Analysis of Spare Parts Inventory Control Using Economic Order Quantity (EOQ) Method at PT Astra International Tbk. Toyota Sales Operation AUTO2000 Bogor Siliwangi

Sandi Noorzaman [1*] , Maya Andini Kartikasari [2], Muhammad Danawan Esa Abdi [3]

[1,2,3] Sekolah Tinggi Ilmu Ekonomi GICI, Depok, Jawa Barat 16439, Indonesia
[1] s_noorzaman@yahoo.com; [2] maya.said2001@gmail.com; [3] danawanesa@gmail.com
*** corresponding author**

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ABSTRACT

Along with the development of the current technological era is developing very quickly, one of which is land transportation, especially four-wheeled vehicles. From year to year vehicle technology is increasingly advanced so that it attracts people to have use for transportation or goods transportation purposes. However, along with its use, the vehicle needs regular maintenance so that it is always in prime condition and safe when driving. Therefore, companies engaged in vehicle maintenance and repair services need to prepare for the availability of spareparts to meet the needs of their customers. The type of research used is descriptive research. The data used in this study consists of primary data and secondary data that are qualitative in nature related to spareparts inventory. By using the EOQ method the company can save the total cost of inventory for tmo syn 10w-40sn 1lt around 85% or Rp. 2,652,961, tmo syn 10w-40sn 4lt about 89% or Rp. 2,774,200, element sa oil filter around 95% or Rp. 2,904,527, pad kit disc brake fr around 90% or Rp. 1,631,944 and 34b19r hybrid battery around 88% or Rp. 1,202,923.

1. INTRODUCTION

Technological developments are currently developing very fast, one of which is land transportation, especially four-wheeled vehicles. From year to year there are always improvements, both in terms of features and models. Now four-wheeled vehicles are one of the means of transportation that is widely used by the community for traveling, public transportation or goods transportation. Therefore, along with the use of the vehicle, vehicle maintenance cannot be overlooked by the owner of a four-wheeled vehicle so that it is always in good condition and comfortable when driving.

Talking about vehicle maintenance, of course, companies engaged in the automotive sector are certainly not only producers and distributors, but can provide after-sales services, namely providers of spare parts, maintenance and repair of vehicles. Along with the increase in sales of vehicles, especially four-wheeled vehicles, it will certainly affect the demand for spare parts for four-wheeled vehicles in carrying out maintenance or repairs.

Toyota is one of the well-known four-wheeled vehicle brands in Indonesia. Where the level of sales of Toyota vehicles is quite high in the Indonesian market, one of which is the Toyota Avanza. The Toyota Avanza is one of the best-selling types of Toyota branded vehicles in the market, so it is often called the "car of a million people". PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi is a company in the automotive industry engaged in services as a seller, authorized repair shop and supplier of spare parts for Toyota vehicles. Auto2000 Bogor Siliwangi as an Authorized Toyota Dealer, of course, must always provide satisfactory service for each of its customers and the availability of goods needed to meet consumer demand for products must always be considered so that they are fulfilled according to what is needed.

Too much inventory or lack of inventory is one of the obstacles that often occurs in inventory planning and control in a company. Companies must make good inventory planning and control to avoid

this. If the amount of inventory is available as needed, the services provided to consumers will be fulfilled properly.

There are several obstacles related to planning and controlling the supply of spare parts that usually occur at Auto2000 Bogor Siliwangi, namely delays in the supply of spare parts due to supply chain management, stock outs and excess stocks. The delay in supply from the supply chain manager was because the demand for stock from each branch was too high but the time was limited so that the delivery was delayed the next day and also because of an error in ordering spare parts. Out of stock resulted from the demand for spare parts that day was quite high, this is common for spare parts for the type of front brake pads and the Toyota Avanza battery. And the excess stock is caused by the not optimal calculation of the stock that must be available in the warehouse, for example, there are too many engine oil and oil filters for Toyota Avanza vehicles. This causes customer dissatisfaction with the company because the estimated time is longer than promised and can also lead to high spare part storage costs.

Based on these constraints when there is a delay or out of stock, customers are asked to return another day, approximately 2 to 3 working days. However, for some urgent parts, customers are advised to stay overnight until the required spare parts are available. And for excess stock, the spare part clerk keeps it in a separate area so it doesn't interfere with spare part supply activities, this is still not optimal because the warehouse looks full.

Therefore, it is necessary to plan and control spare parts inventory to make it more optimum, then use the application of EOQ (Economic Order Quantity) as an option to calculate how much stock to order, what is the frequency, how much is the safety stock, how many points reorder (reorder point), and how much the total cost of storage in order to obtain an efficient number of spare parts with minimum storage costs.

2. METHOD

This type of research is Descriptive Qualitative, namely scientific research that is descriptive in nature or describes what it is. According to Ramdhan (2021: 7) descriptive research is research with a method to describe a research result. While the qualitative research method is a research method based on the philosophy of postpositivism, used to research on natural object conditions, (as opposed to experiments) where the researcher is the key instrument, data collection techniques are carried out by triangulation (combined), data analysis is inductive/qualitative , and the results of qualitative research emphasize understanding meaning, and constructing phenomena rather than generalizations (Sugiyono, 2018: 19).

The data sources that the authors obtained in this study were primary data, namely collecting data directly in the field according to the subjects studied by researchers through respondents using observation methods according to the subjects studied, for solving problems being handled by researchers and secondary data, namely those obtained by how to read, understand and study through other media sourced from literature and books, to support and complete primary data.

The data analysis technique used in this research uses Economic Order Quantity (EOQ), Purchase Frequency, and Reorder Point (ROP). Processing data using the calculation of the EOQ method:

1. Process data and calculate using the EOQ method to determine the optimal number of orders.
2. Next, calculate the frequency of orders.
3. Next calculate the total cost of inventory.
4. The final stage is calculating the reorder point.

3. RESULTS AND DISCUSSION

Results

In the data analysis and discussion below it is explained that there are two calculation methods used, namely the method used by PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor

Siliwangi with the EOQ method used by researchers. That includes both ordering costs, carrying costs, total inventory costs, and reorder points.

Spare Parts Inventory Control System According to Company Policy

In running a business, every company certainly has its own methods and ways to organize and manage its business processes. Likewise, PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch currently has its own spare parts inventory control process, both from managing the amount of stock that must be available, the cost of ordering spare parts inventory, the cost of storing spare parts inventory and the total cost of spare parts inventory. Currently the policies implemented by the company in controlling spare parts inventory are:

1. For each spare part that is sold, an order for spare parts must be made in the afternoon of the same day to add to the stock that has been reduced.
2. The amount of stock in the warehouse has been determined for each type of spare part, so there is no provision for the amount of safety stock.
3. The order fee has been set at IDR 10,000/order for telephone, internet and order processing costs.
4. Storage fee 1% of the price of the spare part product for the cost of electricity usage.

However, based on research conducted by researchers, it is still apparent that the inventory control process has not been effective and the costs incurred by the company for controlling spare parts inventory are still not efficient. Judging from the process of ordering spare parts, the frequency is still too frequent which causes the ordering cost to be higher.

Order Cost Analysis According to Company Policy

Ordering costs are costs incurred by the company in procuring 5 types of spare parts. According to company policy, ordering spare parts is done for each spare part that is reduced because it was sold on that day. The components for the cost of ordering spare parts include telephone costs, internet costs and ordering processing costs. The following is frequency data, ordering costs per order and annual ordering costs made by PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch in 2021 can be seen in the following table:

Tabel 1. Order Cost Per Toyota Avanza Spare Parts Order in 2021
(order frequency x order cost)

No.	Spare Part Code	Spare Part Name	Order Frecuency (time)	Order Cost per Orders	Order Cost Per Year
1	08880-83575	TMO SYN 10W-40SN 1LT	303	Rp 10.000	Rp 3.030.000
2	08880-83576	TMO SYN 10W-40SN 4LT	301	Rp 10.000	Rp 3.010.000
3	15601-BZ030	ELEMENT SA OIL FILTER	305	Rp 10.000	Rp 3.050.000
4	04465-BZ170	PAD KIT, DISC BRAKE FR	180	Rp 10.000	Rp 1.800.000
5	28800-YZZNJ	ACCU 34B19R HYBRID	135	Rp 10.000	Rp 1.350.000

Sumber: Olah Data, 2022

Storage Cost Analysis According to Company Policy

Storage costs are costs incurred by the company to store inventory of 5 types of spare parts. Based on the company's policy for storage costs is 1% of the price of spare parts per piece for electricity costs and also in carrying out spare parts inventory the company does not apply the amount of safety stock (Safety Stock) but applies a fixed amount of stock that must be available in the spare parts warehouse. The following is the storage cost per unit of 5 types of spare parts at PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch in 2021 can be seen in the following table:

Tabel 2. Toyota Avanza spare parts storage costs in 2021
(Average Order x Storage Fee)

No.	Spare Part Code	Spare Part Name	Fixed Stock Amount (pcs)	Holding Cost per Unit	Holding Cost Per Year
1	08880-83575	TMO SYN 10W-40SN 1LT	168	Rp 1.050	Rp 88.200
2	08880-83576	TMO SYN 10W-40SN 4LT	44	Rp 4.100	Rp 90.200
3	15601-BZ030	ELEMENT SA OIL FILTER	51	Rp 320	Rp 8.160
4	04465-BZ170	PAD KIT, DISC BRAKE FR	5	Rp 5.000	Rp 12.500
5	28800-YZZNJ	ACCU 34B19R HYBRID	3	Rp 7.300	Rp 10.950

Sumber: Olah Data, 2022

Analysis of Total Inventory Cost According to Company Policy

After getting the calculation results from the previously calculated ordering costs and storage costs, it can be seen that the total cost of inventory control or Total Inventory Cost (TIC) based on company policy by adding up the two costs can be seen in the following table:

Tabel 3. Total Inventory Cost Based on Company Policy in 2021

No.	Spare Part Code	Spare Part Name	Order Cost	Holding Cost	Total Inventory Cost
1	08880-83575	TMO SYN 10W-40SN 1LT	Rp3.030.000	Rp88.200	Rp3.118.200
2	08880-83576	TMO SYN 10W-40SN 4LT	Rp3.010.000	Rp90.200	Rp3.100.200
3	15601-BZ030	ELEMENT SA OIL FILTER	Rp3.050.000	Rp8.160	Rp3.058.160
4	04465-BZ170	PAD KIT, DISC BRAKE FR	Rp1.800.000	Rp12.500	Rp1.812.500
5	28800-YZZNJ	ACCU 34B19R HYBRID	Rp1.350.000	Rp10.950	Rp1.360.950

Sumber: Olah Data, 2022

Spare Parts Inventory Control Analysis According to the EOQ Method

The EOQ method allows companies to determine the most optimal number of orders and is definitely more economical with the number of requests. With the optimal number of orders, the company can order spare parts efficiently with minimum inventory costs.

$$EOQ = \sqrt{\frac{2 \times D \times OC}{CC}}$$

Tabel 4. Calculation of Optimal Purchase Quantity (EOQ)

No.	*Spare Part Name*	Total Needed *Sparepart* (D)	Order Cost (OC)/Orders	Holding Cost (CC)/pcs	EOQ
1	TMO SYN 10W-40SN 1LT	10307	Rp 10.000	Rp 1.050	443
2	TMO SYN 10W-40SN 4LT	1296	Rp 10.000	Rp 4.100	80
3	ELEMENT SA OIL FILTER	3688	Rp 10.000	Rp 320	480
4	PAD KIT, DISC BRAKE FR	326	Rp 10.000	Rp 5.000	36
5	ACCU 34B19R HYBRID	171	Rp 10.000	Rp 7.300	22

Order Frequency According to the EOQ Method

$$\text{Frekuensi Pemesanan (I)} = \frac{D}{Q}$$

Tabel 5. Order Frequency According to the EOQ Method

No.	*Spare Part Name*	Total Needed *Sparepart* (D)	EOQ	Order Frequency
1	TMO SYN 10W-40SN 1LT	10307	443	23
2	TMO SYN 10W-40SN 4LT	1296	80	16
3	ELEMENT SA OIL FILTER	3688	480	8
4	PAD KIT, DISC BRAKE FR	326	36	9
5	ACCU 34B19R HYBRID	171	22	8

Sumber: Olah Data, 2022

Order Cost Analysis According to the EOQ Method

Tabel 6. Order Cost Per Year According to the EOQ Method

$$\text{Biaya Pemesanan} = \left(\frac{\text{D}}{\text{Q}} \times \text{S}\right)$$

No.	Nama *Spare Part*	Total Needed *Sparepart* (D)	Optimal Order Amount (Q)	Order Cost (S)	Order Cost Per Year
1	TMO SYN 10W-40SN 1LT	10307	443	Rp. 10.000	Rp 232.664
2	TMO SYN 10W-40SN 4LT	1296	80	Rp. 10.000	Rp 162.000
3	ELEMENT SA OIL FILTER	3688	480	Rp. 10.000	Rp 76.833
4	PAD KIT, DISC BRAKE FR	326	36	Rp. 10.000	Rp 90.556
5	ACCU 34B19R HYBRID	171	22	Rp. 10.000	Rp 77.727

Sumber: Olah Data, 2022

Storage Cost Analysis According to the EOQ Method

Tabel 7. Storage Cost Per Year According to the EOQ Method

$$\text{Biaya Penyimpanan} = \left(\frac{\text{Q}}{2} \times \text{H}\right)$$

No.	*Spare Part Name*	Optimal Order Amount (Q)	Holding Cost (H)	Holding Cost Per Year
1	TMO SYN 10W-40SN 1LT	443	Rp 1.050	Rp 232.575
2	TMO SYN 10W-40SN 4LT	80	Rp 4.100	Rp 164.000
3	ELEMENT SA OIL FILTER	480	Rp 320	Rp 76.800
4	PAD KIT, DISC BRAKE FR	36	Rp 5.000	Rp 90.000
5	ACCU 34B19R HYBRID	22	Rp 7.300	Rp 80.300

Analysis of Total Inventory Cost According to the EOQ Method

After getting the calculation results from the previously calculated ordering costs and storage costs, it can be seen that the total cost of inventory control or Total Inventory Cost (TIC) based on the EOQ method by adding up the two costs can be seen in the following table:

Tabel 8. Total Inventory Cost Based on the EOQ Method in 2021

No.	Spare Part Code	Spare Part Name	Order Cost	Holding Cost	Total Inventory Cost
1	08880-83575	TMO SYN 10W-40SN 1LT	Rp 232.664	Rp 232.575	Rp 465.239
2	08880-83576	TMO SYN 10W-40SN 4LT	Rp 162.000	Rp 164.000	Rp 326.000
3	15601-BZ030	ELEMENT SA OIL FILTER	Rp 76.833	Rp 76.800	Rp 153.633
4	04465-BZ170	PAD KIT, DISC BRAKE FR	Rp 90.556	Rp 90.000	Rp 180.556
5	28800-YZZNJ	ACCU 34B19R HYBRID	Rp 77.727	Rp 80.300	Rp 158.027

Sumber: Olah Data, 2022

Reorder Point

Reorder point is when a reorder must be made by the company. Reorder points can be made if the amount of inventory in stock continues to decrease, therefore business actors must determine when to reorder points so that they do not experience stock shortages or stock outs or excess stock or over stock.

The waiting time that arises due to waiting for spare parts to arrive at the spare parts warehouse is 3 days. Reorder point can be calculated by the formula:

Tabel 9. Spare Part Needs Per Day

$$d = \frac{D}{jumlah\ hari\ kerja\ dalam\ satu\ tahun}$$

No.	*Spare Part Name*	Spare Parts Usage per Year (D)	Number of working days	Needs Per Day (d)
1	TMO SYN 10W-40SN 1LT	10307	305	34
2	TMO SYN 10W-40SN 4LT	1296	305	4
3	ELEMENT SA OIL FILTER	3688	305	12
4	PAD KIT, DISC BRAKE FR	326	305	1
5	ACCU 34B19R HYBRID	171	305	1

Sumber: Olah Data, 2022

Tabel 10. Reorder Point (ROP)

ROP = ($d \times L$)

No.	*Spare Part Name*	Needs Per Day (d)	Lead Time (L)	ROP
1	TMO SYN 10W-40SN 1LT	34	3	102
2	TMO SYN 10W-40SN 4LT	4	3	12
3	ELEMENT SA OIL FILTER	12	3	36
4	PAD KIT, DISC BRAKE FR	1	3	3
5	ACCU 34B19R HYBRID	1	3	3

Sumber: Olah Data, 2022

Discussion

Results of Comparison of Company Policy Inventory Control and EOQ Methods

The results of calculating the comparison of policies used by PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch and Economic Order Quantity (EOQ) calculation results from the optimal number per order, order frequency and total inventory cost for spare parts tmo syn 10w-40sn 1lt, tmo syn 10w-40sn 4lt, element sa oil filter, pad kit disc brake fr and accu 34b19r hybrid at PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch so that it is clear, the authors describe it with the comparison table below.

Comparison of Optimal Amount of Raw Materials (EOQ)

The results of the comparison of the policies of PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch and calculation of the optimal number of spare parts tmo syn 10w-40sn 1lt, tmo syn 10w-40sn 4lt, element sa oil filter, pad kit disc brake fr and accu 34b19r hybrid for 1 year according to EOQ calculations can be seen in the table below this:

Tabel 11. Comparison Results of Optimal Number of Spare Part Orders

No.	*Spare Part Name*	Company policy (pcs)	EOQ calculation (pcs)	Difference (pcs)
1	TMO SYN 10W-40SN 1LT	34	443	409
2	TMO SYN 10W-40SN 4LT	4	80	76
3	ELEMENT SA OIL FILTER	12	480	468
4	PAD KIT, DISC BRAKE FR	2	36	34
5	ACCU 34B19R HYBRID	1	22	21

Sumber: Olah Data, 2022

Based on the data in table 11, it shows that the optimal number of ordering spare parts for tmo syn 10w-40sn 1lt, tmo syn 10w-40sn 4lt, element sa oil filter, pad kit disc brake fr and accu 34b19r hybrid between company policies and the EOQ method has a very large difference in numbers significantly, including 409 pcs of tmo syn 10w-40sn 1lt, 76 pcs of tmo syn 10w-40sn 4lt, 468 pcs of SA oil filter elements, 34 pcs of FR disc brake pad kits and 21 pcs of 34b19r hybrid accu. This means that the method used by the company is still not optimal and has the potential to be lacking so that it can cause too large ordering costs. When compared to using the EOQ method, the number of orders is indeed quite large, but this can meet customer needs quickly and reduce ordering costs because you don't have to order spare parts too often.

Comparison of Number of Order Frequency

The results of the comparison of the frequency of ordering spare parts for tmo syn 10w-40sn 1lt, tmo syn 10w-40sn 4lt, element sa oil filter, disc brake pad kit fr and accu 34b19r hybrid PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch and the calculation of the order frequency according to the EOQ calculation can be seen in the table below:

Tabel 12. Comparison of Number of Spare Parts Order Frequency

No.	*Spare Part Name*	Company policy (kali)	EOQ calculation (kali)	Difference (kali)
1	TMO SYN 10W-40SN 1LT	303	23	280
2	TMO SYN 10W-40SN 4LT	301	16	285
3	ELEMENT SA OIL FILTER	305	8	297
4	PAD KIT, DISC BRAKE FR	180	9	171
5	ACCU 34B19R HYBRID	135	8	127

Sumber: Olah Data, 2022

Based on the data in table 12, it shows that the frequency of ordering spare parts applied by the company is still higher when compared to calculations using the EOQ method, because according to the results of the EOQ calculation the resulting difference is very large, namely tmo syn 10w-40sn 1lt 280 times, tmo syn 10w- 40sn 4lt 285 times, element sa oil filter 297 times, pad kit disc brake FR 171 times and accu 34b19r hybrid 127 times. This means that the method used by the company can generate ordering costs which are quite large when compared to using the EOQ method the company can save on ordering costs that must be incurred.

Comparison of Total Inventory Cost (TIC)

The results of the comparison of the calculation of the total cost according to the policy of PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch and total inventory costs according to EOQ calculations for spare parts tmo syn 10w-40sn 1lt, tmo syn 10w-40sn 4lt, element sa oil filter, pad kit disc brake fr and accu 34b19r hybrid can be seen in the table below :

Tabel 13. Comparison Results of Total Spare Parts Inventory Costs

No.	*Spare Part Name*	Company Policy (Rp)	EOQ Calculation (Rp)	Savings (Rp)	Saving Percentage
1	TMO SYN 10W-40SN 1LT	3.118.200	465.239	2.652.961	85%
2	TMO SYN 10W-40SN 4LT	3.100.200	326.000	2.774.200	89%
3	ELEMENT SA OIL FILTER	3.058.160	153.633	2.904.527	95%
4	PAD KIT, DISC BRAKE FR	1.812.500	180.556	1.631.944	90%
5	ACCU 34B19R HYBRID	1.360.950	158.027	1.202.923	88%

Sumber: Olah Data, 2022

Based on the data in table 13 it can be seen very clearly that PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch can save the total cost of inventory for tmo syn 10w-40sn 1lt around 85% or IDR 2,652,961, tmo syn 10w-40sn 4lt around 89% or IDR 2,774,200, element sa oil filter around 89% 95% or IDR 2,904,527, the FR disc brake pad kit is around 90% or IDR 1,631,944 and the 34b19r hybrid accu is around 88% or IDR 1,202,923. The total inventory costs incurred by the company are currently greater than the calculations according to the EOQ method so that in this case the inventory control system implemented by the company is not optimal. The company can actually save on expenses that are usually made to place an order. Savings based on this calculation can be made if the frequency of orders made by the company is reduced to the optimal point. To get optimal value in ordering spare parts tmo syn 10w-40sn 1lt, tmo syn 10w-40sn 4lt, element sa oil filter, disc brake fr pad kit and accu 34b19r hybrid, companies need to pay attention to the frequency of orders based on EOQ calculations.

4. CONCLUSION

Based on the results of the research and discussion in the previous chapter, the following conclusions can be drawn:

1. The control system implemented by PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch in ordering spare parts almost every day is done because based on company policy that every spare part sold on 1 day, the reduced spare parts must be ordered back on the same day and the company also does not set a Reorder Point (ROP) in control spare parts supply.
2. The optimal number of purchases of PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch using the EOQ method in 2021 is 443 pcs tmo syn 10w-40sn 1lt, 80 pcs tmo syn 10w-40sn 4lt, 480 pcs sa element oil filters, 36 fr disc brake pad kits pcs and accu 34b19r hybrid as many as 22 pcs.

3. Frequency of ordering PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch using the EOQ method in 2021 is tmo syn 10w-40sn 1lt 23 times, tmo syn 10w-40sn 4lt 16 times, element sa oil filter 8 times, pad kit disc brake fr 9 times and 34b19r hybrid accu 8 times.
4. Total inventory cost (TIC) of spare parts for PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch using the EOQ method in 2021 is tmo syn 10w-40sn 1lt of Rp. 465,239, tmo syn 10w-40sn 4lt of Rp. 326,000, element sa oil filter of Rp. 153,633, pad kit disc brake fr of Rp. 180,556 and a hybrid 34b19r battery of IDR 158,027. So the total cost of spare parts inventory calculated according to EOQ is less than that issued by PT. Astra International Tbk. Toyota Sales Operation Auto2000 Bogor Siliwangi Branch, there are savings in spare parts inventory costs if the company uses the EOQ method in its spare parts inventory.
5. The reorder point (ROP) is the right time according to the EOQ method in 2021, namely for 102 pcs of tmo syn 10w-40sn 1lt, 12 pcs of tmo syn 10w-40sn 4lt, 36 pcs of element sa oil filters, pad 3 pcs FR disc brake kit and 3 pcs 34b19r hybrid accu.

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