PM interval and spares policy — two decisions taken from the asset's reliability record

Menu: CMMS ▸ Assets..., the tab Reliability; CMMS ▸ Spares...

Part 1 — What the function does

What it does. ReliaEn keeps a fitted two-parameter Weibull distribution for every Equipment asset (chapter 6.17). This chapter covers the two decisions taken from it:

Where	The question it answers
The card PM interval on the tab Reliability	At what age should this component be replaced before it fails, and what does the interval the plant has set cost against that?
The column Spares policy from the fitted assets in CMMS ▸ Spares...	What reorder point and maximum keep this part in stock through its lead time?

The card finds the replacement age T* with the lowest long-run cost per hour, and Apply T* to the schedule writes it into the calendar preventive maintenance (PM) schedule. The column adds up the demand of every fitted asset that uses the part, and Apply recommended min/max writes the result into the reorder policy.

From what data. The asset's fitted distribution, a planned-replacement cost Cp and a failure cost Cf, typed or taken from the work orders, the shortest calendar PM schedule, and for a part its lead time, its users and the service level.

When an engineer uses it. When failures are recorded as coded corrective work orders, so that the asset has a fit, and the component is replaced on a calendar PM schedule.

Do not use it when

Situation	Use instead
The asset has fewer than three coded failures	Close more coded corrective work orders, or fit the data in Life Data ▸ Time Dependence ▸ Weibull (2P) distribution...
You want the decision per failure mode	The RCM table on the same tab (chapter 6.19)
You want spares for one planning window with no resupply	System ▸ Spare Parts Optimization...
The PM is triggered by a meter or a condition	Not compared in version 1.0.0

Part 2 — The example's input data

Setting. Pump P-101's mechanical seal is changed every 90 days under the schedule Pump overhaul. The plant prices a planned replacement at 8,000 baht, a failure at 40,000 baht and an hour of downtime at 2,000 baht. The seal kit SP-001 is held at location MAIN with a lead time of 30 days and a minimum of 1, a maximum of 3.

Input	Value
Cp — cost of a planned replacement	8000, already in the file
Cf — cost of a failure	40000, already in the file

Downtime cost per hour	2000, already in the file
Service level	0.95, the default
File in the examples zip	6-PM-Interval-RCM/ReliaEn-Five-Pump-Plant.reliaen: five machines, the pumps P-101 and P-102 and the fans P-103 to P-105, with their work orders, one PM schedule, four parts. Work on a copy

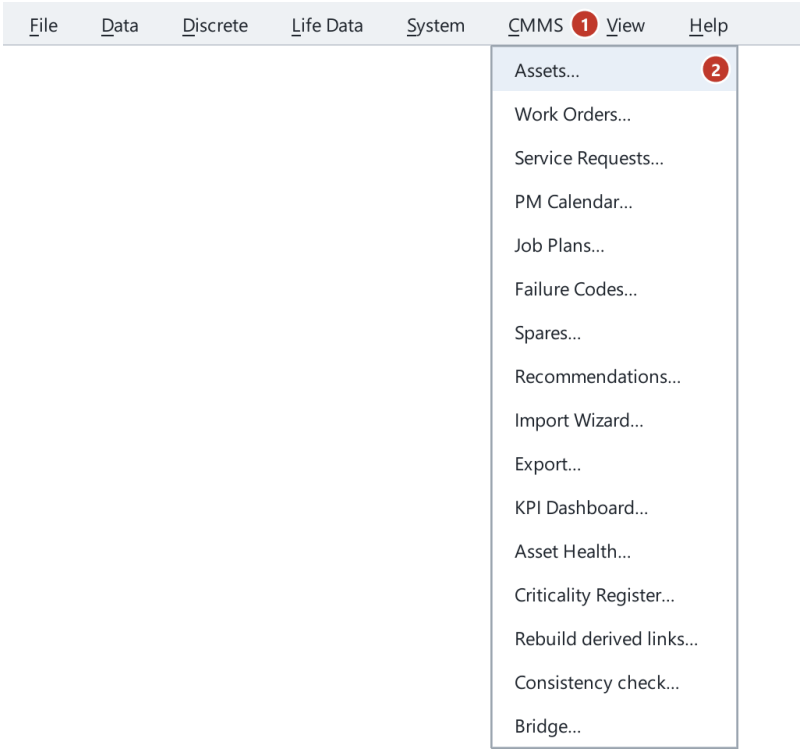
The card PM interval of P-101 as the file opens:



The card PM interval as the file opens

Part 3 — How to use it, step by step

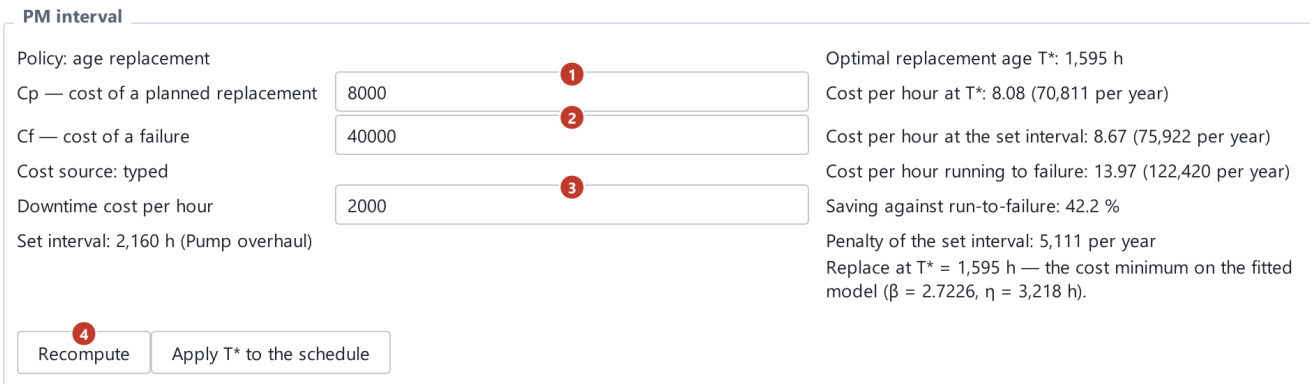
1. **Open a copy of the example's CMMS file, then choose CMMS ▸ Assets...** in the menu bar. The window CMMS — Assets opens.



Step 1 — the menu path

- ① CMMS: the menu.
- ② Assets...: the entry to click.

2. **Select P-101 in the tree, open the tab Reliability and scroll down to the card PM interval.** Steps 3 to 6 work on the card:



Steps 3 to 6 — the three costs

3. ① **Check that Cp — cost of a planned replacement reads 8000.**
4. ② **Check that Cf — cost of a failure reads 40000.**
5. ③ **Check that Downtime cost per hour reads 2000.**
6. ④ **Click Recompute.**

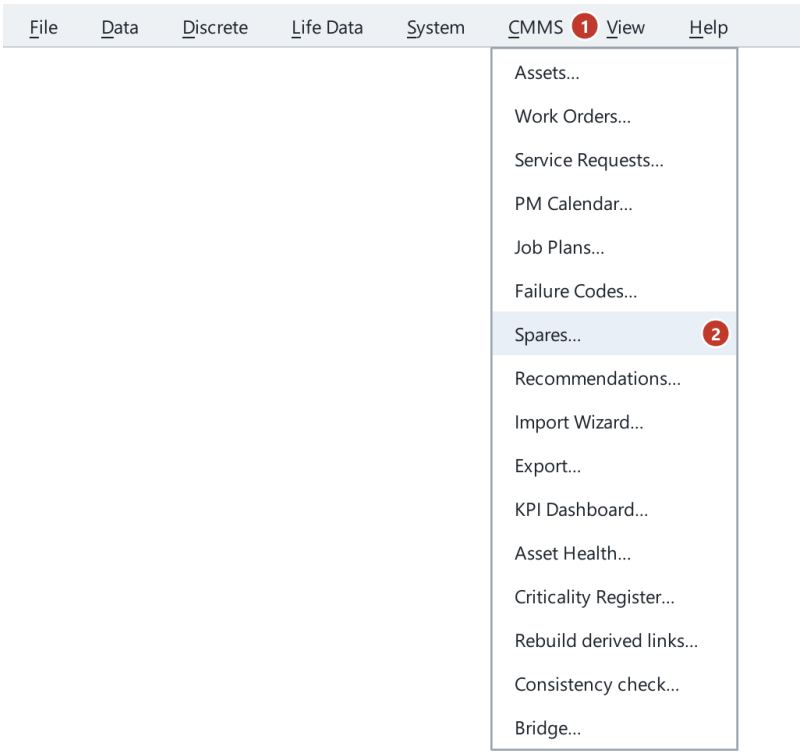
7. **Read the card, then click Apply T* to the schedule:**



Step 7 — the card after Recompute

- ① The cost source.
- ② The set interval.
- ③ T*.
- ④ The cost at T*.
- ⑤ The cost at the set interval.
- ⑥ The cost running to failure.
- ⑦ The saving.
- ⑧ The penalty.
- ⑨ The verdict line.
- ⑩ Apply T* to the schedule.

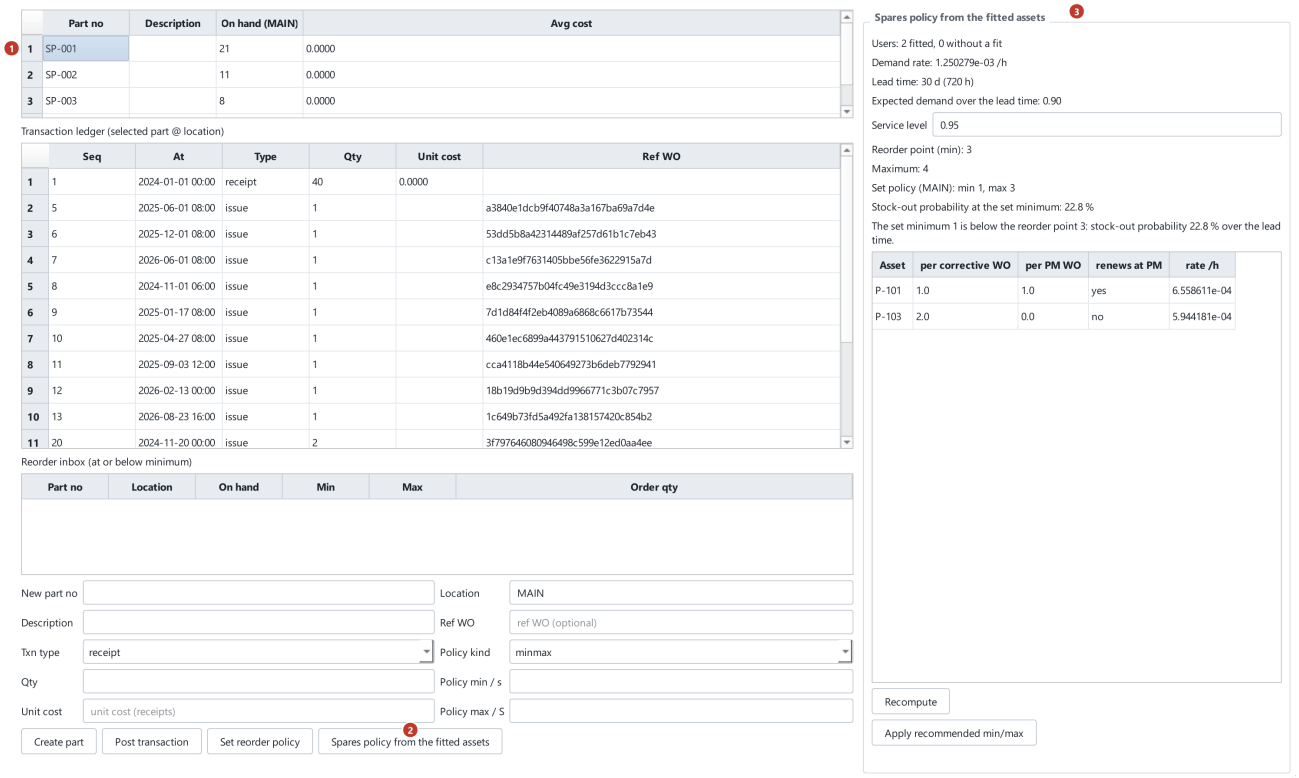
8. **Close the window and choose CMMS ▸ Spares…:**



Step 8 — the menu path

- ① CMMS: the menu.
- ② Spares…: the entry to click.

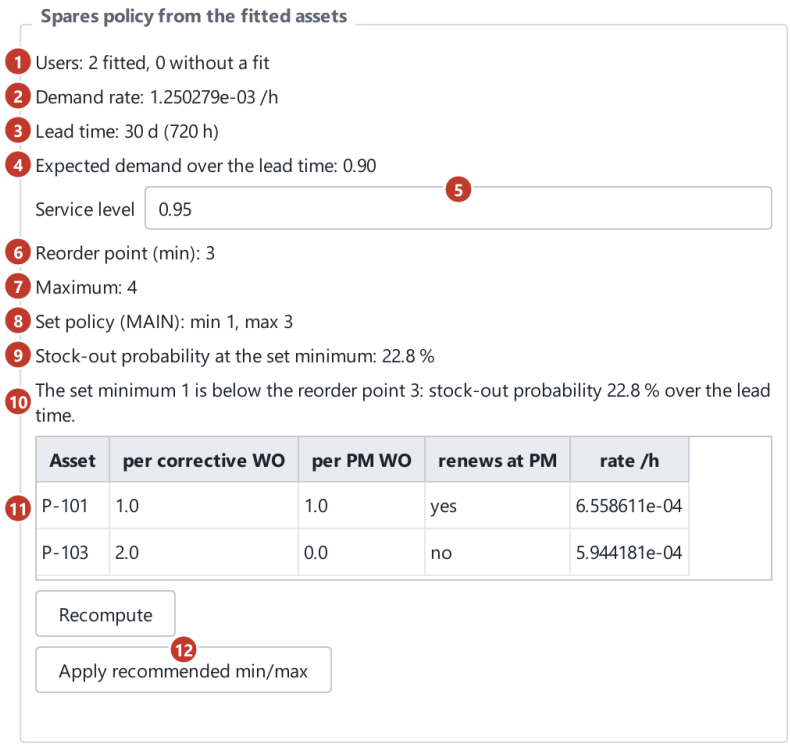
9. **Select SP-001. If the column is hidden, click Spares policy from the fitted assets:**



Step 9 — the window with SP-001 selected

- ① The part SP-001.
- ② The button that shows or hides the column.
- ③ The column.

10. **Read the column, then click Apply recommended min/max:**



Step 10 — the column of SP-001

- ① The users.
- ② The demand rate.
- ③ The lead time.
- ④ The expected demand.
- ⑤ Service level.
- ⑥ The reorder point.
- ⑦ The maximum.
- ⑧ The set policy.
- ⑨ The stock-out probability.
- ⑩ The flag line.
- ⑪ The user table.
- ⑫ Apply recommended min/max.

Part 4 — The result, picture by picture

The card after Recompute:



The card PM interval

- ① Cost source: typed: the card uses the costs in the boxes, not those of the work orders.
- ② Set interval: 2,160 h (Pump overhaul): 90 days of 24 hours.
- ③ Optimal replacement age T*: 1,595 h: the age with the lowest cost per hour.
- ④ Cost per hour at T*: 8.08 (70,811 per year): what the seal costs when it is replaced at 1,595 hours.
- ⑤ Cost per hour at the set interval: 8.67 (75,922 per year): the same for the 90-day schedule.
- ⑥ Cost per hour running to failure: 13.97 (122,420 per year): the same with no planned replacement.
- ⑦ Saving against run-to-failure: 42.2 %: replacing at T* costs 42.2 % less than running to failure.
- ⑧ Penalty of the set interval: 5,111 per year: 75,922 less 70,811, what the 90-day schedule costs a year more than T*.
- ⑨ The verdict: Replace at T* = 1,595 h — the cost minimum on the fitted model (β = 2.7226, η = 3,218 h). β above 1 means the seal wears out, so replacing it by age can pay.
- ⑩ Apply T* to the schedule: enabled.

What to decide. Keep planned replacement: it saves 42.2 % against running to failure. Bring the schedule forward from 2,160 to 1,595 hours to save 5,111 baht a year.

After Apply T* to the schedule:

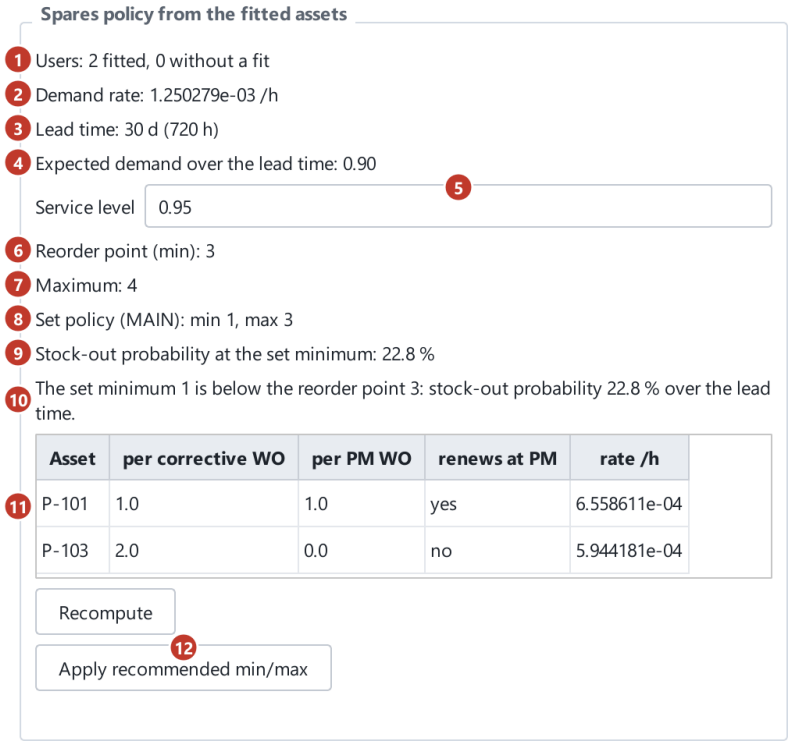


The card after Apply T* to the schedule

- ① Set interval: 1,584 h (Pump overhaul): T* in the schedule's own unit, 1,595 ÷ 24 to the nearest day is 66 days, and 66 × 24 = 1,584 hours.
- ② Cost per hour at the set interval: 8.08 (70,813 per year): now level with T*.
- ③ Penalty of the set interval: 3 per year: what the rounding to whole days still costs.
- ④ Applied: Pump overhaul now every 66 d.
- ⑤ Apply T* to the schedule: disabled, because the schedule already equals T* in whole days.

What to decide. Nothing more on the card. The change is kept in the schedule's interval history and the audit log, and the next PM work orders follow the 66-day interval.

The column of SP-001 after that change:

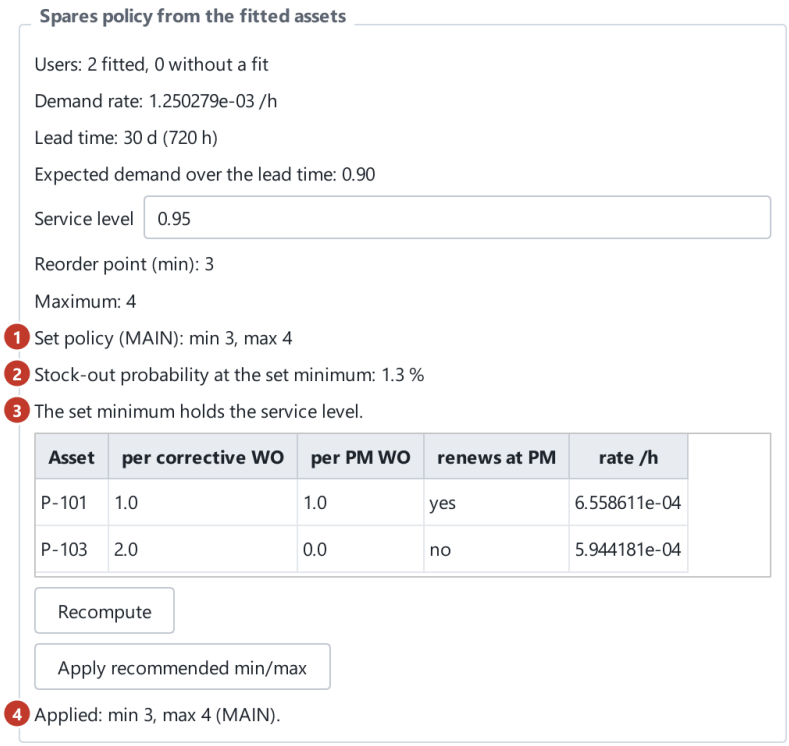


The column of SP-001

- ① Users: 2 fitted, 0 without a fit: both machines that use the kit have a fit.
- ② Demand rate: 1.250279e-03 /h: the two rates of the user table added up.
- ③ Lead time: 30 d (720 h): a reorder takes 30 days to arrive.
- ④ Expected demand over the lead time: 0.90: 1.250279e-03 × 720 hours.
- ⑤ Service level 0.95: the target.
- ⑥ Reorder point (min): 3: the smallest stock that covers the lead-time demand with a probability of at least 0.95. Two kits cover it with 0.937, three with 0.987.
- ⑦ Maximum: 4: the reorder point plus the expected demand rounded up.
- ⑧ Set policy (MAIN): min 1, max 3: the policy the store has today.
- ⑨ Stock-out probability at the set minimum: 22.8 %: the chance that more than 1 kit is needed during a reorder.
- ⑩ The flag line: The set minimum 1 is below the reorder point 3: stock-out probability 22.8 % over the lead time.
- ⑪ P-101 issues one kit per corrective and one per PM work order, and renews at PM is yes, so its rate 6.558611e-04 counts the planned replacements too. P-103 issues two per corrective work order and none at PM: 5.944181e-04.
- ⑫ Apply recommended min/max: enabled.

What to decide. Before Apply T* to the schedule this same column read a rate of 1.099045e-03, a demand of 0.79, a reorder point of 2, a maximum of 3 and a stock-out probability of 18.8 %. The shorter interval uses more kits, so the store has to follow it. Raise the minimum to 3 and the maximum to 4.

After Apply recommended min/max:



The column after Apply recommended min/max

- ① Set policy (MAIN): min 3, max 4: the reorder policy now holds the recommendation.
- ② Stock-out probability at the set minimum: 1.3 %: down from 22.8 %.
- ③ The flag line: The set minimum holds the service level.
- ④ Applied: min 3, max 4 (MAIN).

What to decide. Nothing more to change. The store now reorders the kit when its stock falls to 3.

Part 5 — How to interpret the results

Read the verdict line first. It gives the optimum with β and η, or the reason there is none. No age-based PM justified — run-to-failure or condition-based (β = 0.74448 ≤ 1). is what pump P-102 shows: a component that does not wear out is as likely to fail just after a replacement as before it, so monitor its condition or run it to failure. No economic PM: a failure costs no more than a planned replacement (Cf 5,000 ≤ Cp 5,000). means replacing early never pays.

Check where the costs come from. Clear Cp and Cf and click Recompute, and the card takes them from the work orders: Cp is the mean of the PM orders, Cf the mean of the corrective orders plus the mean time to repair (MTTR) times Downtime cost per hour. On P-101 this gives Cost source: work orders (3 PM, 6 corrective) and a T* of 1,806 hours. The records show what was paid; the typed figure shows what a failure really costs the plant. Decide which to trust before you apply T*.

Never act on a card without the downtime cost. With Downtime cost per hour also cleared, the card adds Downtime cost per hour not set — Cf is the repair cost only. Cf then leaves out the lost production, and on P-101 T* moves out to 2,314 hours, longer than it should be.

A small penalty means the set interval is close enough. The penalty is the yearly price of keeping the plant's interval. Weigh it against the work of changing the schedule.

Look at the spares after every interval change. A part issued at PM follows the PM interval, as SP-001 did here. The card and the column are also calculated again each time a coded corrective work order of the asset closes.

What the two functions do not do. The card optimises age replacement only, against the shortest calendar schedule. The column assumes Poisson demand over the lead time and works for the location in the field Location.

Several people may work on one file. Both Apply buttons write only if the schedule or the policy is still the version the window read. Otherwise ReliaEn refuses by name and writes nothing: open the record again and apply again.