Westinghouse
Electric Company

Box 355
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January 15, 2002
LTR-NRC-02-2

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Attention: J. S. Wermiel, Chief
Reactor Systems Branch
Division of Systems Safety and Analysis

Subject: Fuel Criterion Evaluation Process (FCEP) Notification of the Quick Release Top Nozzle (QRTN) Design, (Proprietary)

Dear Mr. Wermiel:

Enclosed are copies of the Proprietary and Non-Proprietary versions of the Fuel Criterion Evaluation Process (FCEP) Notification of the Quick Release Top Nozzle (QRTN) Design. This submittal serves as Westinghouse notification to the NRC, as required by the SER on Westinghouse Fuel Criteria Evaluation Process (FCEP), that the NRC-approved process in WCAP-12488-A is being used for the determination of acceptability of the QRTN design for full region application and implementation. This design will first be implemented on a full region basis in the McGuire and Catawba units during their next refueling outage and may be implemented for other licensees in the future.

Also enclosed are:

1. One (1) copy of the Application for Withholding, AW-02-1507 with Proprietary Information Notice and Copyright Notice.

2. One (1) copy of Affidavit, AW-02-1507.

This submittal contains Westinghouse proprietary information of trade secrets, commercial or financial information which we consider privileged or confidential pursuant to 10 CFR 9.17(a)(4). Therefore, it is requested that the Westinghouse proprietary information attached hereto be handled on a confidential basis and be withheld from public disclosure.

This material is for your internal use only and may be used solely for the purpose for which it is submitted. It should not be otherwise used, disclosed, duplicated, or disseminated, in whole or in part, to any other person or organization outside the Office of Nuclear Reactor Regulation without the expressed prior written approval of Westinghouse.

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Correspondence with respect to any Application for Withholding should reference AW-02-1507 and should be addressed to H. A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

Henry A. Sepp, Manager
Regulatory and Licensing Engineering

Copy to:
S. L. Wu, NRR
R. Caruso, NRR
U. Shoop, NRR
D. Holland, NRR

Westinghouse
Electric Company

Box 355
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AW-02-1507

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Attention: J. S. Wermiel, Chief,
Reactor Systems Branch
Division of Systems Safety and Analysis

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Fuel Criterion Evaluation Process (FCEP) Notification of the Quick Release Top Nozzle (QRTN) Design, (Proprietary)

Reference: Letter from H. A. Sepp to J. S. Wermiel, LTR-NRC-02-2, dated January 15, 2002

Dear Mr. Wermiel:

The application for withholding is submitted by Westinghouse Electric Company LLC, a Delaware limited liability company ("Westinghouse"), pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.790, Affidavit AW-02-1507 accompanies this application for withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference AW-02-1507 and should be addressed to the undersigned.

Very truly yours,

Henry A. Sepp, Manager
Regulatory and Licensing Engineering

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

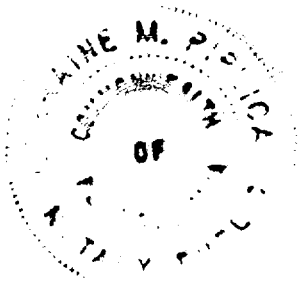
COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Henry A. Sepp, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC, a Delaware limited liability company ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Henry A. Sepp, Manager
Regulatory and Licensing Engineering

Sworn to and subscribed
before me this 15th day
of January, 2002.

Lorraine M. Piplica
Notary Public



Notarial Seal
Lorraine M. Piplica, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Dec. 14, 2003
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory and Licensing Engineering, in Nuclear Services, of the Westinghouse Electric Company LLC, a Delaware limited liability company ("Westinghouse") and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Electric Company in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked "Fuel Criterion Evaluation Process (FCEP) Notification of the Quick Release Top Nozzle (QRTN) Design, (Proprietary)," January 15, 2002, for submittal to the Commission, being transmitted by Westinghouse Electric Company (W) letter (LTR-NRC-02-2) and Application for Withholding Proprietary Information from Public Disclosure, Henry A. Sepp, Westinghouse, Manager Regulatory and Licensing Engineering to the attention of J. S. Wermiel, Chief, Reactor Systems Branch, Division of Systems Safety and Analysis. The proprietary information as submitted by Westinghouse Electric Company is to provide notification to the NRC staff of the implementation of the Quick Release Top Nozzle (QRTN) design modifications under the Fuel Criterion Evaluation Process (FCEP).

This information is part of that which will enable Westinghouse to:

(a) Assist customers in improving their fuel performance (zero defects).

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to continue to implement corrective actions to ensure the highest quality of fuel in order to meet the customer needs.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluation justifications and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing the enclosed improved core thermal performance methodology.

Further the deponent sayeth not.

Proprietary Information Notice

Transmitted herewith are proprietary and non-proprietary versions of documents furnished to the NRC. In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).

Copyright Notice

The documents transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies for the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.790 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection not withstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond these necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

Fuel Criterion Evaluation Process (FCEP)
Notification of the QRTN Design

January 2002

Fuel Criterion Evaluation Process (FCEP)
Notification of the Quick Release Top Nozzle (QRTN) Design

Introduction and Background:

Development of a quick release top nozzle (QRTN) design, to replace the current Westinghouse reconstitutable top nozzle (RTN) design for 17x17, 12 foot fuel design, was initiated by Westinghouse in response to a licensee's desire for a design which significantly improves top nozzle removal and replacement during assembly repair and reconstitution. Thus, in April 1998 a QRTN development effort was initiated for design application to the 17x17 Robust Fuel Assembly (RFA) design for the licensee that originally requested that Westinghouse pursue such a design effort. A unique "quick release" joint mechanism was the underlying design theme to achieve this goal.

In Spring 2000, the licensee inserted eight RFA LUAs with the QRTN design into one of their four units fueled by Westinghouse. The purpose of these LUAs were to test the performance of the QRTN under incore irradiation conditions (e.g., test for irradiation effects as well as corrosion and crud effects, test the new top nozzle handling tool, measure the "quick release" joint forces, and measure the top nozzle removal and reinsertion forces). The LUAs operated for an eighteen month cycle and were inspected at the end-of-cycle in the Fall 2001. An inspection summary discussion is provided later in this notification. With the successful completion of the LUAs (no operational or design issues were identified), the licensee and Westinghouse intend to transition to full region application of the QRTN design for the licensee's spring reload in 2002 (February/March 2002).

The QRTN joint design offers several advantages over the current RTN split insert joint. These include: 1) a reduced nozzle removal / installation time using minimal force, 2) no loose parts created during the reconstitution process, 3) stronger, more durable inserts, 4) greatly simplified site tooling requirements reducing equipment and mobilization cost, setup time and crew size, and 5) improved axial joint stiffness permitting a reduction in total number of joints.

Design Description:

The QRTN is made from the same two-piece cast top nozzle weldment as the current RTN design (cast enclosure & top plate with wrought material adapter plate). The nozzle assembly uses STD holddown springs/screw configuration as in the current RTN design (with bead-blasted Alloy 718 Inconel hold-down spring screws) and can be incorporated into the Integral Clamp Top Nozzle (ICTN) design when that design is fully implemented. The key difference between the nozzles is the QRTN joint components housed in the adapter plate.

Relative to the RTN, the QRTN nozzle adapter plate has [

] [a,c] in the QRTN compared to the RTN.

The key feature of the QRTN is the unique, "quick release" joint mechanism for attachment of the nozzle to the guide thimbles. This feature replaces the RTN joint consisting of a lock tube, insert and machined groove in the nozzle at all twenty-four thimble locations in the nozzle. In the QRTN, [

] [a,c]. See Figure 1 for a top view illustration of the top nozzle.

New nozzle components of the QRTN are the [

] [a,c]. See Figure 2a and 2b. Components separate from the nozzle, but part of the QRTN design, are the [ ] [a,c]. See Figure 2b and 2c. These machined [ ] [a,c] are bulged to the guide thimble ends.

At each locking joint location within the adapter plate, [

] [a,c]. This clearance allows free nozzle removal and installation with minimal force.

[

] [a,c].

[

] [a,c] to allow fuel rods to easily pass during top end assembly reconstitution.

Joint operation to unlock is as follows: [

] [a,c]. Joint locking is the reverse.

Design Categories for FCEP:

A. Fuel Damage and Fuel Rod Failure Criteria

a. Clad Stress
b. Clad Strain
c. Clad Fatigue
d. Clad Oxidation
e. Zircaloy Clad Hydrogen Pick-up
f. Fuel Rod Axial Growth
g. Clad Flattening
h. Rod Internal Pressure
i. Fuel Clad Fretting Wear
j. Fuel Rod Clad Rupture (Burst)
k. Fuel Pellet Overheating
l. Non-LOCA Fuel Clad Temperature
m. LOCA Fuel Clad Temperature
n. Departure from Nucleate Boiling (DNB)
o. Thermal-Hydrodynamic Stability

B. Fuel Coolability

a. Fuel Assembly Hold-Down Force
b. Clad Embrittlement During Locked Rotor/Shaft Break Accident
c. Clad Ballooning and Flow Blockage
d. Violent Expulsion of Fuel (Rod Ejection)
e. Fuel Assembly Structural Response to Seismic/LOCA Loads

C. Nuclear Design

a. Shutdown Margin
b. Fuel Storage Sub-criticality
c. Stability
d. Reactivity Feedback Coefficients
e. Power Distribution
f. Maximum Controlled Reactivity Insertion Rate

Evaluation:

Each of the parameters under each category listed above have been examined and those impacted by the design change to the QRTN will be addressed in the following sections.

Category A:

Fuel Damage and Fuel Rod Failure Criteria

Parameters "a-m" in this category are not impacted by the QRTN design change since the fuel rod was not altered. Parameters "n" and "o" are discussed below.

As noted in the Design Description section, the change from the RTN design to the QRTN design results in [

] [a, c].

DNB

As noted above, the hydraulic loss coefficient of the QRTN design has [

] [a, c] where DNB is a concern (e.g., the parameters which are contributors to DNB are not affected[1]).

Thermal-Hydrodynamic Stability

As noted previously, there is a minor change in the [ ] [a, c]; however, this change is well within the Westinghouse experience basis and it has been shown that large margins exist to density wave instability[1][2][3]. Thus thermal-hydraulic stability issues are not a concern for this minor change.

Category B:

Fuel Coolability

Parameters "b, c and d" in this category are not impacted by the QRTN design since the fuel rod and associated pressure drops are unchanged and since there is no change to the average fuel pellet enthalpy that the fuel would experience. Parameters "a" and "e" are discussed below.

Fuel Assembly Hold-down Force

As noted previously, the fuel assembly [

] [a, c], the minimum net force on the lower core plate that is required to support the reactor internals analysis for normal operations (cold zero and hot full power) is still met at beginning of life and at the end of each cycle. This assessment also confirms that the fuel assembly will not liftoff during normal operations. In addition, the assessment shows that for the hot pump overspeed transient, the hold-down force generated does not result in a permanent set in the spring packs such that it reduces the post-transient hold-down force below the minimum acceptable value.

Fuel Assembly Structural Response to Seismic/LOCA Loads

The fuel assembly [ ] [a, c] are not affected by the QRTN design change. Even a detailed model would indicate an insignificant difference, but the simplified models, used in the fuel assembly load analysis and the systems analysis, would be identical to the current RFA model with an RTN.

Category C:

Nuclear Design

None of the parameters in this category are affected by the QRTN design change. The fuel rod design is identical to the RFA design with an RTN, as are the grid locations, masses and pressure drop.

LTA Inspection Summary:

Eight 17x17 RFA LUAs featuring the QRTN were fabricated as part of a reload fuel region for a licensee in December 1999. These LUAs were designed to test the performance of the QRTN under incore irradiation conditions (e.g., test for irradiation effects as well as corrosion and crud effects – none expected).

The PIE plan involved removal, inspection, and re-installation of the QRTN nozzle from two of the LUAs using two simple long handling tools. For the examination, the assemblies were placed in a spent fuel pool rack with the nozzles ~ 23 feet below the pool surface (~ 36 feet to the bridge). Removal consisted of pre-work visual inspection of the nozzle and locking joints, unlocking of the [ ] [a, c] with verification and nozzle removal. Installation was the reverse. The operation and inspections were monitored via camera and videotaped. There was no indication of unusual wear or component design deficiency (flawless appearance and performance).

All design objectives were met for the design and tooling interface. These include: robust design having no loose parts, positive indication of joint locking, near zero nozzle removal force, reduced crew size, simplified tooling, reduced setup time and easier decontamination. The overall goal for fast nozzle removal/reinstallation was met and is likely to improve as experience builds. Two hours were spent on the PIE of the first assembly and only one hour on the second assembly. The numerous first time inspections performed consumed the bulk of this time. These facts will aid in the licensee ensuring that ALARA considerations are met in the future if a fuel assembly would require reconstitution and will minimize or eliminate fuel assembly reconstitution from being a critical path issue during the outage. Four additional LUA inspections are planned (two different assemblies each at the end of irradiation cycles two and three).

Conclusion:

It is concluded that the QRTN design will have no effect on the performance of the fuel assembly in the design categories listed above. The QRTN design changes may therefore be implemented under the Fuel Criteria Evaluation Process, which requires NRC notification; however, no NRC review is necessary. Since an LTA has demonstrated acceptable performance, the QRTN will be implemented on a full region basis for the licensee that was analyzed. Full region application of the QRTN for other licensees will require the same analysis to be completed but no future FCEP notifications to the NRC would be necessary as specified by the SER for FCEP[1].

References:

1. Davidson, S. L., (Ed.), et al., "Westinghouse Fuel Criteria Evaluation Process," WCAP-12488-A, October 1994.

2. Davidson, S. L. and Iorii, J. A., "Reference Core Report – 17x17 Optimized Fuel Assembly," WCAP-9500-A, May 1982.

3. Davidson, S. L. and Kramer, W. R. (Eds.) et al., "Reference Core Report VANTAGE 5 Fuel Assembly," WCAP-10444-P-A, September 1985.

Table 1
RTN versus QRTN Design

a, b, c

General Information

Figure 1
Quick Release Top Nozzle
(Top View)

a, b, c

Figure 2
Quick Release Top Nozzle Joint
(Unlocked Position)

a, b, c

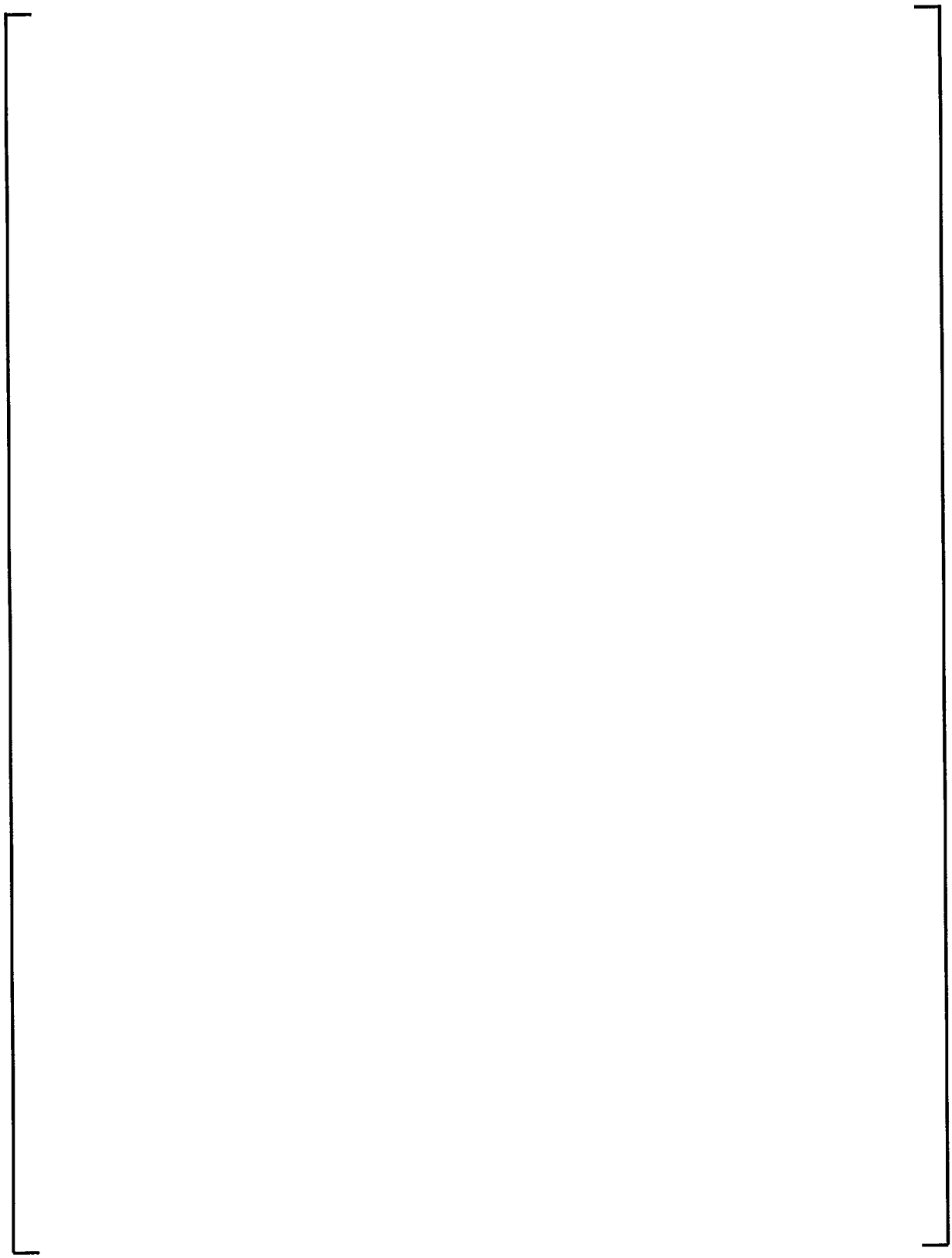


Figure 3
Quick Release Top Nozzle Joint
(Unlocked Position)

a, b, c