Advanced Pneumatic Knee

NK-1H

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# MEMO

# 2. Main Specifications

## <Specifications>

**Type : NK-1H (NK-1Hs)**

**Weight : 910 g (910g)**

**Maximum Knee Flexion:160 degrees**

**Working Temperature Range**
**: -20 to 50 °C**

**Maximum allowable load: 125kg**

("Maximum allowable load" is defined as the total weight of the amputee, prosthesis and any load being carried. Although the NK-1H is engineered with a safety margin to allow for temporary everyday situations, prolonged or excessive exceeding of the load limit can lead to serious damage to the unit which could result in instability or falling.)

*NK-1Hs with a built-in extension spring.

*These specifications are subject to change without notice.

## <Features>

### Following the Change in Walking Speed

The newly developed pneumatic cylinder enables your knee joint to automatically adjust the swing speed to changes in walking speed.

### Lightweight and Compact

With its high-strength titanium frame, the NK-1H makes the dream of a lightweight and durable prosthesis a reality.

The compact design enables smaller amputees, such as women and children to use the knee joint with ease and comfort.

### Provides Stability in the Stance Phase

The newly designed load brake improves stability in the stance phase and insures a smooth shift to the swing phase.

### Easy Adjustment

Ease of adjustment allows CPOs an easy fitting.



4) After confirming the smooth movement of the joint with bending and extending the knee joint several times, re-install the bolt cover and the screw bolt. (See Figure 9.)

Caution: To prevent the setscrew from loosening, apply an adhesive (Loctite #242 or equivalent) to it.

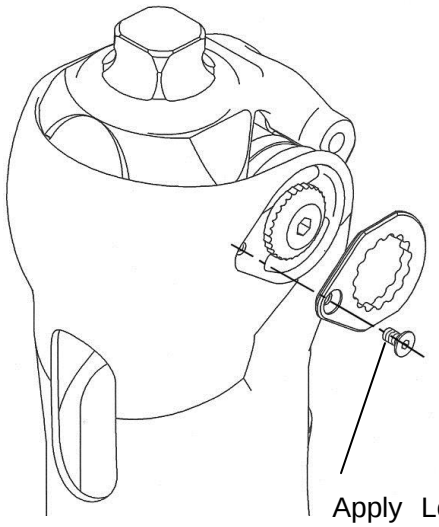



Figure 9.

# 3. Alignment Adjustment

The following is the standard alignments for the NK-1H. NO OTHER ALIGNMENT IS EITHER RECOGNIZED OR PERMITTED.

Set the benchmark alignment of an above-knee prosthesis containing a NK-1H knee joint as follows (see Figure 1):

### 1) Alignment in the Front Plane

As shown in Figure 1 (a), align the prosthesis so that the weight load line passes through the center of the knee and the heel.

### 2) Alignment in the Sagittal Plane

As shown in Figure (b), align the prosthesis so that the weight load line passes 10 - 15 mm in front of the knee joint to a point at the center of the heel and toe-break.

***When setting the alignment, pay attention to the following points:**

① Do not deviate from the standard alignments permitted for this knee joint.

②Doing so could cause excessive force on the knee joint and lead to failure or malfunction of the knee.

* Set the alignment with the knee joint extended fully.



**<Parts List>**

| No. | Name | Tightening torque (N-m) | ＊ |
|---|---|---|---|
| 1 | Frame | － | |
| 2 | Pneumatic cylinder | － | |
| 3 | Knee plate | － | |
| 4 | Brake pad | － | (M) |
| 5 | Pad adjustment screw | － | |
| 6 | M4 Set screw | １．８ | (L) |
| 7 | Crevice pin bolt | ３．７ | (L) |
| 8 | O-ring | － | (G) |
| 9 | Knee cover | － | |
| 10 | Rivet | － | |
| 11 | Brake block | － | |
| 12 | Knee plate shaft | － | |
| 13 | Adjustment plug | － | |
| 14 | Adjustment spring | － | |
| 15 | Spring seat | － | |
| 16 | Knee plate pin | － | (M) |
| 17 | Brake holder | － | |
| 18 | Thrust bearing | － | (M) |
| 19 | Thrust washer | － | |
| 20 | Dust proof cover | － | |
| 21 | M3 screw bolt | － | (L) |
| 22 | Knee axis screw | － | |
| 23 | Bolt cover | － | |
| 24 | Extension stopper | － | |
| 25 | Trunnion pin | ２．４ | (L) |
| 26 | O-ring | － | (G) |
| 27 | Cushion rubber | － | |
| 28 | M4 Set screw | － | (L) |

* The following adhesives and greases are used in assembly:

(L) : Loctite #242 or equivalent

(G) : Lithium grease

(M) : Molybdenum grease

# 4. Load Brake Adjustment

To adjust the load brake, first adjust the prosthesis alignments as described in section 3 and then proceed as follows:

### 1) Brake Force Adjustment (See Figure 2)

① Have the amputees steady themselves by holding on to parallel bars or a handrail.

② Adjust the brake force by slowly turning adjustment screw “A” with a 4 mm hex wrench until the knee does not buckle even when bent 20-30 degrees under full body weight.

Caution: The amputee should be seated during these adjustments. Adjustments are made by turning adjustment screw “A” located in the front of the knee joint as shown in Figure 2.
- Turning adjustment screw “A” clockwise reduces the braking action; turning it counterclockwise increases the braking action.

③ After adjustment, confirm that there is no braking action as the tip of toe leaves the floor even when walking fast and, if possible, when walking down a slope or stairs.
If the brake engages under these circumstances, slowly reduce the braking action by turning adjustment screw “A” clockwise.

### 2) Shaft Clearance Adjustment (See Figure 3)

This adjustment should be made only under the following circumstances:

**①There is backlash and excess play in the knee.**

**②There is heavy resistance at the knee shaft.**

**③Adjustment screw “A” has been fully tightened.**

**④Turning adjustment screw “A” does not effect braking action.**

**(Note that the shaft clearance was optimized at the factory, so additional adjustments are not usually necessary.)**

-The optimum setting of adjustment screw “B” is obtained by tightening the screw with a 3 mm hex wrench to a torque of 0.8 N-m and then backing it off (turning the screw counter clockwise) 135 degrees. (See Figure 3.)

Caution: If there is insufficient braking action, turn adjustment screw “B” clockwise until sufficient braking action is obtained.



### 2) Flexion limit

The terminal impact adjustment valve (TV) is used for this adjustment.
(using a 2 mm hex wrench)

- If the terminal impact is too strong when extending, turn the terminal impact adjustment valve (TV) clockwise by 2-3 marks at a time.
- If the knee is hard to fully extend, turn the TV counterclockwise by 2-3 marks.

* The initial setting is “10”. Turning the valve clockwise makes the terminal impact softer; turning it counterclockwise makes the impact stronger.

### 3) Final Check

Check whether changing walking speeds feels natural and comfortable.
If there is any discomfort when walking, repeat the above adjustments.

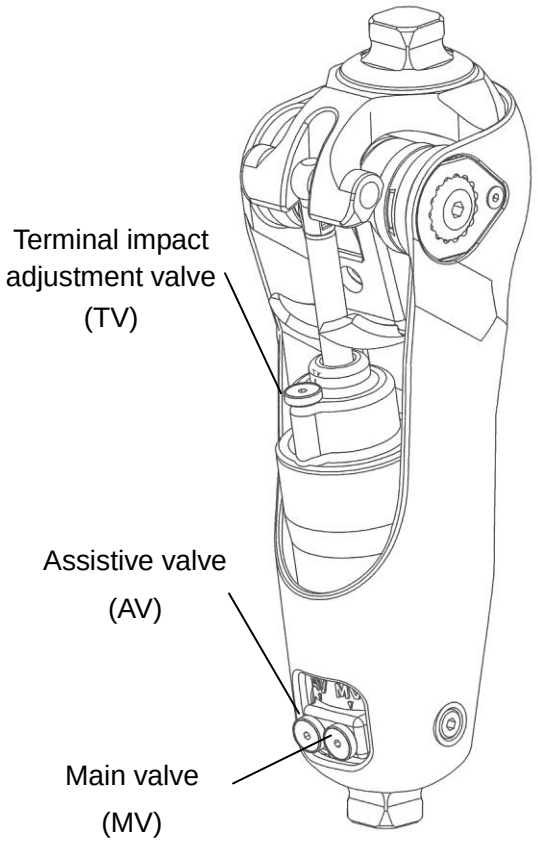
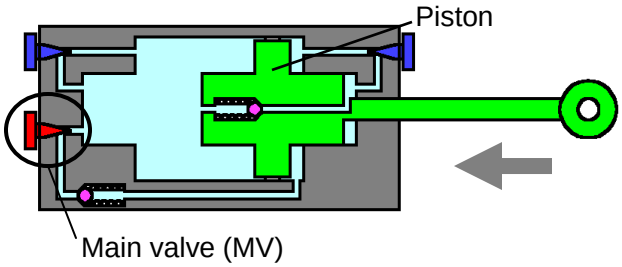



Figure 4. Adjustment Valves

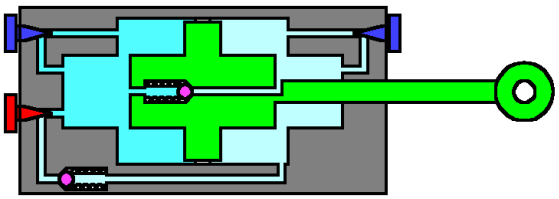
# 5. Pneumatic Cylinder Operating Principles

The following figures show the operating principles of the pneumatic cylinder:

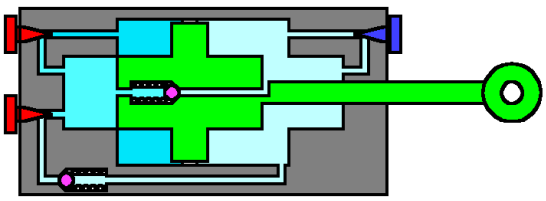
① The figure below shows the pneumatic cylinder position when the amputee is standing. As the knee bends, the piston in the cylinder will slide from right to left as shown. During this movement, the pressure in the air chamber is adjusted by the main valve (MV).



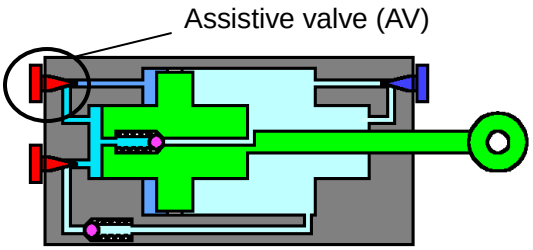

②The further and faster the piston slides, the stronger the repulsion force of the pneumatic cylinder.



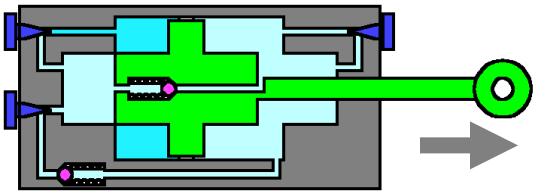
③When the knee bends to a certain degree, the air chamber is then divided into two sections.



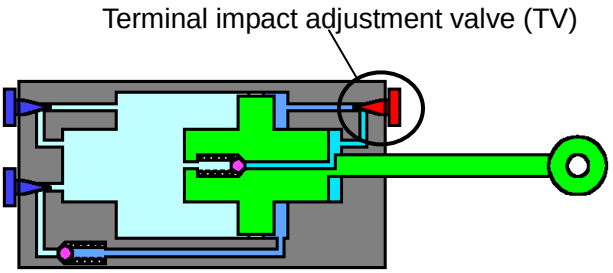
④The air pressure in the divided air chamber is adjusted by the assistive valve (AV). When the AV is closed, the maximum repulsion force will be generated.




⑤The repulsion force of the compressed air pushes the piston to the extension side.



⑥Just before the piston extends fully, the terminal impact adjustment valve (TV) operates to reduce shock (terminal impact).




**If the valve is suitably adjusted, the pneumatic cylinder in the NK-1H automatically optimizes the swing back speed during changes in walking speed.**
**In addition, impact on extension can also be reduced.**