



ENGINEERING DEPARTMENT

BULLETIN

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MULTIPLE KNOCKOUTS

A. INTRODUCTION

This Bulletin was prepared by the NEMA Joint Sections Committee on Multiple Knockouts.

It is intended as a guide to manufacturers both in the design, tooling and production of knockouts; and in the development of material for the education of inspectors and users regarding the proper removal of multiple knockouts.

The text and illustrations shown in Part C are recommended as a model for instruction sheets to be prepared by individual manufacturers and placed in products containing multiple knockouts, so that instructions will be readily available to users when needed. (Both the text and illustrations may be adapted as required to conform with specific multiple knockout constructions.)

For additional considerations on knockout design, see NEMA Engineering Bulletin No. 71 "Knockout Diameters and Fitting Dimensions to Assure Mechanical and Electrical Continuity."

B. SUGGESTIONS ON PRODUCTION AND INSPECTION OF MULTIPLE KNOCKOUTS

Care should be exercised in the design of multiple knockouts. A successful knockout cluster depends on the correct quantity, distribution and cross-section of the ties. The center knockout should have only one tie for conduit at least up to 3/4 (21) trade size. The multiple knockout cluster is punched alternately in and out. The smallest knockout (center) should be punched inward wherever possible to assist in securing the un-removed knockout section(s) and in the proper seating of a locknut.

Proper press set-up is also necessary for a successful knockout cluster. The punch and die must be sharp, and the knockouts must be cut cleanly, except at the ties, so that light can be seen through the cut portion. The knockouts should then be flattened back into the parent metal.

An alternative to flattening is to punch the knockout short of all the way through, so that the maximum opening around any knockout section does not exceed 0.010 in (0.25 mm). Care must be taken to keep the depth of punch such that the knockout will function properly.

The inspection process should begin with the initial punch-and-die and flattening press set-ups. In inspecting, it is important to determine that the knockouts are capable of supporting a 10 lb (45 N) weight without loosening or opening more than 0.010 in (0.25 mm), and of being removed without undue effort. The ties must not be fractured, either before or after flattening.

Both the punching and flattening operations should be inspected periodically throughout the entire production run.

Completed knockouts should be tested by following the instructions given in Part C below. In accordance with those instructions, remove the center knockout and each succeeding ring as separate steps in the inspection procedure. After each knockout section is removed, the remaining ties should show no evidence of fracture and the remaining ring sections should not be displaced. Except for metal left at the ties, which may need to be removed separately, removal of each knockout section should leave a clean-cut hole.

C. RECOMMENDED METHOD (EASIEST AND BEST WAY) TO REMOVE MULTIPLE KNOCKOUTS

IMPORTANT: Remove knockouts ONE AT A TIME, alternating INWARD and OUTWARD.

FIRST: Determine which way the first knockout is punched.

1. Remove center knockout in the direction that it is punched. Place screwdriver blade against point farthest from tie and strike the knockout to loosen it (Fig. 1). Bend back and forth to break tie.

NEXT: Remove rings ONE AT A TIME without straining remaining rings.

1. Pry first ring in the direction that it is punched with screwdriver midway between ties, using pliers flat against box under screwdriver (Fig. 2).
2. Bend first ring section in the direction that it is punched, with pliers, then back and forth to break ties (Fig.3).
3. Remove successive rings in the direction that they are punched by striking screwdriver (with blade located at a point midway between ties), then bend ring sections back and forth to break ties.

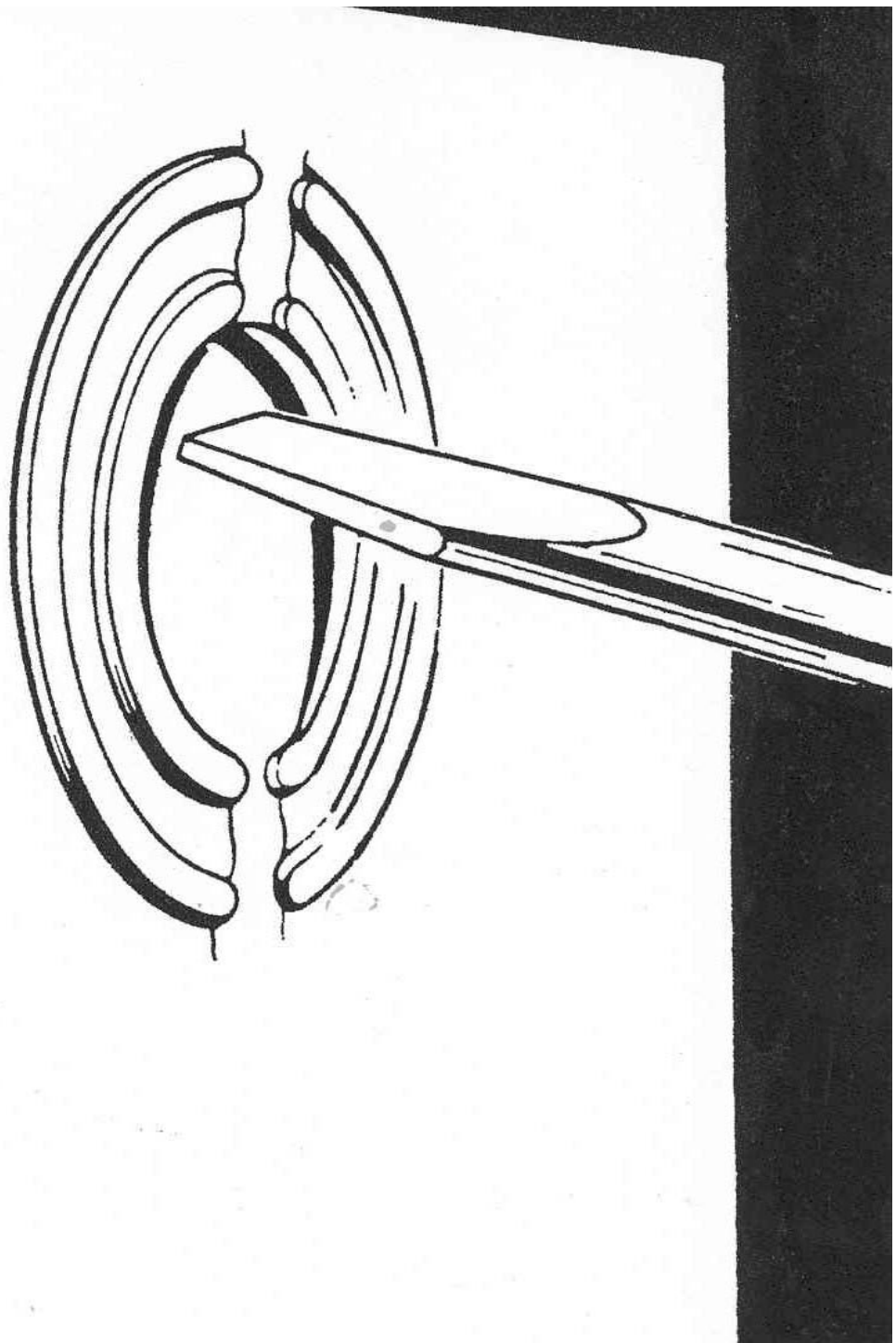


Figure 1

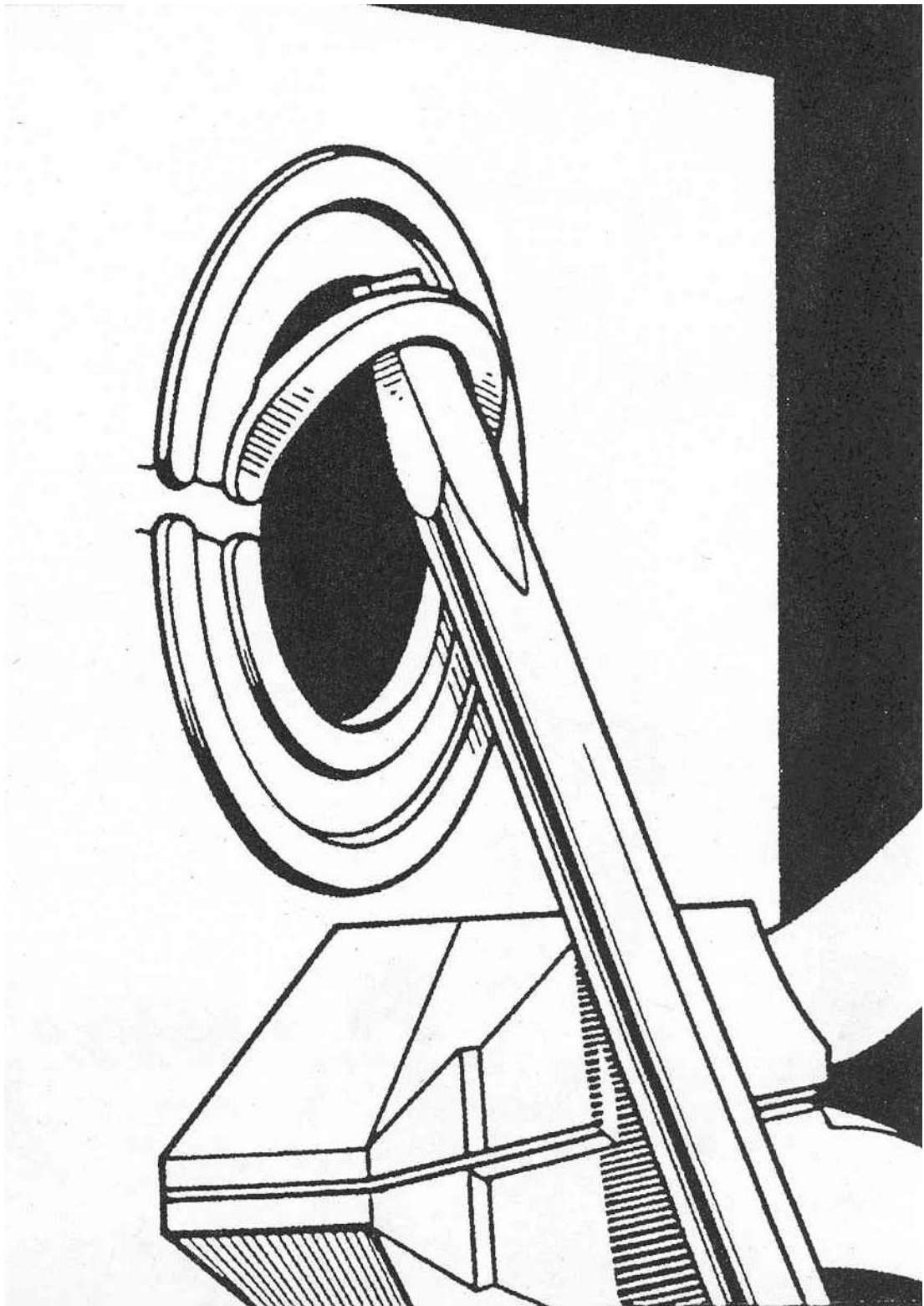


Figure 2

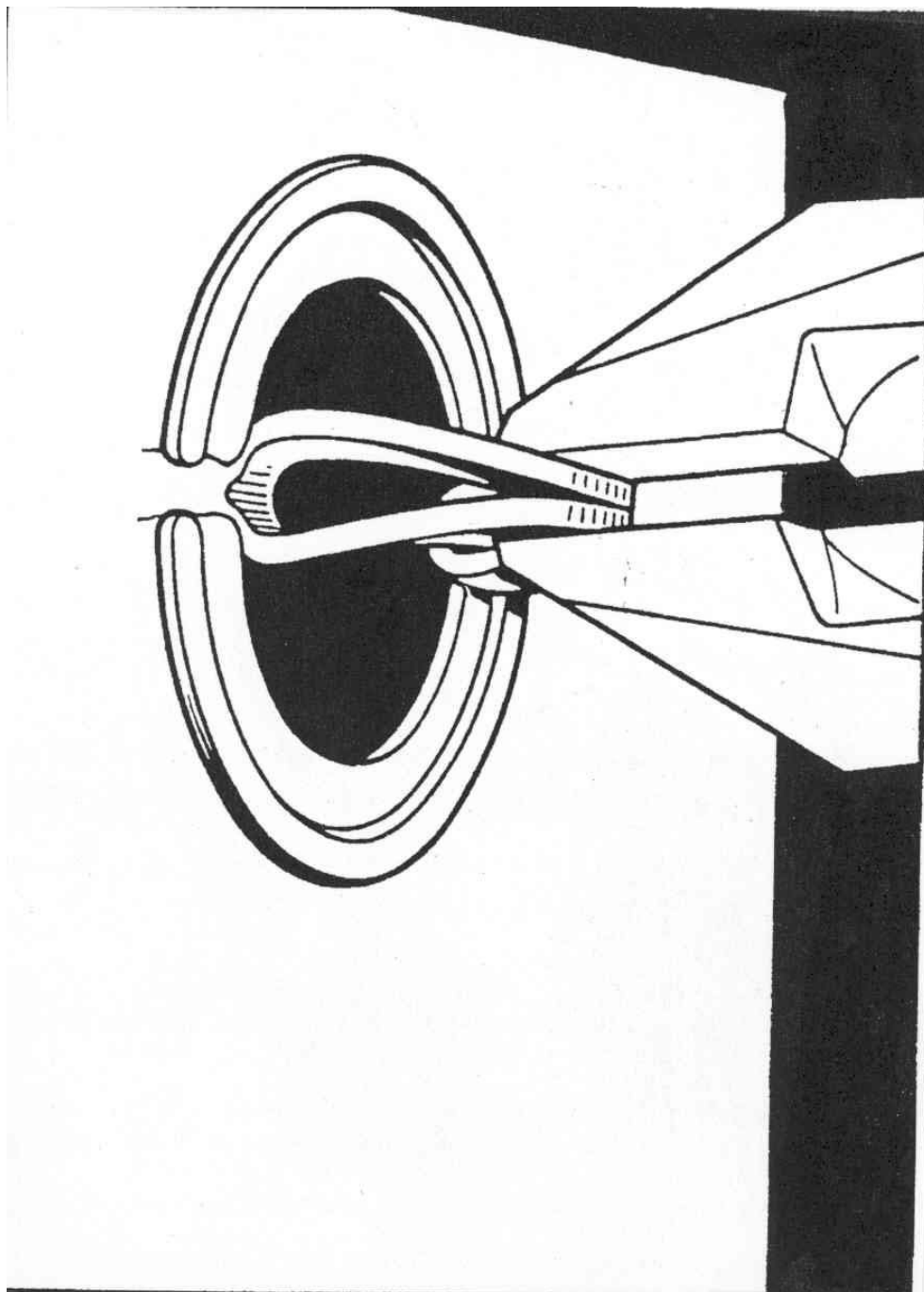


Figure 3

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