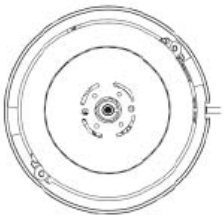
PARTS LIST /TECHNICAL GUIDE

Automatic Cal. 4R15A/16A

[SPECIFICATIONS]

Item \ Cal. No.	4R15A/16A

Movement
[Bridge side] [Calendar side]



- 3 hands (hour, minute, and second hands)
- Calendar (Date: Date disk)
  (Day: Day disk)

Movement size
- Diameter Outside: Ø 27.4 mm
  Casing: Ø 27.0 mm
- Height: 5.25 mm

Driving system		Automatic winding				
Additional function		Automatic winding function * Day and date correction function				
Crown operation	Normal position	Free				
	1st click position	*Day and date correction				
	2nd click position	Time setting (Hour and minute)				
Vibration per hour		21,600 (6 beats per second)				
Loss/Gain	Daily rate worn on the wrist at temperature range between 5 °C and 35 °C)	Between -35 and +45 seconds				
	Standard rate for measure-ment	Mainspring wind up status	Fully wind up			After 24 hours from fully wind up
		Testing positions	Dial upward: T0 (CH)	6 o'clock at the top	9 o'clock at the top	Dialupward : T24 (CH)
		Measurement (daily rate in seconds:s/d)	± 20 s/d	± 30 s/d	± 30 s/d	(Isochronism fault: T24-T0) ± 30 s/d
Regulation system		ETACHRON system				
Lift angle of the escapment		53 °				
Continuous operating time		From fully wound to stoppage: Approximately 50 hours				
Number of jewels		22 jewels				

* Cal. 4R15A has only date but without day. Descriptions related to day display and day correction are only applicable for Cal. 4R16A.

SEIKO WATCH CORPORATION

SPECIFICATIONS

FEATURES

SEIKO Automatic Cal.4R series is developed based on the most popular Cal. 7S series design with two improved specifications.

1. Longer duration period (=more than 50 hours) realized by a new design of the barrel with mainspring made of the high elastic material SPRON 510 (a registered trademark of Seiko Instruments Inc.)
2. Quality finish of the oscillating weight with the "Cotes de Geneve"

CHARACTERISTICS OF A MECHANICAL WATCH

1. This mechanical watch operates using power obtained from a mainspring.
2. While loss/gain of a quartz watch is indicated by a monthly or annual rate, accuracy of a mechanical watch is normally indicated by a daily rate (loss/gain per day).
3. Normal usage accuracy of a mechanical watch varies according to conditions of use (time period that the watch is worn on the wrist, temperature environment, hand movement, and winding state of the mainspring).
4. When the watch is affected by strong magnetism, it temporarily gains or loses time. If the watch encounters a strong magnetic field, the parts of the watch may be magnetized. In this case, repairs such as removal of magnetism are required.

PARTS LIST

Disassembling procedures Figs. : ① → ⑱

Reassembling procedures Figs. : ⑱ → ①

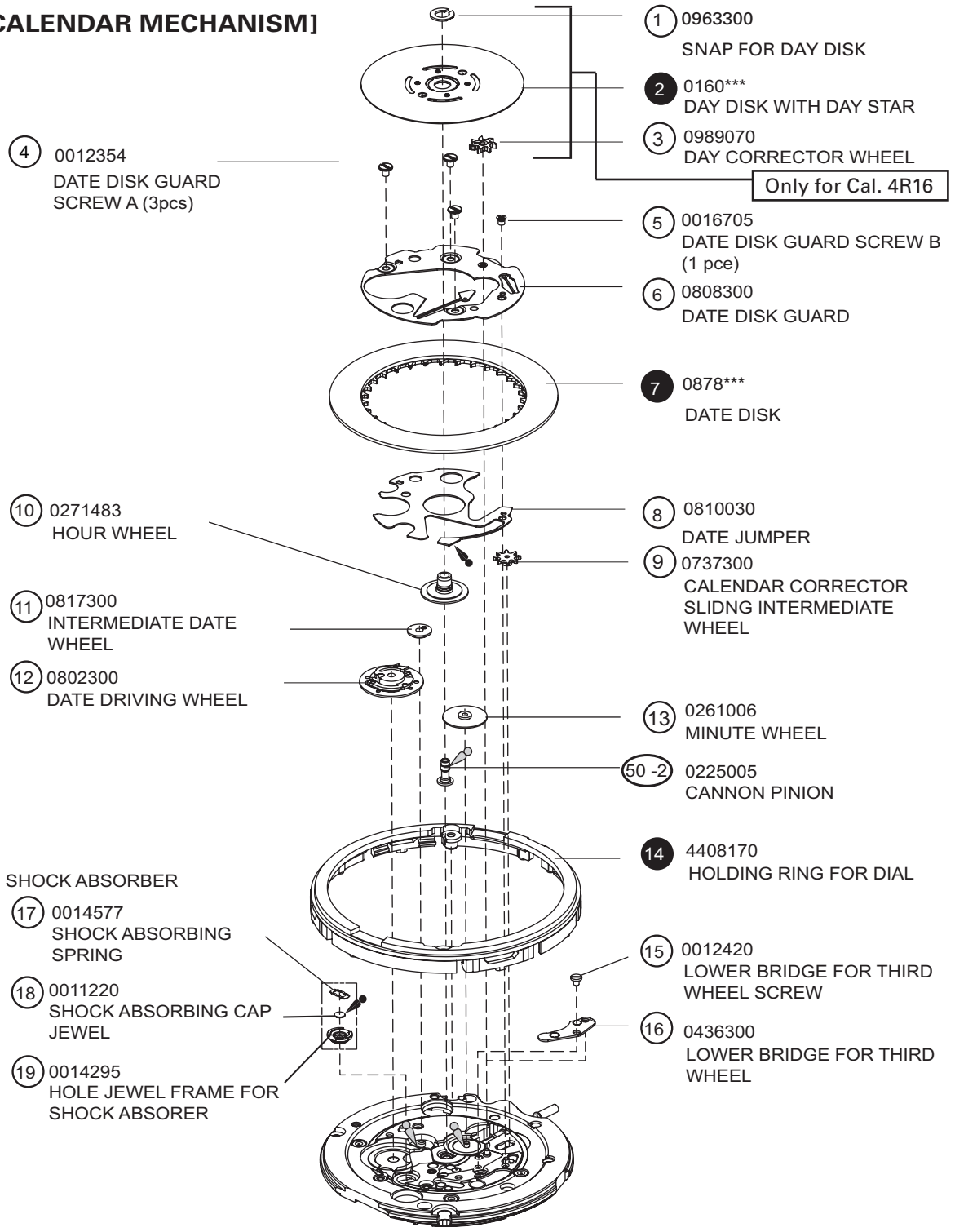
Lubricating: Types of oil

- AO-3 (Moebius A)
- SEIKO Watch Oil S-6
- SEIKO Watch Oil S-4

Oil quantity

- Liberal quantity
- Normal quantity
- Small quantity

[CALENDAR MECHANISM]

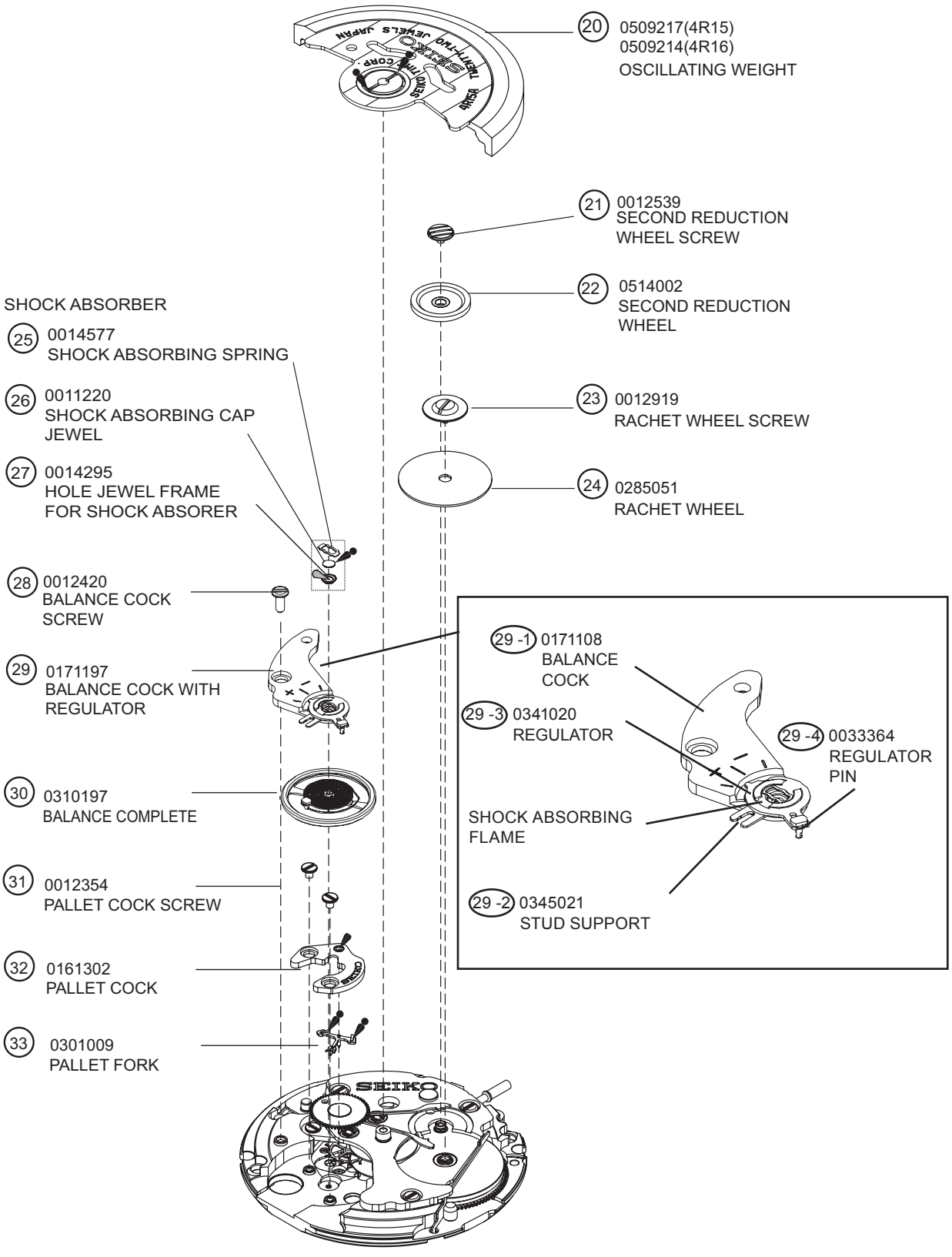


For parts ❷, ❼ and ⓮, refer to “REMARKS” on page 6.

PARTS LIST

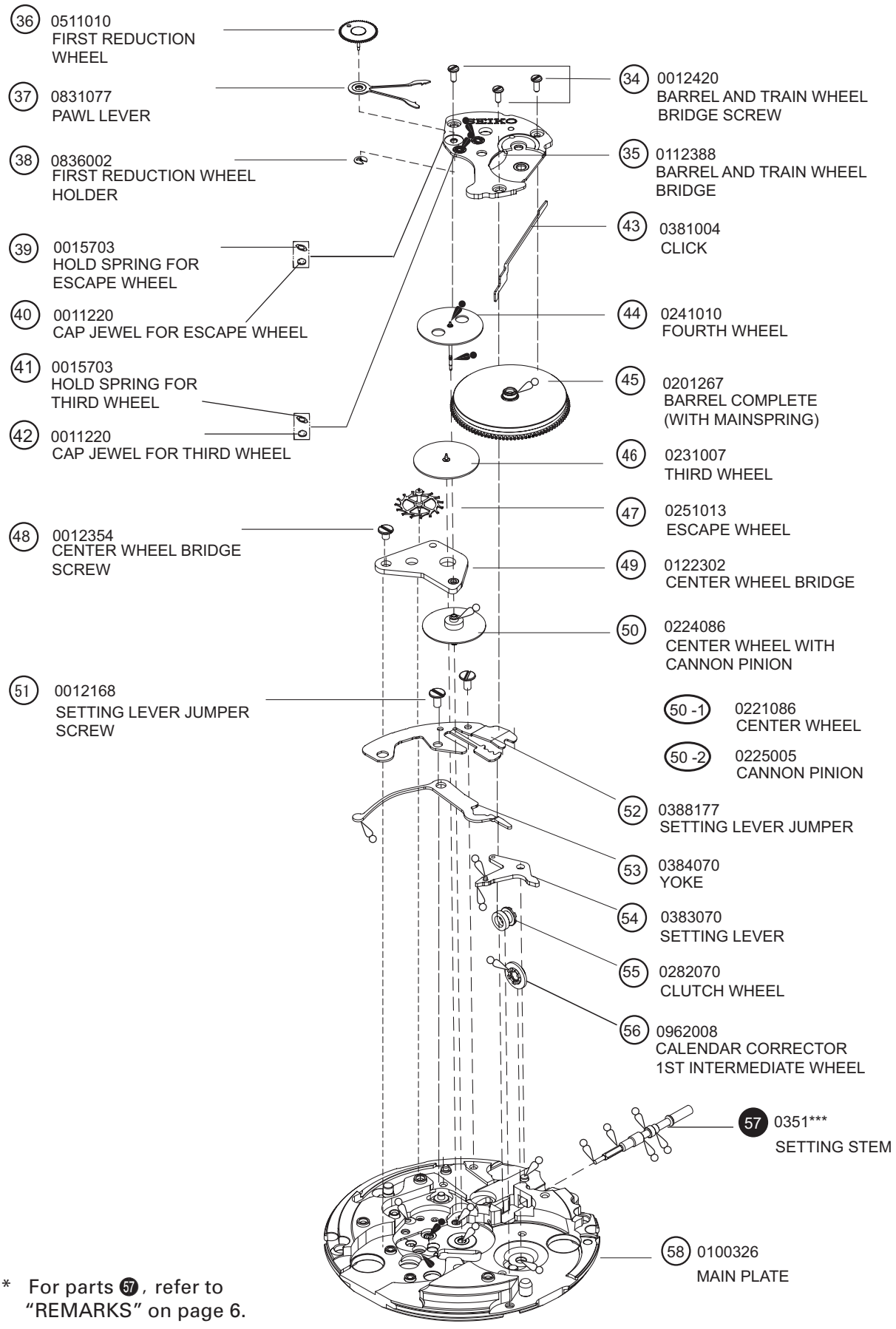
[BALANCE AND ESCAPEMENT]

[WINDING MECHANISM (1)]



PARTS LIST

[WINDING MECHANISM (2), GEAR TRAIN MECHANISM AND SETTING MECHANISM]



* For parts ⓱, refer to "REMARKS" on page 6.

PARTS LIST

REMARKS

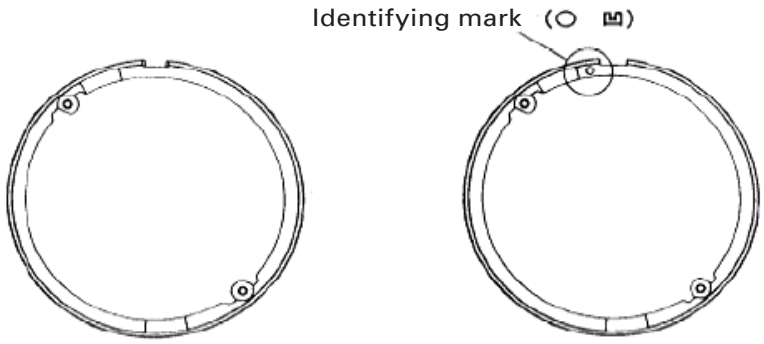
● How to find the correct parts, if not determined by 4 digit caliber number

Following parts are determined based on the design of watches, such as hands height, dial color, and design of cases. Please refer to the SEIKO WATCH PARTS CATALOGUE in order to choose corresponding parts.

❷ DAY DISK WITH DAY STAR
0160***

❼ DATE DISK
0878***

⓮ DIAL HOLDING SPACER
4408***
The dial holding spacer for a diver's watch has an identifying mark.

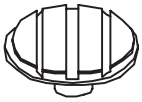
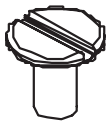


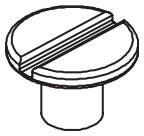
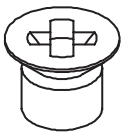
4408170 **4408171**

⓱ SETTING STEM
0351***

PARTS LIST

● How to discrimianate resembled parts

Parts code	Parts name
 **0012 919**	(23) Ratchet wheel screw
 **0012 539**	(21) Second reduction wheel screw
 **0012 168**	(51) Setting level jumper screw

Parts code	Parts name
 **0012 354**	(4) Date dial guard screw A (31) Pallet cock screw (48) Center wheel bridge screw
 **0016 705**	(5) Date disk guard screw B
 **0012 420**	(15) Lower bridge for third wheel screw (28) Balance cock screw (34) Barrel and train wheel bridge screw

PARTS LIST

Location of the jewels

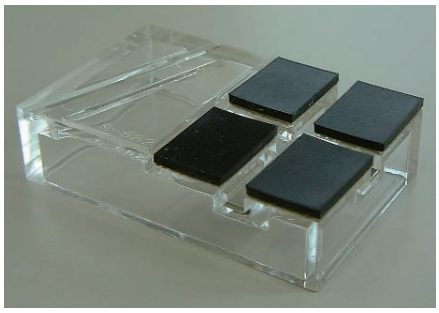
	Upper		Lower	
	Cap Jewel	Hole Jewel	Cap Jewel	Hole Jewel
Center wheel	—	○	—	○
Forth wheel	—	○	—	—
Third wheel	○	○	○	○
Escape wheel	○	○	○	○
Pallet fork	—	○	—	○
Balance	○	○	○	○
First reduction wheel	—	○	—	○
Pallet fork (entry pallet)	○			
Pallet fork (exit pallet)	○			
Balance (roller jewel)	○			
Total	22 jewels			

PARTS LIST

● Tools and consumables required for disassembling/reassembling

• Movement holder

UNIVERSAL MOVEMENT HOLDER
(S-682)



• Watch oils

SEIKO watch grease S-6 and S-4. watch oil AO-3 (or Moebius A)

S-6

AO-3

S-4

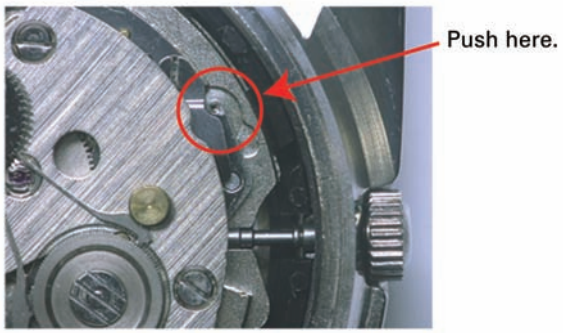
REMARKS ON DISASSEMBLING AND REASSEMBLING THE MOVEMENT

● How to remove the SETTING STEM before dismantling the movement

Crown position: NORMAL

Push the SETTING LEVER gently (refer to the picture on the right) in order to disengage it from the SETTING STEM.

Then pull out the crown with the stem completely.



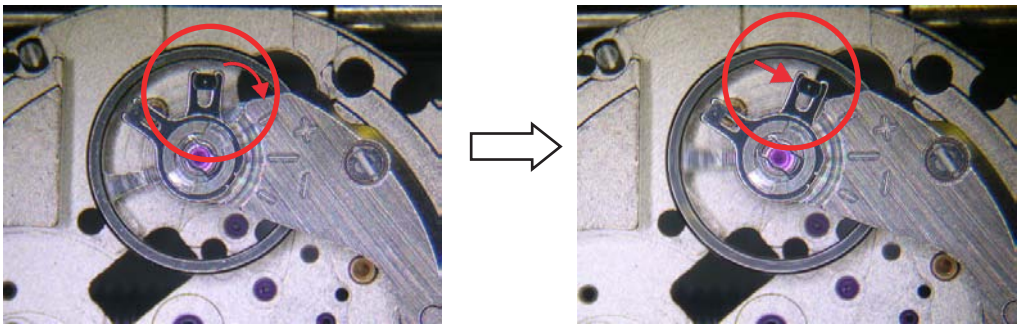
* After dismantling the movement from the case, push back the crown with the SETTING STEM to the movement.

● Balance and escapement

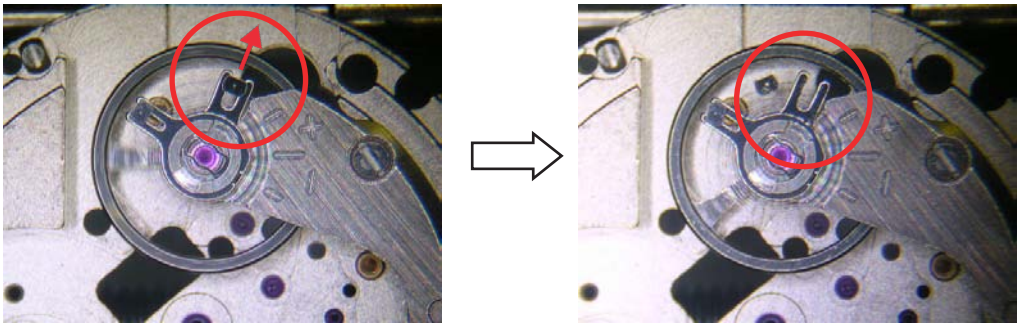
How to disassemble/reassemble the BALANCE and BALANCE COCK

• Disassembling

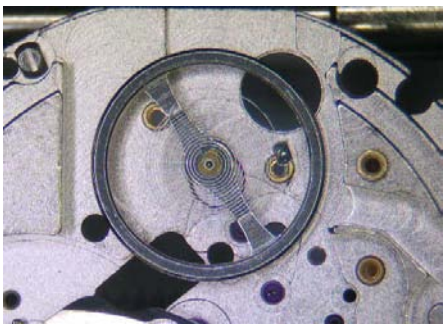
1) Rotate the STUD SUPPORT until it touches to the BALANCE COCK.
When doing so, make sure that the second bend of the balance-spring does not touch the REGULATOR PIN.



2) Push out the stud parallel to the slit of the STUD SUPPORT (the direction also shown by the red arrow in the illustration) in order to remove it from the STUD SUPPORT.



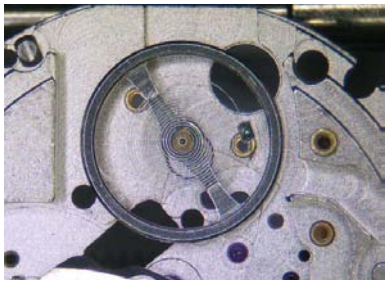
3) Unscrew the BALANCE COCK SCREW and remove the BALANCE COCK WITH REGULATOR.



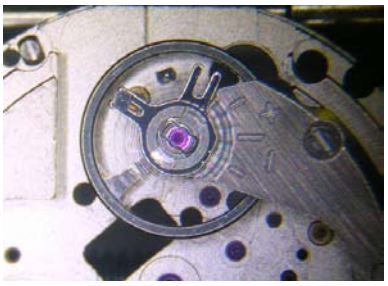
4) Remove the BALANCE COMPLETE WITH STUD.

- **Reassembling**

1) Install the BALANCE COMPLETE WITH STUD to the MAIN PLATE.

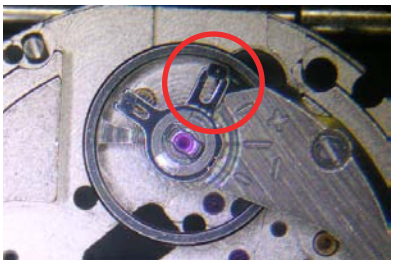


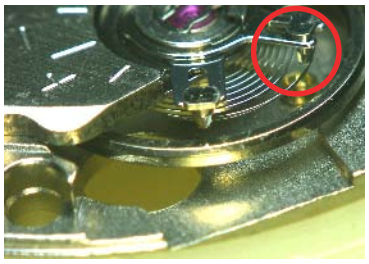
2) Set the BALANCE COCK WITH REGURATOR and tighten the BALANCE COCK SCREW.



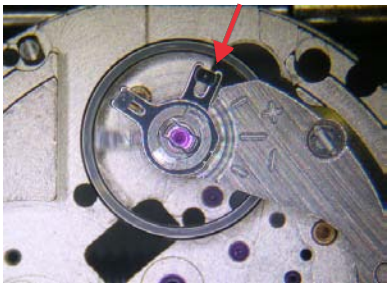
3) Temporarily set the stud to the STUD SUPPORT.

Do not engage the balance-spring to the REGULATOR PIN. The balance-spring passes outside of the REGULATOR-PIN at this stage.





4) Push back the stud parallel to the slit of the STUD SUPPORT.



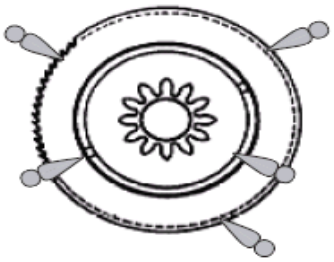
5) Engage the balance-spring with the slit of the REGULATOR PIN.

* When assembling the BALANCE COMPLETE, pay great attention not to deform the balance-spring, especially at the second bend.

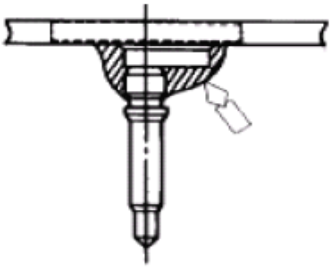
● Winding mechanism

- Lubricating

㉒ SECOND REDUCTION WHEEL
Lubricate the SECOND REDUCTION WHEEL.
Refer to the right figure.

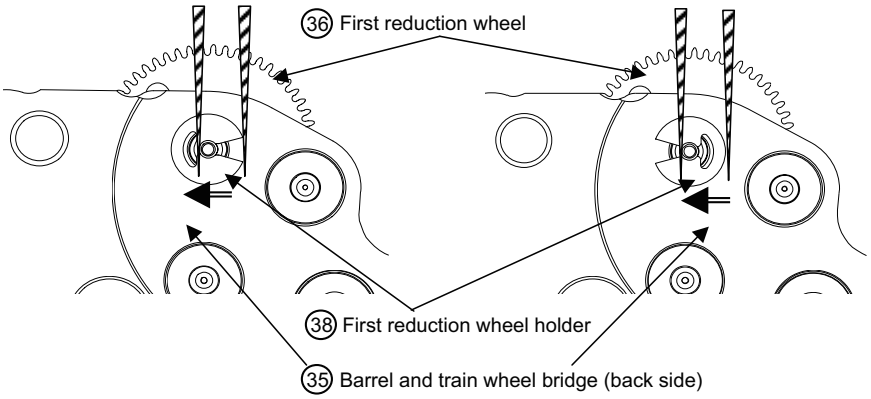


㊱ FIRST REDUCTION WHEEL
Liberally lubricate the FIRST REDUCTION WHEEL.
Refer to the right figure.



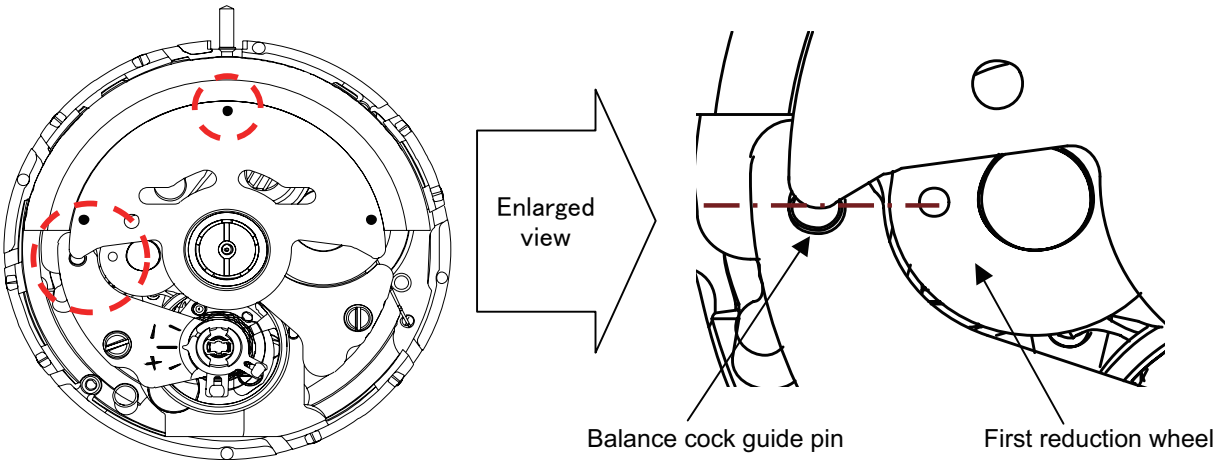
㊳ FIRST REDUCTION WHEEL HOLDER

<< Disassembling >> **<< Assembling >>**



⑳ OSCILLATING WEIGHT

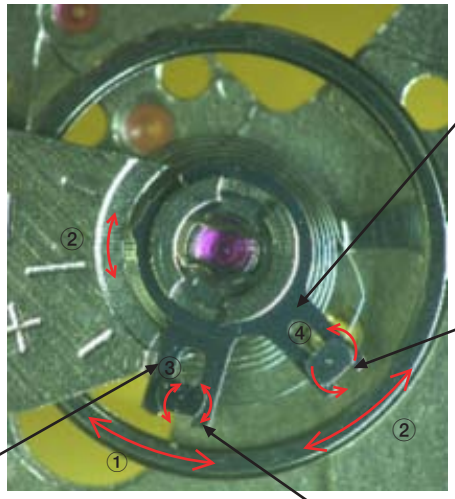
When fixing the OSCILLATING WEIGHT, an alignment with the FIRST REDUCTION WHEEL is necessary in order to wind the MAINSPRING most efficiently. Rotate the FIRST REDUCTION WHEEL manually until its hole aligns with the gilt dot on the BALANCE COCK and set the OSCILLATING WEIGHT vertically at the stem side, and then tighten the screw. Refer to the figure below.



TECHNICAL GUIDE

REGULATION

● Names of the parts for regulation and their functions



② [REGULATOR]
Regulation of the accuracy rate (+) or (-) by adjusting the operative length of the balance-spring

④ [REGULATOR PIN]
Adjustment of the play of the balance-spring embraced in its slit

① [STUD SUPPORT]
Correction of the beat error by positioning the roller jewel correctly

③ [STUD (glued at the balance-spring)]
Alignment of the balance-spring to the center of the regulator pin's slit

● How to regulate the isochronism fault by adjusting the position of the balance-spring

This caliber has the Etachron system for fine regulation of the isochronism fault, which is the same design used for both Cal. 7S-B series and 6R series.

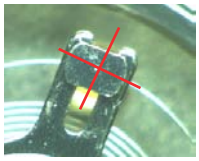
When an amplitude of the balance becomes weak, the watch shows time loss, in general.

By making a clearance of the balance-spring smaller, the decline curve of the instantaneous rate gets shallower.

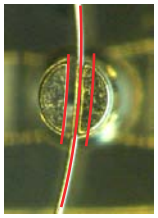
1) Make sure that the REGURATOR PIN is aligned in a vertical position to the REGURATOR and the balance-spring passes parallel through the slot of the REGULATOR PIN before fine-tuning the STUD and the REGULATOR PIN.

REGULATOR PIN

top side view



back side view



angled view

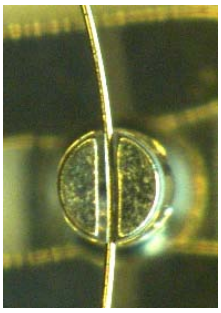
2) Rotate the STUD in order to align the position of the balance-spring passes through the center of the slot of the REGULATOR PIN.

STUD

top side view

REGULATOR PIN

back side view

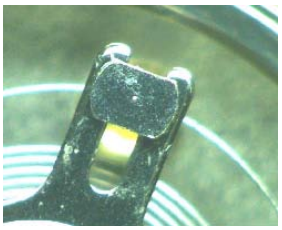


3) Rotate the REGULATOR PIN counterclockwise in order to fine-tune the clearance of the balance-spring passing through the slot of it.

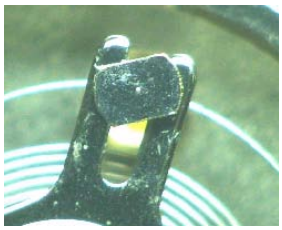
REGULATOR PIN

top side view

Before rotating

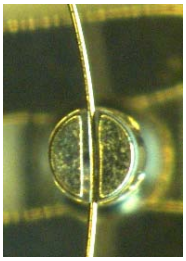


After rotating



back side view

Before rotating



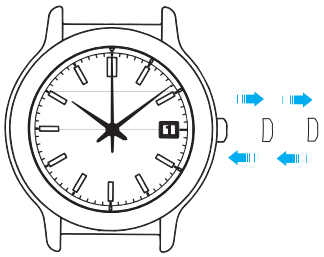
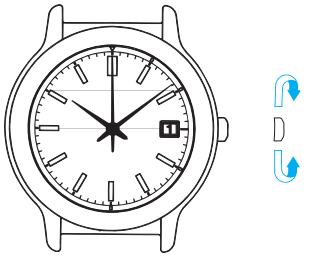
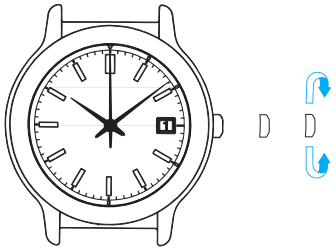
(Maximum clearance)

After rotating

(Minimum clearance)

REMARKS ON INSPECTION AND MEASUREMENT

● Function check

Operation	Function	Checkpoint
 Pull out the crown to the 2nd click and push it back in to the normal position. Repeat the same several times.	Setting mechanism - switching the function of the time setting	Make sure that it has a click at each position and the stem is not pulled off.
 Pull out the crown to the 1st click, then turn it.	Calendar mechanism - correcting the date (and day), if available	Make sure that the date (and day) changes smoothly.
 Pull out the crown to the 2nd click, then turn it.	Setting mechanism - hour and minute hand setting	Make sure that the hour and minute hands move smoothly (without touching each other or touching the surface of the dial or inside of the glass).
	Hands installation	
	Calendar mechanism - date change	Make sure that the date changes when the hour and minute hands pass around midnight.

● Water resistance test

Check the water resistance according to the designated specification of the watch.

Marking on the case back	Test method	Applied pressure
WATER RESISTANT (WATER RESIST)	Air leak test	3 BAR
WATER RESIST 5BAR	Water pressure test ⇩ Condensation test	5 BAR
WATER RESIST 10BAR		10 BAR
WATER RESIST 15BAR		15 BAR
WATER RESIST 20BAR		20 BAR
SCUBA DIVER'S (AIR DIVER'S) 150 m	Condensation test ⇩ Water pressure test ⇩ Condensation test	18.75 BAR = 150 (m) times 0.125
SCUBA DIVER'S (AIR DIVER'S) 200 m		25 BAR = 200 (m) times 0.125
He-GAS DIVER'S 300 m		37.5 BAR = 300 (m) times 0.125
He-GAS DIVER'S 600 m		75 BAR = 600 (m) times 0.125
He-GAS DIVER'S 1000 m		125 BAR = 1000 (m) times 0.125

● Accuracy test

Measure the rate in three different positions within 30 minutes after the watch is fully wound up (wait approximately for 5 minutes after winding up in order to get a stable oscillation of the balance) and make sure the value shows within the range in the table below.

Measure the rate in dial-up position after 24 hours from fully wound up (T24) and check the rate difference with the rate in dial-up position when it is fully wound up (T0). Make sure that the value of T24-T0 shows within the range of the isochronism in the table below.

Standard rate for measurement	Mainspring wind up status	Fully wind up (T0)			After 24 hours from fully wind up (T24)
	Testing positions	Dial upwards: T0 (CH)	6 o'clock at the top	9 o'clock at the top	Dial upwards: T24 (CH)
	Measurement (daily rate in seconds:s/d)	±20 s/d	±30 s/d	±30 s/d	(Isochronism fault: T24-T0) ±30 s/d

ACCURACY OF MECHANICAL WATCHES

- The accuracy of mechanical watches is indicated by the daily rates of one week or so.
- The accuracy of mechanical watches may not fall within the specified range of time accuracy because of loss/gain changes due to the conditions of use, such as the length of time during which the watch is worn on the wrist, arm movement, whether the mainspring is wound up fully or not, etc.
- The key components in mechanical watches are made of metals which expand or contract depending on temperatures due to metal properties. This exerts an effect on the accuracy of the watches. Mechanical watches tend to lose time at high temperatures while they tend to gain time at low temperatures.
- In order to improve accuracy, it is important to regularly supply energy to the balance that controls the speed of the gears. The driving force of the mainspring that powers mechanical watches varies between when it is fully wound and immediately before it is unwound. As the mainspring unwinds, the force weakens.

  Relatively steady accuracy can be obtained by wearing the watch on the wrist frequently for the self-winding type and winding up the mainspring fully everyday at a fixed time to move it regularly for the wind-up mechanical type.
- When affected by external strong magnetism, a mechanical watch may loss/gain time temporarily. The parts of the watch may become magnetized depending on the extent of the effect. In such a case, consult the retailer from whom the watch was purchased since the watch requires repair, including demagnetizing.

● Duration time test

Check the continuous ooperating time of the watch after the mainspring is fully wound up and leave it oon natural condition with the dial-up position. Make sure that the watch runs **more than 50 hours** until it stops.