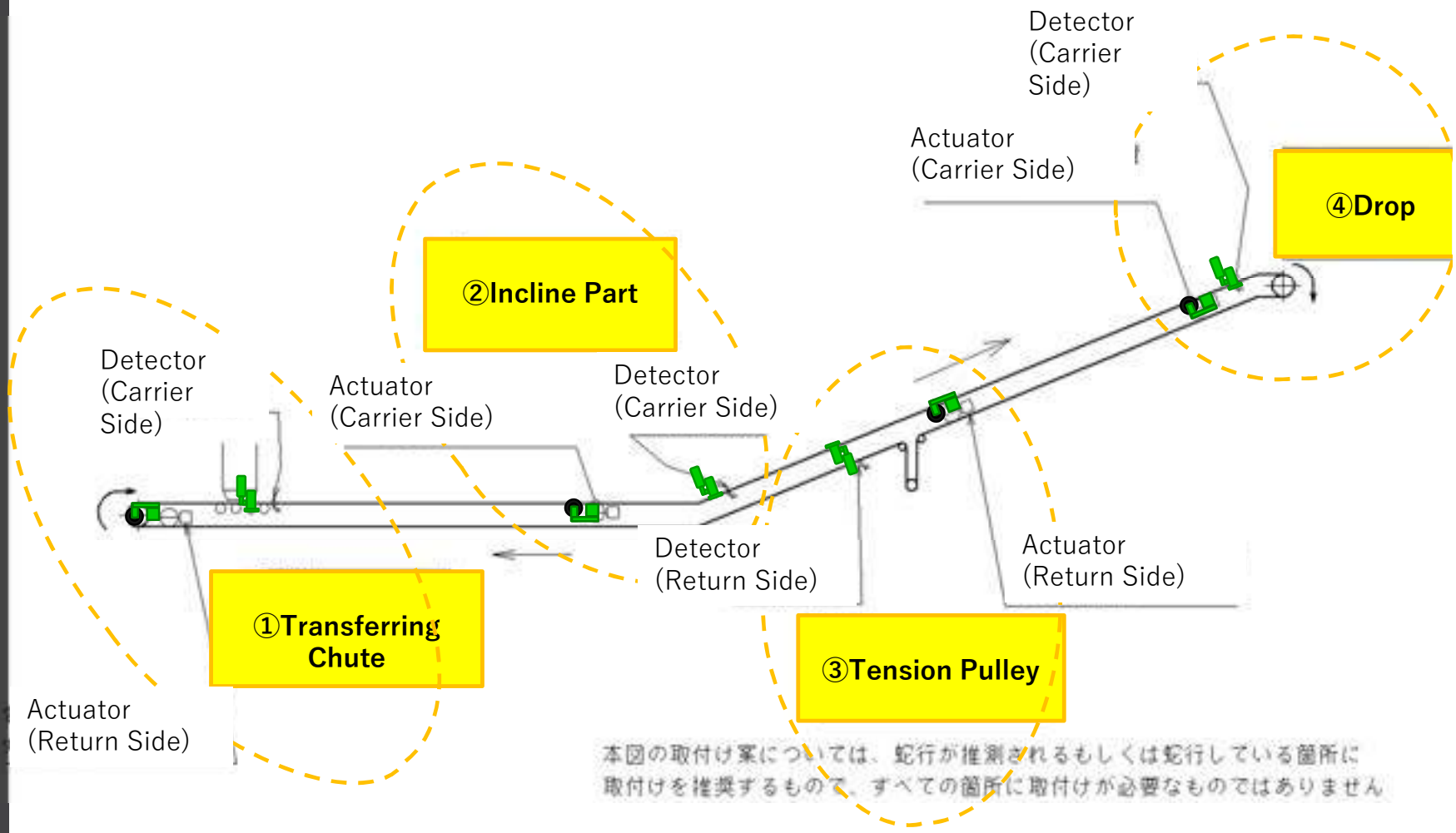


Detectors monitor belt misalignment. And according to the signal from the Detector, the Actuator automatically turns carrier roller by motor power.

Motor-operated Adjusting carrier is also applied at the conveyer with the short length of 10m or less and **Constant Feed Weigher (DFW)** because self-aligning mechanical carrier is not powerful enough for those applications.

③④ : Fix the belt sway

Application example for Motor-operated Adjusting Carrier



⑤ : Detect belt slip and stop the conveyor

⑤ : Detect belt slip and stop the conveyor

Rainwater or dust is infiltrated between the head pulley and belt.

↓

Slip

↓

Fire Accident

Blocking chute

Belt cut break

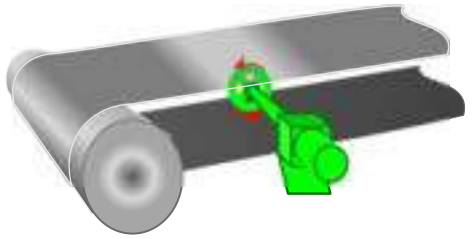
↓

Speed down of belt or roller

↓

Material drop

Detect speed down of belt and roller and stop the conveyor.



⑤ : Detect belt slip and stop the conveyor

Magnetic type : Speed Relay

- **No power supply is required:** Installation cost saving
- **No maintenance is required:** Operates long time without lubrication or inspection
- **Superior durability:** Supply record of more than 45,000 units

Measuring the belt velocity

Install the Speed Relay so that touch roller presses the belt in the vertical direction.

Measuring tail pulley rotational speed

Connect the Speed Relay and tail pulley with coupling.

⑤ : Detect belt slip and stop the conveyor

Proximity Switch type : Speed Switch

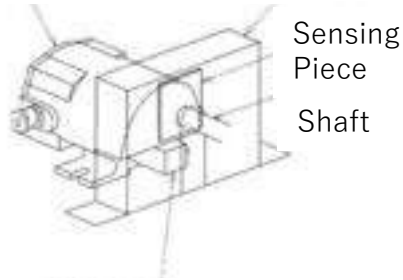
- **No Physical contact with the rotating shaft.**
- **Adjustable setting of actuating speed at site**
- **Compensating timer**

Measuring the belt velocity

Install the Speed Relay so that touch roller presses the belt in the vertical direction.

Measuring tail pulley rotational speed

Proximity Switch detect pulse signal generated when a sensing piece attached to the shaft passes the Proximity Switch.



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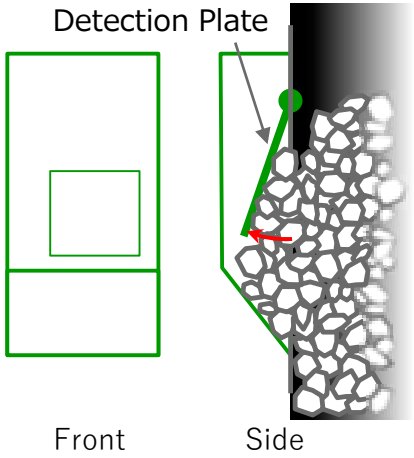
⑥ : Detect blocking chute and stop the conveyor

⑥ : Detect blocking chute and stop the conveyor

There're several ways to detect the blocked chute as per application.

①Chute Switch

The Chute Switch is equipped at chute sidewall by cutting out the square hole.
When the load clogs the chute, the detection plate is pushed back to activate the switch.
It is widely used for bulk conveyor since there's no protrusion part.



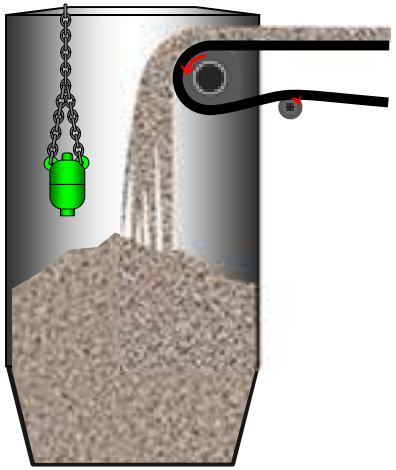
⑥ : Detect blocking chute and stop the conveyor

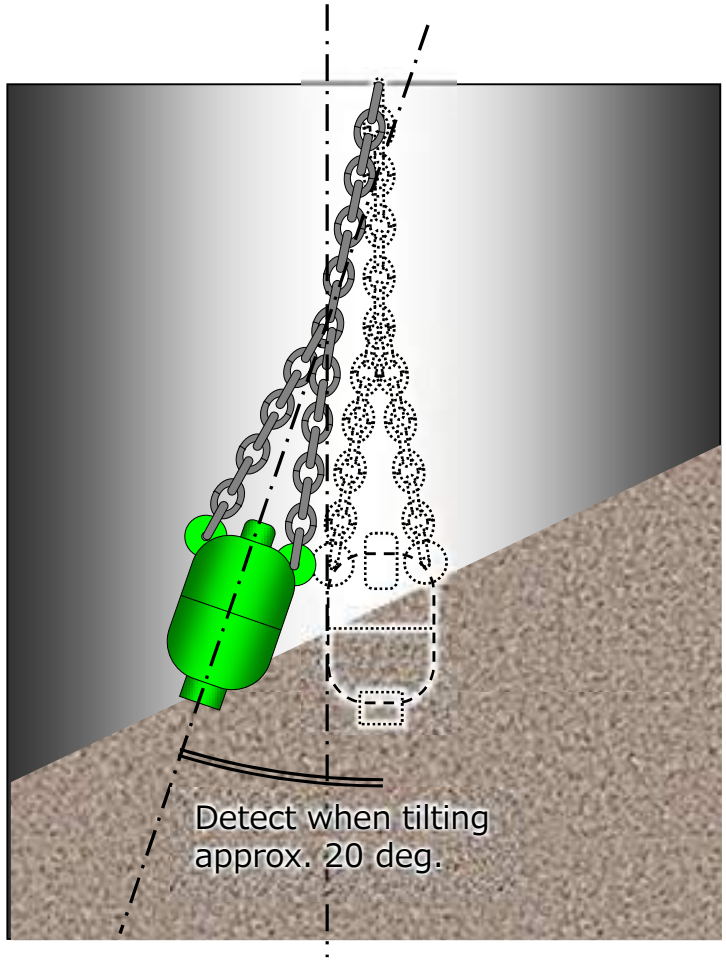
②Full Detector

Full Detector is the tilting type level switch, designed to be hung in the chute.

When the material level goes up and tilts the sensing weight, the limit switch is activated.

Because it is hardly affected by build-up material , it is widely applied for bulk and powder application.

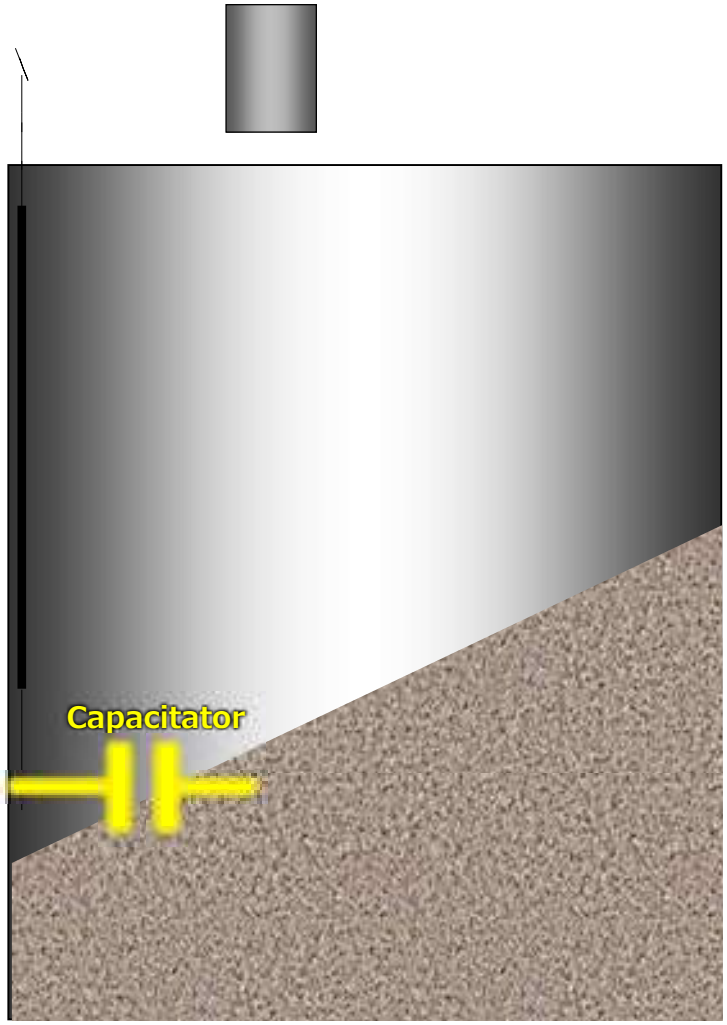




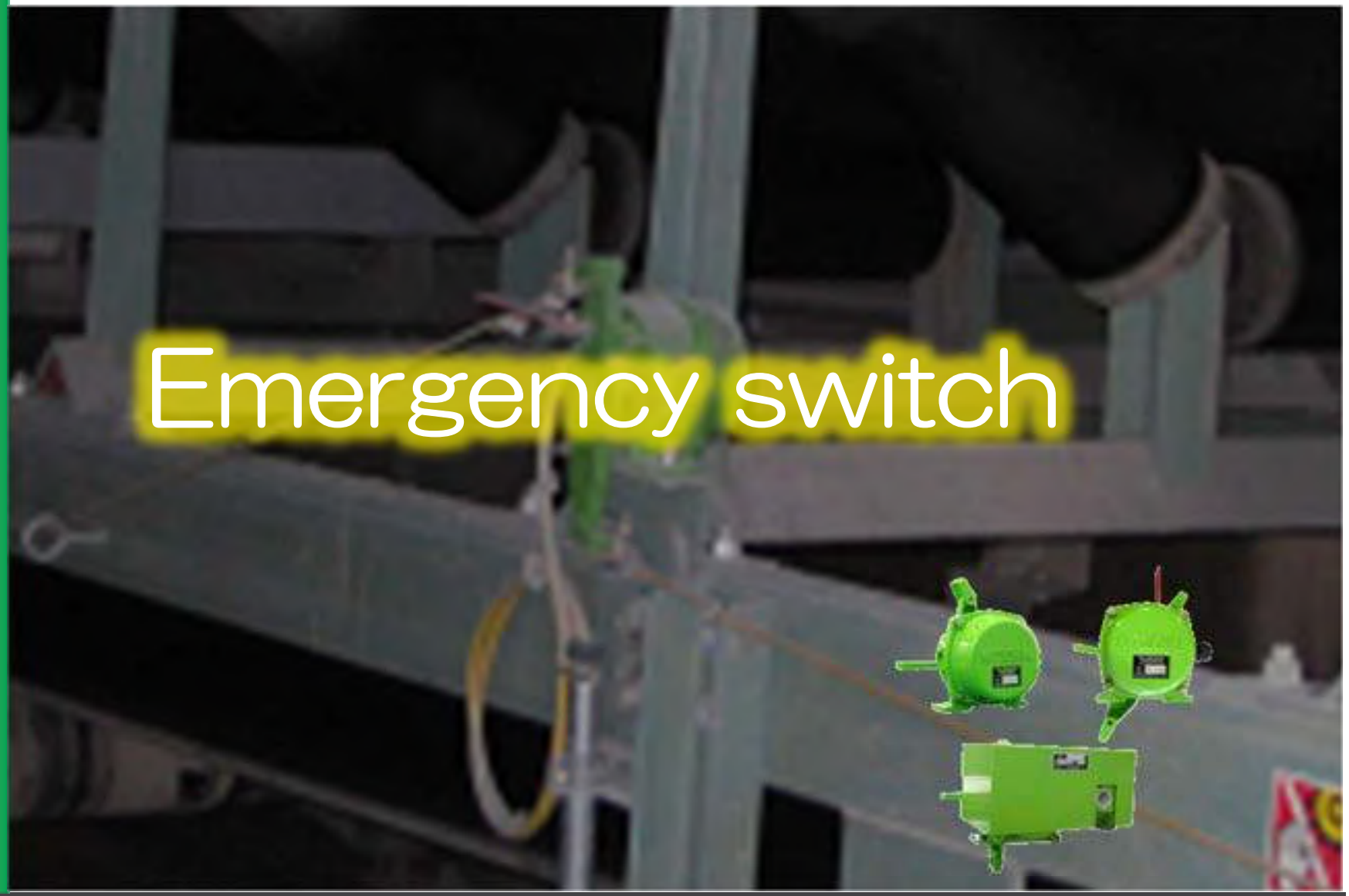
⑥ : Detect blocking chute and stop the conveyor

③Admittance type Level Switch

The capacitator is formed between the detection electrode hung in chute and sidewall. And it monitors capacitance change which occurs as material touches the electrode.

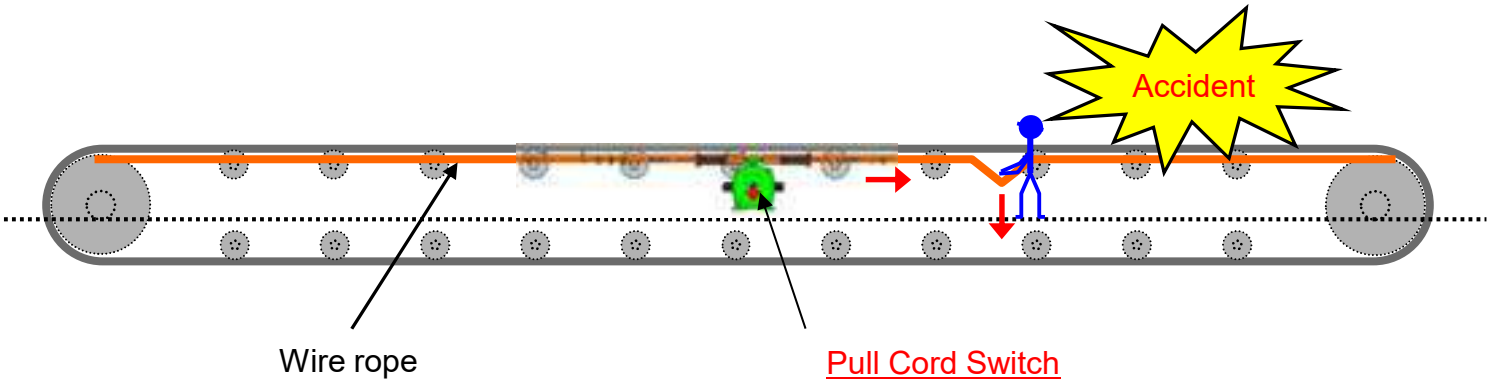


⑦ : Stop the conveyor from anywhere



⑦ : Stop the conveyor from anywhere

With Pull Cord Switch...



your can stop the conveyor **immediately at the site.**

It prevents the **unexpected start-up** during conveyor maintenance by activating the switch.

⑦ : Stop the conveyor from anywhere

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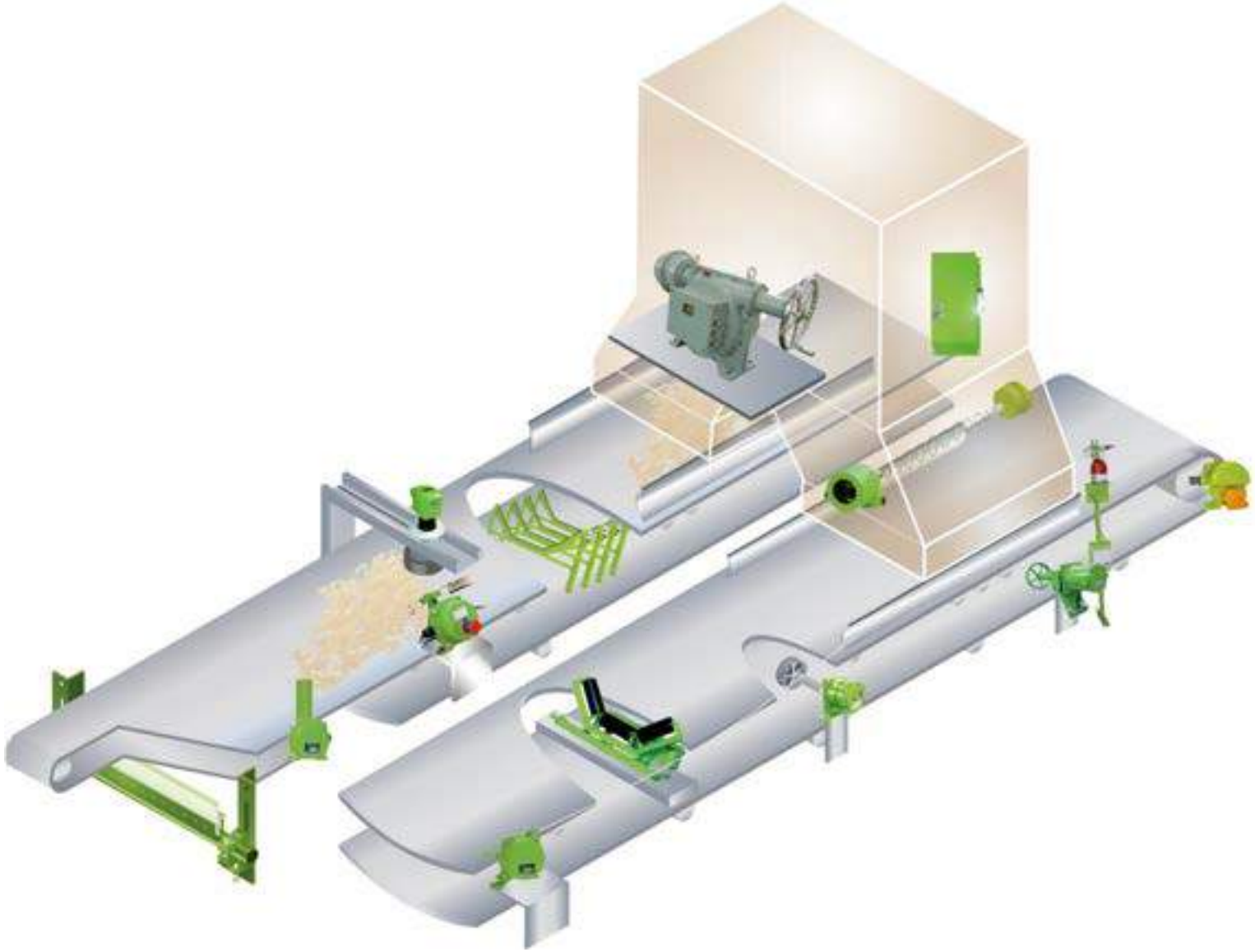
Belt Conveyor Protection Equipment



Today's topics

1. **Countermeasures for trouble on belt conveyor operation**
   (Mr. Mamoru OMURA, Regional Sales Manager at MMT)
   a. Typical troubles / accidents
   b. General countermeasures

2. **Introduction of safety and protection devices**
   (Mr. Mamoru OMURA, Regional Sales Manager at MMT)
   a. Safety devices against each accident
   b. Technical advice for each device

3. **Proposal from Matsushima Measure Tech Japan**
   (Mr. Kazuhito MAEDA, Marketing Manager at MMT)
   a. Belt Tear Detector
   b. Conveyor Power Generator

4. **Question and Answer** session

Belt Tear Detector
(Longitudinal belt rip protection)

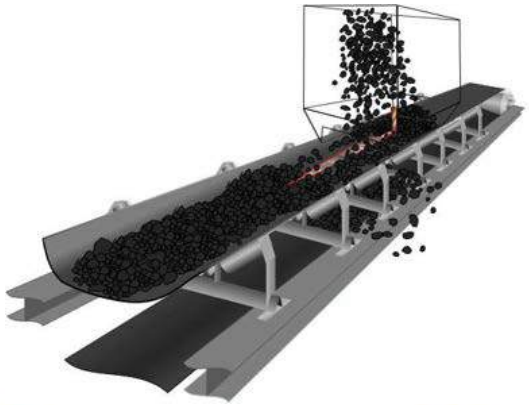
Belt Tear Detector
(Longitudinal belt rip protection)

Once a foreign material gets stuck into the conveyor……..

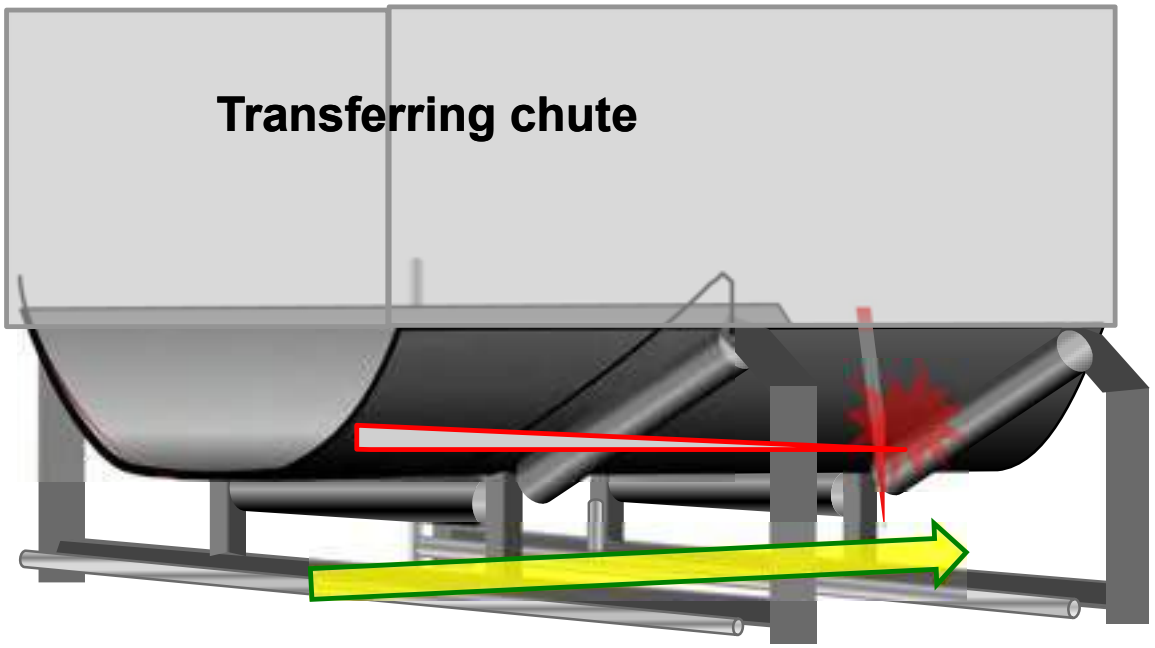
**The conveyor continues to move,
the rip expands and materials are fallen out.**

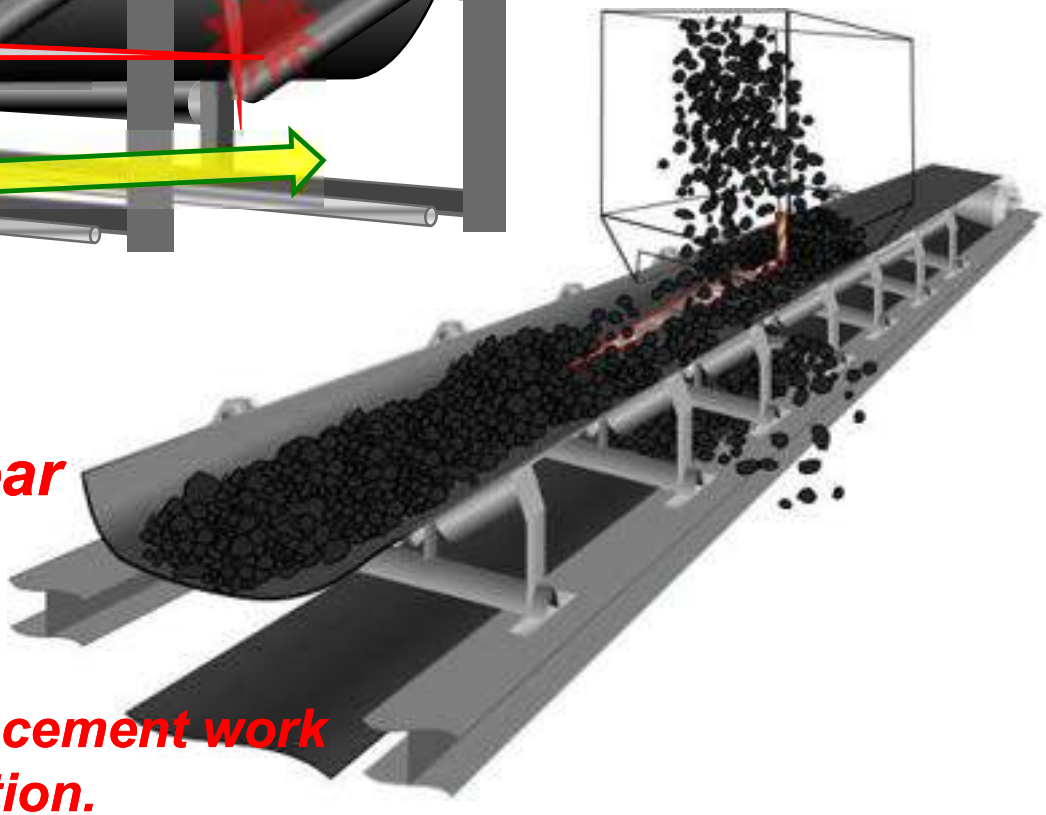
**Eventually,
A whole set of the belt needs to be replaced!!**

Transferring chute



Belt Tear Detector



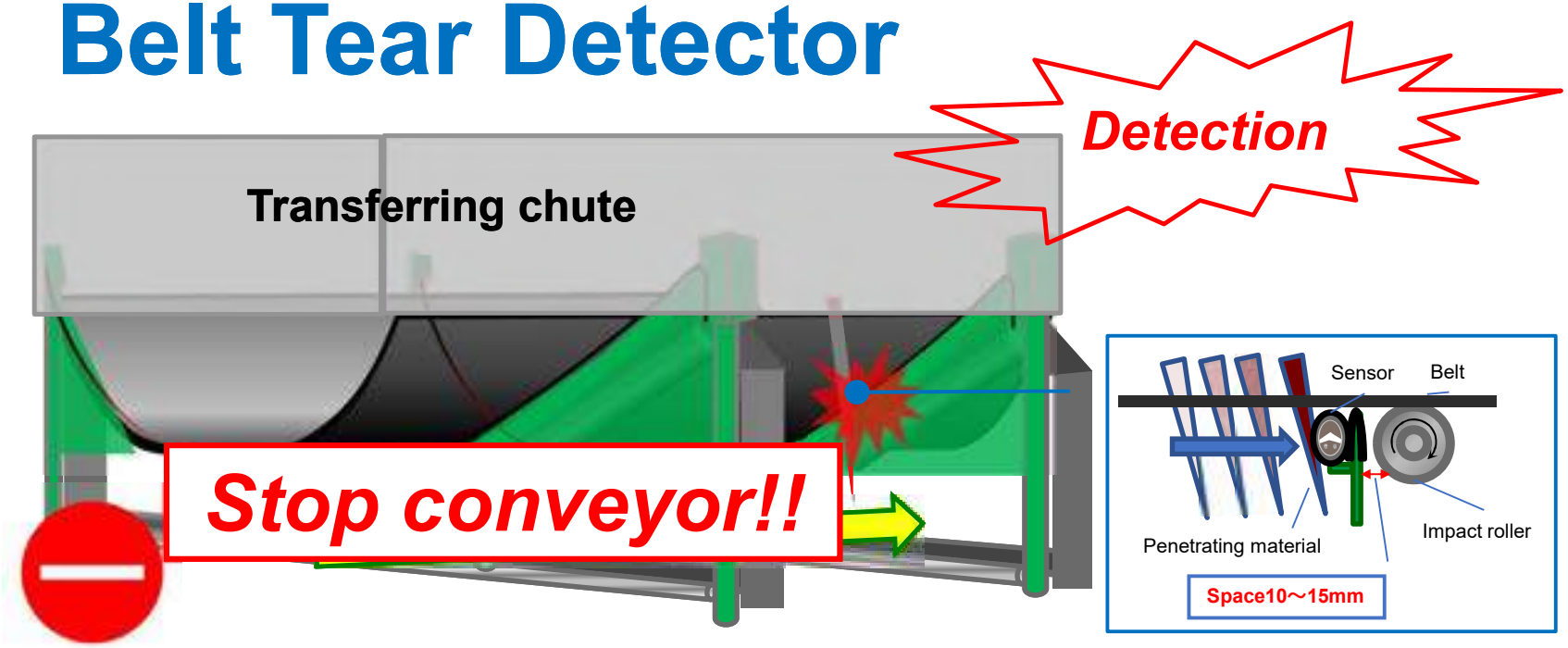


Longitudinal Belt tear

⇩

Tremendous loss of replacement work and cost, and stop operation.

Belt Tear Detector



If any material penetrates belt,

↓

It pushes the sensor before contacting the impact roller. Our detector finds it, and makes a detection signals.

↓

Stop the motor of the conveyor!!

Belt Tear Detector

/ Pipe conveyor model

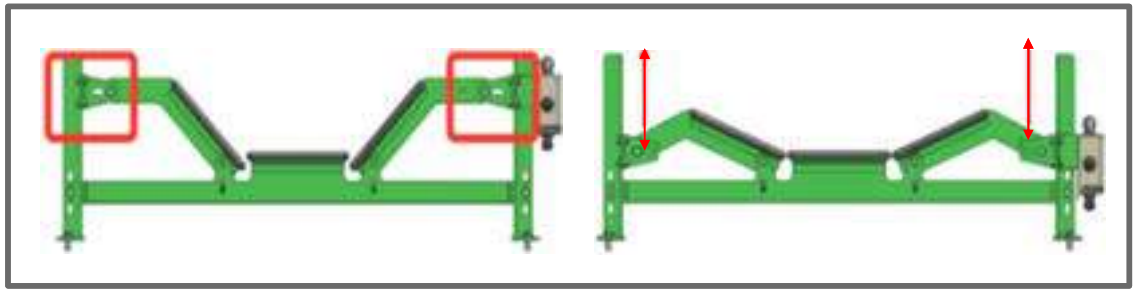
< Features >

- The sensitive sensor (touch switch) is applied, same as Belt Tear Detector for belt conveyor.
- It is applicable in heavy environment
- It can be designed and manufactured in accordance with each conveyor dimension.

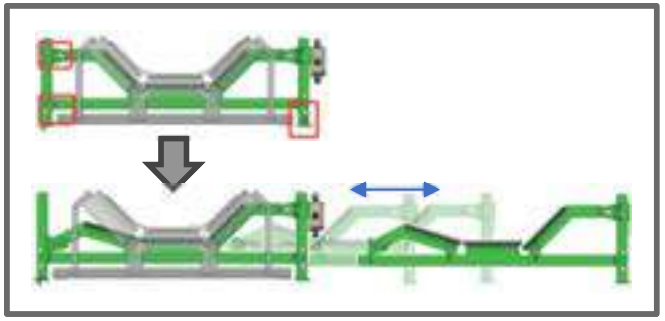
New type Belt Tear Detector
/ Tomcat type detector

< *Features of Tomcat type* >

1. The trough angle can be adjusted at the site.



2. *Remove and Installation are easy.*



4. Power Generator for Belt conveyor monitoring system

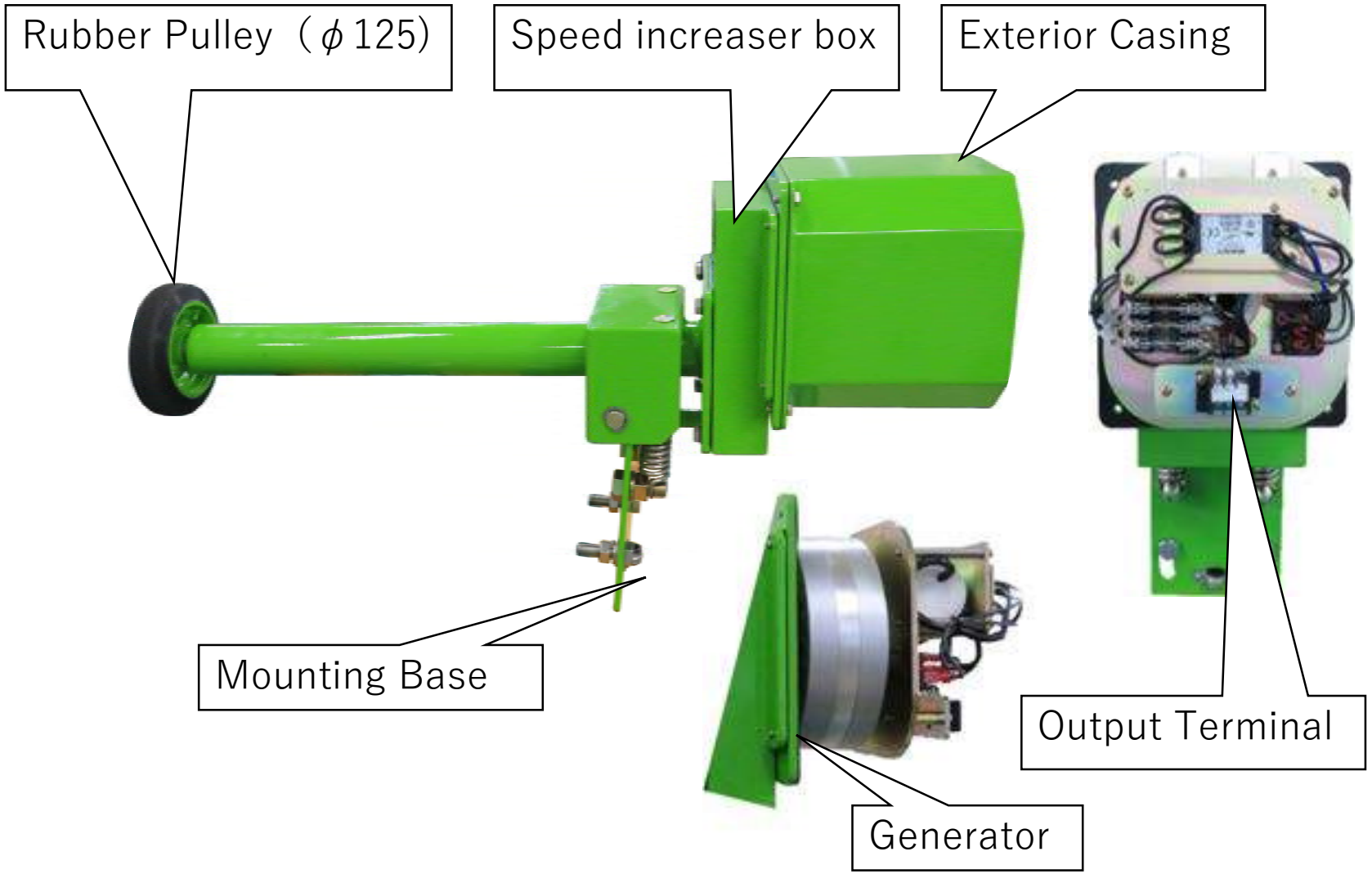
Development background

The purpose of Belt Conveyor is to bring the material, semi-finished goods or finished goods to the next process smoothly. It is widely used at the material handling process.

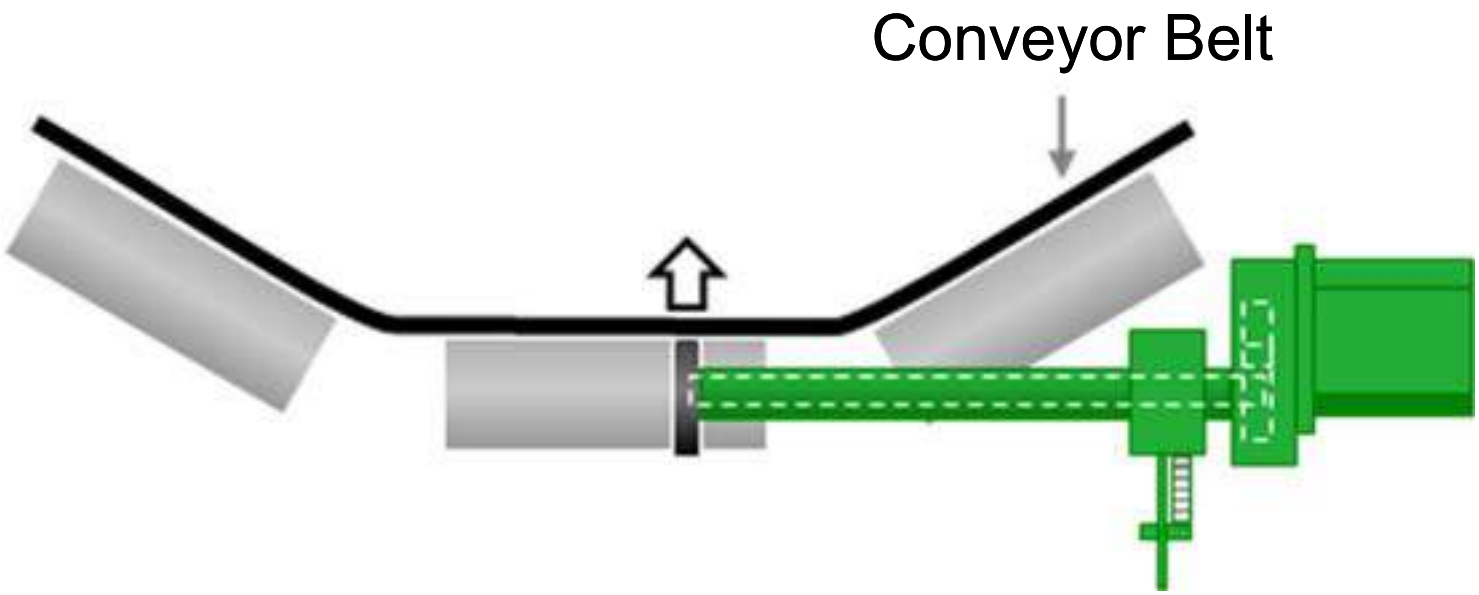
The accident or breakdown of conveyor causes huge losses and may affect the company’s daily operation. Therefore, the demand for the sensors that monitor the sign of malfunction to occur is growing.

As IoT technologies are introduced to the industry, supplying the power to those devices is the major issue to face. That is how the Belt Conveyor Generator is developed.

Overview



Principle



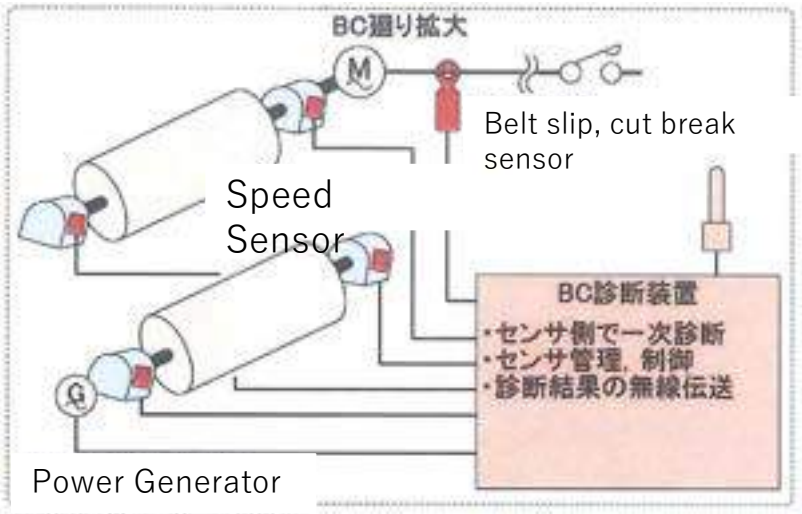
As the belt conveyor operates, the rubber pulley installed beneath it rotates together.

The energy from pulley rotation is conveyed to the generator through internal shaft and speed increaser box to be converted to the electric power.

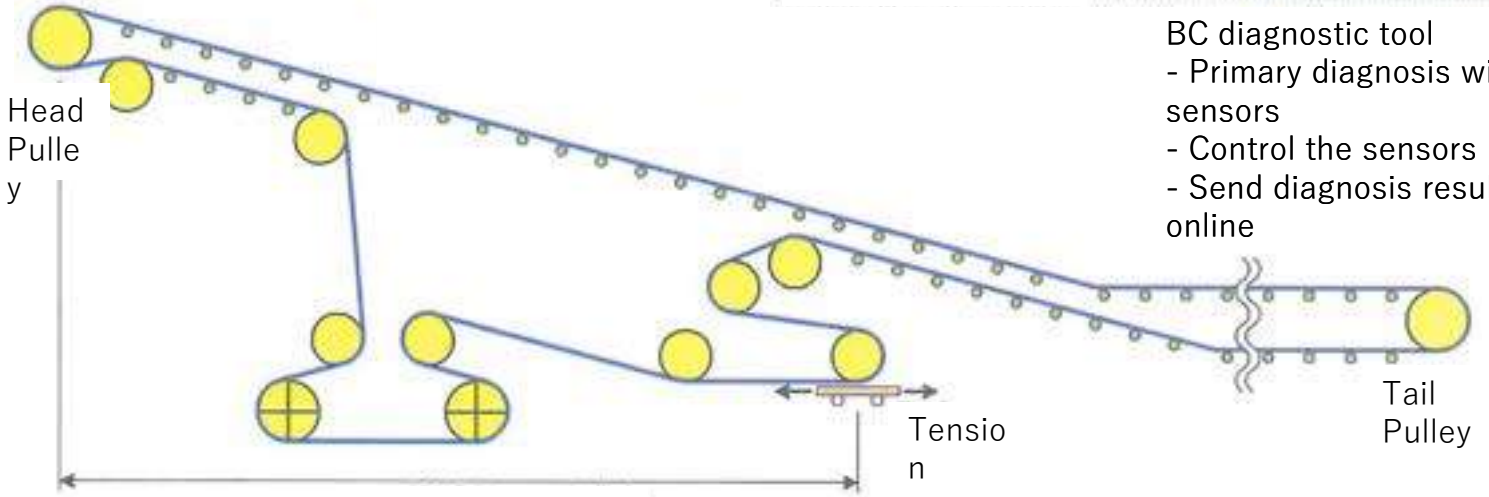
Example of application 1

Driven pulley
Driving pulley

Pulley: 6-12 units/ BC
Point to be monitored: 12-24

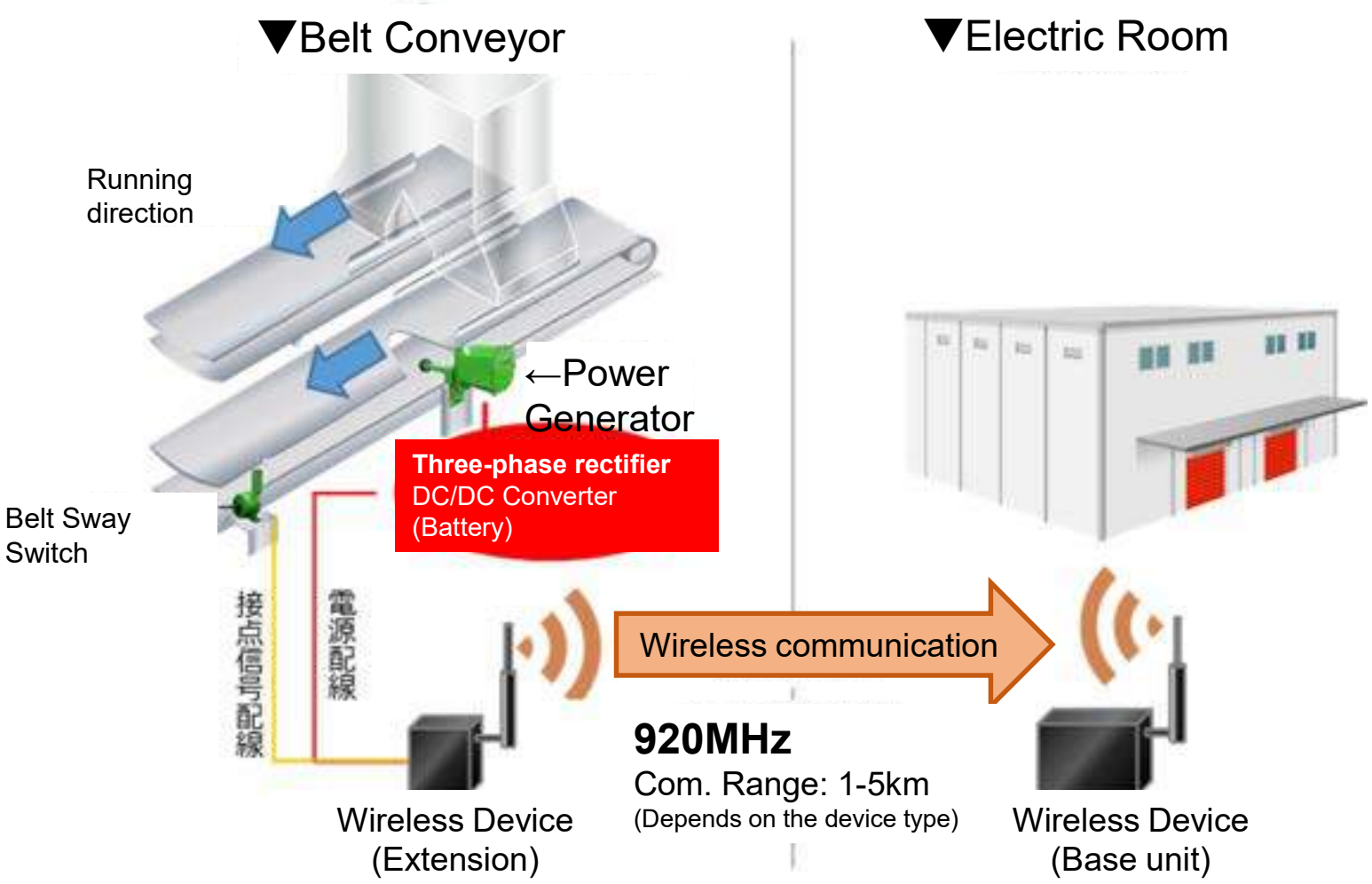


BC diagnostic tool
- Primary diagnosis with sensors
- Control the sensors
- Send diagnosis result online



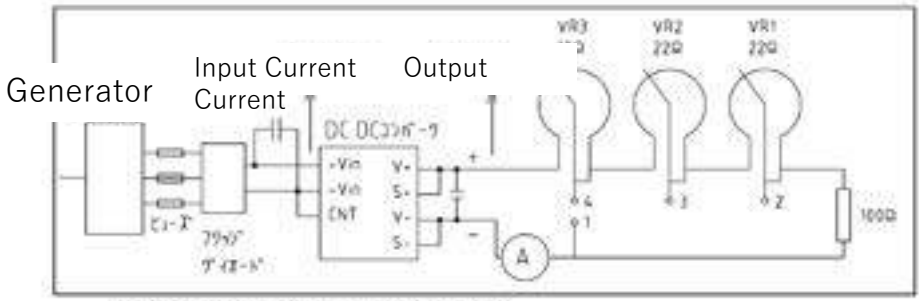
Most pulleys are located at 30-40 meters from the head pulley

Example of application 2



Test result

Test Result with DCDC converter Use-range up type



Mfr. : TDK Lamda
Input:DC60V-160V
Output: DC12V
Output Current: Max 4.2A
Power: Max 50W

* S/T the same load resistance as previous expt.
* Purpose of the test is to confirm if output capacity reaches 37W

Conducted with φ125 Pulley pressed against the dummy belt (rubber wheel) 2020.7.29

160V DCDC Converter
Catalog Spec: 60V - 160V

φ125 pulley Speed-up 1.8/1	79m/min	Rotational Speed: 363rpm

Load Resistance			Voltage		Current A	Current Output W
Short Circuit	Resistant Value		V in	V out		
	Target Value	Actual Value			I	P
non	-	-				0.00
1-2	54.0Ω	51.9Ω	104.5	12.93	0.23	2.73
1-3	32.0Ω	30.4Ω	102.5	12.03	0.39	4.66
1-3 VR2 1/2	22.0Ω	21.9Ω	98.5	12.34	0.62	7.59
1-4	10.0Ω	10.3	96.9	12.34	1.24	15.35
1-4 VR3 3/4	7.5Ω	7.5	94.6	12.38	1.73	21.36
1-4 VR3 1/2	5.0Ω	4.9Ω	92.8	12.38	3.05	37.76
1-4 VR3 3/8	3.8Ω	3.9Ω	99	12.38	5.35	66.23
1-4 VR3 1/4	2.5Ω	*	*	*	*	*

*test aborted: When resistance value is less than 3Ω, it may cause blown fuse

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Matsushima Measure Tech Co., Ltd.

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Nagoya sales office

Osaka sales office

【 Affiliated company 】

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The performance and quality of Matsushima Switch is the world top class!!

2 years warranty period!!

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