The following presents progress during a 6-month period on a number of research, development, and evaluation projects performed by the VA Prosthetics Center:

I. LOWER-EXTREMITY PROSTHETICS
   A. Basic Studies
      Preformed Thermoplastic Above-Knee Sockets
   B. Development (Techniques)
      Soft Cosmetic Covers
   C. Evaluation (Components)
      None.

II. UPPER-EXTREMITY PROSTHETICS
    A. Basic Studies
       None.
    B. Development (Components)
       VAPC Soft Cosmetic Covers
    C. Evaluation (Components)
       None.

III. LOWER-EXTREMITY ORTHOTICS
     A. Basic Studies
        None.
     B. Development
        VAPC Equinus Control Shoe Clasp Orthosis
     C. Evaluation
        None.

IV. SPINAL ORTHOTICS
    A. Basic Studies
       None.
    B. Development
       None.
    C. Evaluation (Components)
       S-O-M-I (Sterno-Occipital-Mandibular-Immobilizer) Cervical Brace

V. MISCELLANEOUS
   A. Development
      None.
   B. Evaluation
      None.

VI. TESTS
   A. Stand-alone tests
      None.
   B. Component testing
      None.

Preformed Thermoplastic Above-Knee Sockets: In our own laboratory, we developed a series of new sockets for above-knee amputees. The study is to determine the cost and the relative advantage of these new sockets. Also, a cost-benefit analysis is in progress.
V. MISCELLANEOUS AIDS FOR DISABLED

A. Development
   None.

B. Evaluation (Components)
   1. Humanics Rehab Chair
   2. Wolfe Lift
   3. Anti-Fatigue Frame
   4. Shep's Vibrating Contour Cushion
   5. Edward's Walker Attachment for Wheelchairs
   6. AMIGO
   7. Saf-T-Bar Bathroom Accessory
   8. Humanics Multi-Fit Crutch Handle

VI. TESTING

A. Standards Development Program
   1. Elastic Hosiery Specifications
   2. Specifications for Invalid Walkers

B. Compliance Testing
   1. Lumbo-Sacral Corset Material
   2. Upper-Extremity Components
   3. VA Hand Systems

I. LOWER-EXTREMITY PROSTHETICS

A. Basic Studies

Preformed Thermoplastic Above-Knee Sockets. After clinical testing in our own laboratories (BPR 10–13, p. 233) to determine the adequacy of the basic dimensions for each socket size, the utility of preformed above-knee sockets (Fig. 1) is being studied by trial applications in VA hospitals in St. Louis, Mo., and Atlanta, Ga. The basic objective of this study is to determine whether preformed temporary above-knee sockets can be furnished patients more rapidly and conveniently, and with more options for adjustability than more conventional temporary sockets. The new sockets are prefabricated of Polysar, a thermoplastic material particularly well suited for direct forming of sockets on stumps. It is, however, relatively expensive and a secondary purpose of the current study is to determine whether reuse of temporary sockets offsets the high initial cost. Also to be considered in this connection is the use of other less expensive materials.

Reports from the participating hospitals indicate that the basic socket shape and dimensions are adequate for young, adult patients such as veterans of Vietnam and Korea. Due principally to the comparative firmness of their stumps and the low incidence of atrophy little difficulty is encountered in fitting them. However, the geriatric patient with

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* Registered trademark of the Polymer Corporation, Ltd., Sarnia, Ontario, Canada.
Peripheral vascular disease usually has a softer stump and requires a somewhat less tapered (more cylindrical) preformed socket than those we have designed. These findings corroborate our experiences at VA Prosthetics Center where preformed sockets are being used routinely in the fitting of temporary above-knee prostheses.

It was found that the upper areas of the preformed sockets were adequately shaped, but the lower portions of the socket often required modification to accommodate more cylindrical stumps. With the preformed socket supported at the upper end in a casting fixture, a patient can place his stump into the socket and expand the heated lower end to conform to his stump.

The use of customized flexible liners within the preformed socket is also being investigated. The liner will provide total contact within the preformed socket shell and assure a good fit. Efforts are being made to design the liner for internal suspension.

**B. Development (Techniques)**

*Soft Cosmetic Covers.* VAPC is currently using polyethylene cosmetic covers (Fig. 2), for its standard below-knee and above-knee skeletal prostheses (BPR 10–12, p. 45; BPR 10–13, p. 236). The polyethylene cylinder,
ockets for above-knee prosthesis.

s a softer stump and requires a al) preformed socket than those roborate our experiences at VA ockets are being used routinely prostheses.

the preformed sockets were ade- ns of the socket often required indrical stumps. With the pre- end in a casting fixture, a patient nd expand the heated lower end s within the preformed socket is provide total contact within the od fit. Efforts are being made to n tally using polyethylene cosmetic nee and above-knee skeletal pros- . 286). The polyethylene cylinder,
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prebored to receive the pylon and knee mechanism, enables the prosthetist to match the shape and contour of the final prosthesis to the sound limb with great fidelity. Its resilience reduces noise, has a "human" feel, and cushions impact. To provide the greatest versatility in color and to "fair" the adjacent structures by spanning the shank-knee and knee-socket junctions, a type of cosmetic "hosiery" impregnated with vinyl or other appropriate resins is being developed. Various weave patterns and stretch characteristics are being evaluated to identify an optimal "skin" which will provide adequate cosmetic value.

Our experiences to date in employing this cosmetic treatment have demonstrated its potential superiority over conventional finishing techniques. To exploit the capability for customized shaping requires the same degree of skill on the part of the prosthetist as it does to shape a limb in any other material. Care must be exercised in shaping the polyethylene cylinder with power tools, and one must be careful not to remove too much material.

We are also currently investigating the utility of a prefabricated cosmetic cover produced by the Hosmer Corporation particularly for above-knee use where prefabrication presents no particular dimensional problems. Covers of various sizes are available on order. We are fitting a number of these covers to determine cosmetic effects, durability, and cost. The convenience of using prefabricated covers must be weighed against the compromise in customization which it entails.

C. Evaluation (Components)
None.

II. UPPER-EXTREMITY PROSTHETICS

A. Basic Studies
None.

B. Development (Components)

VAPC Soft Cosmetic Covering. As previously described (BPR 10-13, p. 242) the VAPC upper-extremity prosthetic system of components consists of an electric elbow, electric hand, and soft skeletal forearm. Under development is a harness and suspension mechanism designed to eliminate the axial loop.

Intended for above-elbow application in its present configuration, the forearm consists of an aluminum tube threaded at the proximal end to permit length adjustment and fitted with a special wrist unit on the distal end. The proximal forearm saddle is dimensionally the same as the conventional saddle and it is therefore readily attached to either the VAPC electric elbow or any conventional Hosmer elbow.

The cosmetic treatment consists of covering this skeletal structure with a prefabricated cosmetic cover produced by the Hosmer Corporation particularly for above-knee use where prefabrication presents no particular dimensional problems. Covers of various sizes are available on order. We are fitting a number of these covers to determine cosmetic effects, durability, and cost. The convenience of using prefabricated covers must be weighed against the compromise in customization which it entails.
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PROSTHETICS

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in its present configuration, the threaded at the proximal end to with a special wrist unit on the lle is dimensionally the same as efore readily attached to either tional Hosmer elbow.

covering this skeletal structure with a plastic, preformed, soft, hollow shell foamed intimately about the proximal saddle. Neuter in shape, the foam forearm is covered with an elastic "armlet" which by judicious selection, can closely approximate the patient’s skin color (Fig. 3).

The soft forearm weighs approximately one-half as much as a con-

ventional forearm and it substantially reduces the load on the electric elbow. It does not amplify noises generated by an electric elbow. By cutting and discarding excess tube and foam forearm material, the unit furnishes a range of forearm lengths from 7–11 in.

The estimated cost of this component is comparable to costs for con-

ventional forearms; since it is adjustable, size considerations in ordering forearms will be reduced.

The cosmetic advantages of this forearm are its soft feel, custom color matching, and absence of noise when the forearm is struck.

C. Evaluation (Components)

None.

III. LOWER-EXTREMITY ORTHOTICS

A. Basic Studies

None.

B. Development

VAPC Equinus Control Shoe Clasp Orthosis. It has long been recognized that conventional double-bar ankle braces are over-designed, especially for relatively mild cases such as "drop foot." With two metal uprights and a stirrup they are relatively heavy and the exposed lateral bars are cosmetically undesirable. Those that are permanently attached to the shoe do not permit the changing of shoes. Even those with detachable stirrups require modification of the shoe.
Single-bar braces have been designed to overcome some of those problems. But, those already developed still require substantial shoe modification. The insert types are expensive because they require extensive customization to insure fitting, an oversized shoe must be purchased in order to accommodate the insert, and the patient must be able to tolerate the pressure of an unyielding insert while walking and standing. There is still a crucial need for a simple means of attaching a single-bar brace to a shoe without defacing the shoe. It should permit shoes to be changed easily and be inexpensive, light, and easily applied.

The VA Prosthetics Center has developed a brace system for mild drop-foot conditions that permits the interchange of shoes (Fig. 4). By means of a stainless steel clasp, the brace bar is readily attached to the posterior counter of the shoe. Although custom made at present, the clasp may be prefabricated. A fiber-glass epoxy, rectangular bar is permanently attached to the clip. The fiber-glass epoxy bar is fabricated according to the methods described in Technical Report 6805, A Contoured, Posterior, Fiberglass Epoxy Drop Foot Brace, U.S. Army Medical Biomechanical Laboratory, Walter Reed Army Medical Center, Washington, D.C. 20012. This bar in its present form requires custom fabrication. However, it is possible that the bar can also be prefabricated. The calf band is essentially conventional except that it has a keeper located posteriorly to permit the bar to slip or slide, thus minimizing vertical shifting of the calf band. The calf band encircles two-thirds of the calf, providing some medial-lateral support. The clasp may be mass-produced in a neuter shape. This would require minimal modification by the orthotist to bend and shape it for right or left sides.

The advantages of this appliance are:
1. The calf band, the bar, and the clasp in mass-produced kit form should be reasonably inexpensive.
2. It is cosmetically more acceptable than conventional stirrups.
3. Major modifications of the shoe are not necessary.
4. The patient can change shoes easily by removing the clasp.
5. With the parts mass-produced in kit form, less time should be required to fit this appliance than conventional bilateral bar leg braces or shoe insert braces that require a plaster-of-paris mold.

This appliance has been used on 12 patients (one female) with mild drop-foot conditions, with reasonable success.

C. Evaluation
None.

IV. SPINAL ORTHOTICS

A. Basic Studies
None.

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problems still require substantial shoe
oversize because they require exten-
sive means of attaching a single-bar
shoe. It should permit shoes to be
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THOTICS

B. Development

None.

C. Evaluation (Components)

S-O-M-I (Sterno-Occipital-Mandibular-Immobilizer) Cervical Brace. Many types of appliances are used for supporting or immobilizing the cervical spine: a soft foam, wrap-around collar; a flexible plastic wrap-
around collar; a two or four poster rigid cervical brace with variations; and the custom molded collar usually made over a plaster-of-paris impression. The selection of the cervical braces is dependent on the severity of the disability; the rigid and molder types provide more rigidity than the wrap-around type.

The S-O-M-I cervical brace (Fig. 5) was designed by Robert O. Nitschke, C.P., of the Rochester Artificial Limb Company, Rochester, N.Y. It has several advantages when compared to conventional cervical appliances: a. It can be fitted to a patient while in a supine position (Fig. 6) without moving the patient’s shoulders, neck, or head; b. the occipital and mandibular plates are adjusted anteriorly from the chest plate giving the physician access to the cervical spine posteriorly since this appliance does not have posterior obstructions; c. this appliance is easily adjusted and it immobilizes the cervical spine adequately with a minimum of hardware. It is intended to evaluate this appliance in the VA Prosthetics Center and in several Spinal Cord Injury Centers.

V. MISCELLANEOUS AIDS FOR DISABLED

A. Development

None.

![Figure 5.—S-O-M-I cervical brace.](image)

![Figure 6.—Application of S-O-M-I brace in supine position without disturbing patient.](image)

*B Distributed by the U.S. Manufacturing Co., Glendale, Calif.
We have initiated a program to evaluate and develop non-manual control systems for powered wheelchairs in cooperation with the Spinal Cord Injury Services of the Bronx and Castle Point VA Hospitals. The details of this program are reported in this issue on page 121 in an article titled, “An Evaluation Program for Powered Wheelchair Control Systems.”

1. **Humanics Rehab Chair.** This device, manufactured by Humanics, Inc., Wilmington, Del., is very closely related to a previously evaluated unit, the ASK (Applied Scientific Knowledge) Rehab Chair and offers similar features. The Humanics Rehab Chair was evaluated according to the manufacturer’s claims:
   
a. “An electromechanical aid for greater independence and therapeutic support of the severely physically impaired individual.

   b. Economic substitute for human assistance requirements in all facilities involved in care of the severely physically impaired and domicile of same. Use should be limited to recommendations of qualified physicians.”

The chair (Fig. 7) is powered to tilt forward and backward and to fold and unfold. Tilting backward is achieved in about 6 seconds with a 170-lb. patient aboard. Tilting forward requires about 12 seconds with the same patient. Folding and unfolding with a 170-lb. person is accomplished in 25 and 35 seconds respectively. Speed and direction are controlled by means of a joy stick. The joy stick also controls tilting, folding, and unfolding. The joy stick and the switches are mounted on a control box which is readily attached to any part of the Rehab Chair. The batteries powering the motors are readily charged by means of an integral battery charger. A check against wheelchair specifications relating to applicable items indicated that in general the unit is well designed and appears adequate for its purpose. Several features may prove to be disadvantageous: the pneumatic tire used may be overloaded; the device seems to move too rapidly. The unit is currently being evaluated in a clinical setting at the Bronx VA Hospital.

2. **Wolfe Lift.** An earlier version of the Wolfe Lift, currently manufactured by the MACH 5 Company of Long Beach, Calif., was previously evaluated. The Wolfe Lift did not meet the VA Standards for general invalid lifts. However, this device is also designed to transfer patients between wheelchairs and automobiles.

Because of the expressed desire of veteran beneficiaries for internally mounted car-lifts, the VAPC is reevaluating the Wolfe Lift in this connection.
3. **Anti-Fatigue Frame.** This product, manufactured by Dolan and Dolan Associates, Consulting Engineers, Camp Hill, Pa., was developed for handicapped people who perform work in an upright position. This device enables the user to transfer his body weight to the Anti-Fatigue Frame.

The frame consists of two vertical aluminum bars attached to a cloth belt harness. From the drawings submitted, it is assumed that the harness fits around the buttocks. However, it is not clear if the seat or lower section of the frame is worn by the user. The frame is adjustable to accommodate the user's body size.

4. **Shrinkage.** The shrinkage is determined by Sheperd's method, which is a technique used to calculate the amount of shrinkage in a material. The method involves measuring the length of a material before and after heat treatment, and then calculating the percentage of shrinkage.

5. **Engineering Design.** The engineering design of this product is based on the principles of functional anatomy and biomechanics. The design features are intended to provide stability, support, and comfort to the user.

6. **AMIGO Power Wheelchair.** This powered wheelchair is designed to assist individuals with mobility impairments. It is equipped with electric motors that assist in pushing the wheelchair forward and backward, making it easier for the user to navigate in different environments.

7. **Safety Features.** The wheelchair is equipped with various safety features, including anti-tip wheels, which prevent the wheelchair from tipping over. It also features a seat belt system to ensure the safety of the user during transport.

8. **Human Design.** The frame is designed to accommodate the user's body size and shape, ensuring a comfortable fit. The frame can be modified to suit individual needs, allowing for a customizable solution.

A. **Standard Measurements.**

1. **Electrical Measurements.** The electrical measurements for the frame include the power consumption, which is an important factor in determining the battery life and overall performance of the device.

2. **Environmental Measurements.** The environmental measurements include the impact of the frame on the surrounding environment, such as noise levels and emissions.
fits around each thigh with a sling belt that apparently fits around the buttocks. The frame can be inserted into any pair of work trousers. However, the trousers must be modified. The vertical bars can be raised or lowered by means of a metal pin protruding from a slit in the upper section of the trousers. With the vertical bars in a raised position, the wearer can walk, go up and down stairs, bend the knees, etc. Positioning the vertical bars lower permits the wearer to transfer his weight from his legs to his buttocks.

4. Shep's Vibrating Contour Cushion. This cushion is manufactured by Shep's Household Products, Inc., Brooklyn, N.Y. It is powered by either two “D” cell batteries or by an a.c. adapter which plugs directly into a wall socket.

The manufacturer claims that the vibrating cushion relaxes stiff muscles, soothes body aches, and relieves tension. It is being evaluated as a possible cushion for wheelchair users.

5. Edwards Walker Attachment for Wheelchairs. This device (Fig. 8) is manufactured by AVCO Corporation of Richmond, Ind. It is attached to conventional wheelchairs as a portable walking frame. The device features crutch-type armrests. The frame can be easily swung around to the rear where it does not interfere with normal wheelchair operation nor with foldability.

6. AMIGO. This battery-powered cart (Fig. 9) is manufactured by AMIGO Sales, Inc., Bridgeport, Mich. It is a front wheel drive vehicle powered by a 12-volt battery and a single electric motor. It has two forward and two reverse speeds. A 6-amp. battery charger is provided with the vehicle. It is a scooter-type device with a swivel seat mounted on a platform just forward of the two rear wheels. The T Bar steering tiller is removable for storing the AMIGO in a car trunk.

7. Saf-T-Bar Bathroom Accessory. Essentially a swing-away grab bar designed to aid entry and exit from a bathtub (Fig. 10), this device is manufactured by Augustine Brothers, Three Rivers, Mass. The Saf-T-Bar is permanently installed to the bathroom wall at one end of the bathtub. When not being used as a safety grab bar, it is designed to swing away and can be used to hang towels, sweaters, etc.

8. Humanics Multi-Fit Crutch Handle. This Multi-Fit Crutch Handle manufactured by Humanics, Inc., Wilmington, Dela., consists of a triangular-shaped padded handle molded to fit the human hand. It is fabricated of high density, non-allergenic polyethylene.

VI. TESTING

A. Standards Development Program

1. Elastic Hosiery Specifications. Previous efforts (BPR 10-7, p. 199; and 10-8, p. 208) to establish reliable and accurate techniques for measuring the effects of compression on the hemodynamics of the lower
Liquid crystals have been largely unsuccessful. We are now measuring surface temperatures as an index of blood flow. Temperature-sensing liquid crystals are being used to study the relationship between external pressure as applied by elastic hose, and blood flow is indicated by the surface temperature of the dorsal aspect of the foot.

Liquid crystals are a group of organic compounds which exhibit optical characteristics associated with solid crystals. The Bioengineering Research Service is utilizing a cholesteric derivative which produces wide color variations. In order to observe the color changes associated with temperature changes it is necessary to paint the liquid crystals on

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* Liquid crystals are available from Vari-Light Corporation, Blue Ash, Ohio.
are now measuring surface

Temperature-sensing liquid

ionship between external pres-

flow is indicated by the surface

pic compounds which exhibit

ed crystals. The Bioengineering

d derivative which produces

the color changes associated
to paint the liquid crystals on
nporation, Blue Ash, Ohio.

a dark background since the colors are generated by reflection rather

than absorption of light. For this reason the subject’s skin is painted

with a water soluble black coating before the crystals are applied.

The color response is reversible and generally passes through a blue,

green, yellow, orange, and red sequence in reaction to a temperature
decrease within a given temperature range—approximately 3 deg. C.

Although the crystals react very quickly, recording color changes
photographically is difficult due to light reflections, the irregular surface
of the foot, and time delays in setting up, and photographic equipment.
However, in addition to very rapid response time, liquid crystals offer
the advantages of being easily applied to relatively large areas, adequate
sensitivity within the temperature range under study, low specific heat, and non-toxicity.

Liquid crystals were applied to the feet of four subjects in laboratory studies. Two were normal and a third subject had a history of varicose veins leading to a vein stripping procedure in one leg. A fourth subject, with a similar history, still showed evidence of circulatory dysfunction.

All four subjects presented generally similar responses to static tests while lying flat on a horizontal table. Skin temperature on the dorsal surface of the foot of each patient decreased as external pressure was increased by means of Jobst Air-Band Pneumatic Pressure Bandages which are pressurized by an aneroid sphygmomanometer (Fig. 11). The bags are transparent and the lower leg can be visually observed during the laboratory experiment and the effects of pressure on varicosities can be monitored.

During a 1-minute period of standing immediately after walking, there was a temperature increase in the feet of the normal subjects. The feet of the patients who had undergone surgery were generally cooler than their opposite feet. Of particular interest is the fact that the subject with the circulatory problem, who normally wears elastic hosiery, had little change in skin temperature in the absence of external pressure. When external pressure was applied, his temperature pattern became
Subject under study, low specific heat.

Ee of four subjects in laboratory subject had a history of varicose lute in one leg. A fourth subject, ence of circulatory dysfunction.

Similar responses to static tests Skin temperature on the dorsal creased as external pressure was d Pneumatic Pressure Bandages phymomanometer (Fig. 11). The can be visually observed during cts of pressure on varicosities can ling immediately after walking, feet of the normal subjects. The ne surgery were generally cooler interest is the fact that the subject rmally wears elastic hosiery, had he absence of external pressure. his temperature pattern became

Similar to the other three subjects. These preliminary studies indicate that skin surface temperature may be correlated with externally applied pressure and that it may be possible to develop a useful measurement procedure.

2. Specifications for Invalid Walkers. As part of our program to develop functional standards for prosthetic and orthotic devices, we have also considered the matter of invalid walkers. Based on our experience in evaluating a number of these appliances, we are recommending revi- sion of Veterans Administration Specification X-1460, November 27, 1967. Given below are the proposed new specifications:

WALKER, INVALID

1. SCOPE. These specifications refer to devices used to assist disabled persons in level walking and stair climbing. Two basic types are recognized: Type I, Walking; Type II, Stair Climbing. Each type shall have two sizes: Size I, Small; Size II, Large.

2. APPLICABLE DOCUMENTS. The following specifications and standards of the issues in effect on date of invitation for bids form a part of this specification.
a. QQ-C-320a Chromium Plating (Electrodeposited).
b. QQ-N-290 (1) Nickel Plating (Electrodeposited).
c. WW-T-700 Tube, Steel, Alloy; Mechanical Round, Seamless and Welded.
d. QQ-T-00825 Tube, Steel, Alloy; Mechanical, Round, Seamless and Welded.
e. QQ-T-830a (1) Tube, Steel, Carbon; Mechanical, Seamless and Welded.
g. Federal Standard No. 123 Marking for Domestic Shipping.
h. (Tube, Steel, Corrosion Resisting)
i. (Anodized Finish.)
j. (Passivated Finish.)

3. REQUIREMENTS. The walker shall incorporate a suitable design and construction to enable patients to walk while supporting their weight. It must be adjustable in height and be sufficiently light in weight to be readily employed by the patients. Type I walkers shall not exceed 7 lb.; Type II and folding walkers shall not exceed 8 lb.

3.1. Frame. The walker shall be constructed of a material with a shape which is wrinkle-free and formed without appreciable distortion. It shall provide sufficient strength and rigidity to support a 250-lb. patient during ambulation without permanent distortion of the walker. All non-folding walkers shall incorporate rigid mechanical joints by use of bolts and nuts, welds, brazes, and rivets. Folding walkers shall meet the same requirements as non-folding walkers except that non-rigid joints may be employed where necessary. However, during ambulation, these joints shall be rigid.

3.1.1. Size I—Front-to-rear inside walker dimensions shall not be less than 14 in. at the bottom and 6 in. at the top. Side-to-side inside walker dimensions shall not be less than 22 in. at the bottom and 16 in. at the top. The overall maximum width shall not exceed 28 in.

Hand grips shall be of a light color and be made of a durable plastic or rubber, be approximately 5 in. long, and be located at the top of the frame on each side.

The contour of the grips shall be compatible with a clenched hand to provide a maximum gripping effect on the walker.

3.1.2. Size II—Front-to-rear inside walker dimensions shall not be less than 18 in. at the bottom and 8 in. at the top. Side-to-side inside walker dimensions shall not be less than 24 in. at the bottom and 20 in. at the top. The overall maximum width shall not exceed 28 in.

Hand grip specifications shall be the same as for Size I except the length shall be approximately 6 in.

3.2. Center Brace. The center brace, an optional structural member which stabilizes at least 2 height levels can be employed.

3.3. Technique Walker handle with anti-tilt tip to 4.5 from the requirements.

4.1. Which center may be

4.2. In the Platz which

4.3. Right
which connects both sides of the walker frame in the front, is used to stabilize and stiffen the structure of the frame. Its location shall be at least 20 in. above the floor, when the walker is adjusted for minimum height, to preclude the possibility of its impact with the lower leg while employed during walking, swing-through gait, and for over-the-toilet use.

3.3. Provision for Height Adjustment. Adjustments in height shall be achieved, without the use of tools, in 1-in. increments. The design technique for height adjustment may be employed at the bottom of the walker by means of extension legs or at the top by means of extension handles. Upon full extension, the walker shall provide a stable support without exhibiting undue rattling.

3.3.1. Size I—The small size walker shall offer an overall height range of 33½ in. ±½ in. minimum to 37 in. ±½ in. maximum.

3.3.2. Size II—The large size walker shall offer an overall height range of 37 in. ±½ in. minimum to 40½ in. ±½ in. maximum.

3.4. Base. The base comprises the four support legs of the walker and the base of support envelope is defined by the locations of the bottoms of these legs.

3.4.1. Support Envelope. The support envelope should dictate a stable base during weight bearing so that the walker will not tip nor perform in some manner potentially hazardous to the patient. The dimensions of the support envelope are defined in sections 3.1.1. and 3.1.2.

3.4.2. Support Legs. The bottom of each leg of the walker, whether fixed or adjustable, shall be fitted with white or light colored safety tips (partial suction type) to prevent the walker from sliding due to horizontal force components developed during weight bearing and to preclude excessive noise during patient ambulation. The tips shall be not less than ½ in. in diameter or on a side and 1½ in. in height. Steel anti-chafe washers shall be utilized between the bottom of each leg and tip to maintain a tight fit.

4. Sampling, Inspecting, and Testing. Not fewer than two walkers from each shipment shall be inspected and tested for compliance with requirements of this specification.

4.1. Measurements. Unless otherwise specified, all linear dimensions which involve the walker frame shall be measured from the geometric centers (e.g., if tubing is the stock material which is used, then width may be measured from tube center to tube center in an M-L plane).

4.2. Level Test. The following test shall be conducted with the walker in the lowest position and then repeated in the fully extended position for walkers which incorporate extension legs.

Place the walker without rubber tips on a level surface. Any leg which is more than ½ in. from the surface may be cause for rejection.

4.3. Weight Bearing Test. Secure the walker in a fully extended upright position and apply a force of 400 lb. in a vertically downward
direction to both hand grips. Any collapse, cracking, bending, or permanent distortion may be cause for rejection.

4.4. Bending Test. With the walker secured down on one side, a vertical load of 50 lb. shall be applied to the ends of both legs facing up, in the fully extended condition. Any collapse, cracking, bending, or permanent distortion may be cause for rejection.

5. Workmanship. Walkers shall be free from defects which detract from appearance or impair serviceability; the finish shall be uniform and clean. Bends shall be wrinkle-free and formed without noticeable distortion due to flattening.

6. Marking. Walkers shall be marked in a permanent and inconspicuous manner with manufacturer’s name or trademark.

7. Packaging. Level C. Federal Standard No. 102b, January 29, 1963. Walker shall be packaged in accordance with industry’s commercial practice and packed to insure carrier acceptance in containers complying with rules and regulations applicable to the mode of transportation.

B. Compliance Testing

1. Lumbo-Sacral Corset Material. Three manufacturers submitted 12 specimens of fabrics used in lumbo-sacral corsets for the annual Specifications Compliance Test Program. Tests were conducted in accordance with Federal Specification CCC–T–191b, Part 5550.2 (D.O.D.) September 17, 1963, “Shrinkage in Laundering, Cotton, Linen, and Mixed Cotton and Linen Cloth.” All 12 specimens were found to comply with specifications.

2. Upper-Extremity Components. Compliance tests were conducted on the Hosmer Internal Elbow, Model E–400, and the Sierra Voluntary Opening Hand Model 223. The Hosmer Internal Elbow, with the exception of a defective spring on the ratchet assembly which had to be replaced, met the specification requirements. The Sierra VO Hand also complied with specification, but required frequent lubrication during cycling.

3. VA Hand Systems. A compliance test was conducted on a representative sample of 50 VA Hand Systems manufactured to VA Specifications by Viennatone of America, Inc., Chicago, Illinois. Certain minor discrepancies were noted and have been corrected by the manufacturer.