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Proprietary Notice

This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 1, the balance of this letter may be considered non-proprietary.

MFN 08-606

Docket No. 52-010

October 31, 2008

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to a portion of the U.S. Nuclear Regulatory Commission Request for Additional Information (RAI) sent by NRC Letter Nos. 160 and 166 (References 1 and 2). The GEH proprietary response to RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27 are addressed in Enclosure 1. The Non-Proprietary response is addressed in Enclosure 2.

If you have any questions about the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-221, *Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 160, Related To ESBWR Design Certification Application*, dated March 6, 2008 (RAIs 3.11-23 and 3.11-24)
2. MFN 08-316, *Letter from the U.S. Nuclear Regulatory Commission to Robert E. Brown, Request for Additional Information Letter No. 166, Related To ESBWR Design Certification Application*, dated March 28, 2008 (RAIs 3.11-26 and 3.11-27)

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27 - Proprietary Version
2. Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27 - Non Proprietary Version
3. Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27 - Affidavit

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	eDRF	0000-0085-1022 Revision 2

Enclosure 2

MFN 08-606

Response to Portion of NRC Request for

Additional Information Letter Nos. 160 and 166

Related to ESBWR Design Certification Application

Design of Structures, Components, Equipment, and Systems

RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27

Non - Proprietary Version

NRC RAI 3.11-23

In Table 3H-11, "Radiation Environment Conditions Inside Containment Vessel for Accident Conditions," of DCD, Tier 2, Revision 4, GEH provided (1) operating dose rates using NUREG-1465, and (2) six month integrated doses, in upper and lower areas of drywell as well as wetwell and suppression pool gas space. Please provide the following information.

1. *State fission product release phase(s) in NUREG-1465 used for developing the dose rates and integrated doses in the table.*

2. *State how GEH converted fission product release fractions in NUREG-1465 to calculate the dose rates and integrated doses in the table.*

3. *Provide a sample calculation GEH performed to calculate the dose rates and integrated doses in the table.*

4. *If GEH used a computer code(s), please state name(s) of the code and provide its input and output files*

GEH Response

1. Three fission product release phases are utilized: coolant, gap, and early in-vessel (EIV). The release timing and duration are consistent with Regulatory Guide 1.183 and NUREG-1465. The coolant release phase assumes a release over a two-minute period, however, this short decay time is conservatively neglected in the dose calculation itself. The coolant source terms are also neglected since they are negligible relative to the gap and EIV source terms. The gap release phase is 30 minutes and the EIV phase is 1.5 hours.

2. To calculate the beta and gamma dose rates for the ESBWR, a simple RADTRAD model was developed to establish the radionuclide inventory. The RADTRAD model contained two compartments: (1) the containment and (2) the environment. Natural deposition was credited in the containment, with the removal coefficients being identical to those used for Accident Scenario 1 in the ESBWR LOCA Dose Calculation developed for DCD Revision 5. Release timing and duration, source term assumptions, and other pertinent parameters were also consistent with the LOCA off-site and control room dose calculation. Rather than applying the design basis leakage rates assumed in the dose analyses, this analysis conservatively assumes the accident source terms are retained in the containment for 100 days with effectively no ex-filtration.

3. The radionuclides contained in the RADTRAD default "nuclide inventory file" were chosen to maximize the doses to off-site and control room receptors. The radionuclides do not necessarily represent the most conservative inventory for EQ applications. The impact of the overall inventory was reviewed and the review

concluded that the calculated doses were very accurate (~99%) if Xe-131m and Xe-133m were added to the inventory. As such, these radionuclides were added to the RADTRAD nuclide inventory file (Cm-242 and -244 were deleted since they had negligible dose contributions).

This radionuclide inventory was then utilized to calculate beta and gamma dose rates and integrated doses at various representative dose points inside the containment. Four analyses were performed at selected dose points including airborne (beta and gamma), gamma plate-out, beta plate-out and radioactivity in containment sumps.

4. The methodology used for performing the four calculations is described below. Eleven representative dose points encompassing the four zones inside containment were selected for evaluation. The doses were then summed for all four analyses to determine the total integrated dose at each dose point. The maximum dose rate for each dose point was selected from the time step with the highest dose rate. The eleven dose points were then categorized into the four regions of the containment and dose point with the highest integrated dose was selected for the data in Table 3H-11. An example of the four analyses summation of dose rates and doses for a dose point in the upper area of the lower drywell that created the highest integrated dose is included in Attachment A.

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5. RADTRAD was used for the airborne dose analysis. MicroShield® v7.02 was used for the gamma plate-out and sump analyses. A spreadsheet based on Loevinger's equation for an infinitely thin plane of beta radioactivity was used to determine the beta plate-out dose information.

   Examples of RADTRAD and MicroShield® v7.02 computer runs including input and output information are provided in Attachment B.

DCD Impact

DCD Tier 2, Subsections 3.11.6, Appendix 3H Subsection 3H.3.2 and Appendix 3H Table 3H-11 were revised to clarify source of information and changes incorporated in Revision 5 of the DCD. Due to the new calculations, Subsection 3.11.6 and Table 3H-11 will be changed in Revision 6 to address ESBWR specific information in lieu of ABWR based information. DCD markup changes are attached.

The compliance with the applicable portions of the GDC of 10 CFR 50, Appendix A, and the Quality Assurance Criteria of 10 CFR 50, Appendix B are described in the NRC approved Licensing Topical Report on GE's environmental qualification program (Reference 3.11-3).

The COL Applicant will provide a full description and milestone for program implementation of the environmental qualification program that includes completion of the plant specific EQD. (Refer to Subsection 3.11.7, Item 3.11-1-A).

3.11.5 Loss of Heating, Ventilating and Air Conditioning

Sections 6.4 and 9.4 describe the HVAC systems including their design evaluations. The loss of ventilation conditions are considered in Appendix 3H and the calculations are based on maximum heat loads assuming operation of all operable equipment regardless of safety-related classification.

3.11.6 Estimated Chemical and Radiation Environment

Chemical Environment

Equipment in the lower portions of the containment is potentially subject to submergence. The chemical composition and resulting pH to which safety-related equipment is exposed during normal operating and accident conditions is reported in Appendix 3H.

Sampling stations are provided for periodic analysis of reactor water, refueling and fuel storage pool water, and suppression pool water to assure compliance with operational limits of the plant technical specifications.

Radiation Environment

EQ equipment is designed to perform its safety-related function when exposed to the normal operational radiation levels and accident radiation levels.

~~The operating dose rates are based on ABWR plant operating conditions and adjusted for ESBWR using appropriate scaling factors.~~

~~The accident dose rates are based on ABWR plant accident conditions and adjusted for ESBWR using appropriate scaling factors.~~ Dose rates and integrated doses of radiation that are associated with normal plant operation and the DBA condition for various plant compartments are presented in Appendix 3H; these parameters are presented in terms of time-based profiles where applicable.

3.11.7 COL Information

3.11-1-A Environmental Qualification Document

The COL Applicant will provide a full description and a milestone for program implementation of the environmental qualification program that includes completion of the plant-specific EQD per Subsection 3.11.4.4.

3.11-2-H Environmental Qualification Records (Deleted)

Table 3H-11

Radiation Environment Conditions Inside Containment Vessel for Accident Conditions

Plant Zone/Typical Equipment	Maximum Post-Accident Dose Rate[1]		Integrated Dose[3]	
	Gamma (Rad/h)	Beta (Rad/h)	Gamma (Rad)	Beta (Rad)
(b-1) Upper drywell (Figure 6.2-1)	~~2.64~~3.45 E+~~76~~	2.~~64~~09 E+~~87~~	~~2.64~~1.84 E+8	~~2.64~~1.59 E+9
(b-2) Upper area of lower drywell (Figure 6.2-1)	~~2.64~~2.77 E+~~76~~	~~2.64~~1.27 E+~~87~~	~~2.64~~2.29 E+8	~~2.64~~1.13 E+9
(b-3) Lower area of lower drywell (Figure 6.2-1)	~~2.64~~1.97 E+~~76~~	~~2.64~~2.09 E+~~87~~	~~2.64~~6.57 E+~~87~~	~~2.64~~1.59 E+9
(b-4) Wetwell - Suppression pool and gas space (Figure 6.2-1)	~~4.0~~3.47 E+~~76~~	~~5.3~~2.09 E+~~87~~	~~4.06~~.41 E+~~87~~	~~6.61~~.59 E+9

(1) The accident dose rates are based on ~~A~~ESBWR plant accident conditions and ~~adjusted for ESBWR using appropriate scaling factors~~calculated in accordance with RG 1.183 and NUREG-1465.

(2) Note deleted.

(3) Integrated dose is for ~~6 months~~100 days.

NRC RAI 3.11-24

In DCD Tier 2, Revision 4, Table 3H-5 lists the operating dose rates for the various portions of the containment vessel. The listed operating dose rates for the upper drywell and upper area of the lower drywell are given as 26.1 R/hr and for the lower area of the lower drywell as 19.8 R/hr. On the basis of the different operating dose rates in different rooms in the containment vessel as shown in Figures 12.3, show how you arrived at the operating dose rate values for the drywell listed in Table 3H-5. Verify that the listed operating dose rates for the upper and lower drywell of 26.1 and 19.8 R/hr, respectively, in Table 3H-5 are conservative and bounding.

GEH Response

The normal operating drywell dose rates in Table 3H-5 are based on actual calculations for the ABWR design and scaled for the increased ESBWR power level. The ABWR dose rates were multiplied by a factor of 1.15 for the power differential (4500 MWt/3929 MWt) and a factor of 1.15 for the conversion of dose to exposure in air units (Roentgen). These dose rates are considered conservative based on the conversion to exposure in air units and will be verified based on specific equipment location as part of the detailed design process and in accordance with ITAAC 3.8.1.

The figures in Section 12.3 related to the containment show that for normal operations the radiation zone for the lower drywell is Zone J (>5 Sv/hr) and this is based on the assumption that this area is inaccessible during operations and is classified as a very high radiation area in accordance with 10 CFR 20. No specific calculation was performed to justify the >5 Sv/hr categorization.

DCD Impact

DCD Tier 2, Subsection 3.11.6, Appendix 3H Section 3H.3.1 and Appendix 3H Table 3H-5 were revised to clarify source of information and changes incorporated in Revision 5 of the DCD.

NRC RAI 3.11-26

In DCD Tier 2, Rev. 4, Table 3H-5 lists the operating dose rate and the 60-year integrated dose for various zones within the containment vessel.

a) The *60-year integrated dose of 1.7 E+2 R listed for the Wetwell appears to be in error since it is not a factor of 7.4 E+5 (number of hours in 60 years) greater than the operating dose of <1.4 R/hr listed in this table for the Wetwell. Revise this table to provide the correct integrated dose value in the Wetwell.*

b) The 60-year integrated gamma doses listed in Table 3H-5 for the upper and lower drywell areas (plant zones b-1 through b-3) exceed the equipment qualification values for both electronic equipment (1E+4 rads) and other equipment (1E+6 rads) as stated in the footnote for Table 3H-6.

Describe the plant design features, which will be used in these drywell areas to ensure that the radiation qualification limits of the equipment in these areas will not be exceeded.

GEH Response

a) Table 3H-5 has been revised in DCD Revision 5 to correct the integrated dose for plant zone b-4, Wetwell.

b) Specific plant design features to maintain radiation exposure to equipment less than the equipment qualification levels inside the containment during normal operations will be evaluated during the detailed design process and in accordance with DCD Tier 1, Table 3.8-1. These analyses will evaluate each specific equipment location and determine design features needed to maintain integrated doses less than the qualification criteria for electronic equipment. If the integrated dose exceeds the equipment qualification values after the detailed calculations, shielding or other methods (e.g., equipment replacement program) to reduce the dose will be incorporated during the detailed design.

A detailed description of the radiation environment qualification process is addressed in DCD Subsection 3.11.3 and in regard to equipment exceeding integrated dose levels. (MFN 08-086 S42)

DCD Impact

DCD Tier 2, Subsection 3.11.6, Appendix 3H Subsection 3H.3.1, and Appendix 3H Table 3H-5 were revised and changes incorporated in Revision 5 of the DCD.

NRC RAI 3.11-27

The following apply to DCD Tier 2, Rev. 4, Table 3H-11.

a) The last two columns of Table 3H-11 list the integrated gamma and beta doses for zones b-1 through b-4 in the containment vessel. Footnote (3) of this table states that these doses are integrated over a 6 month period (i.e., the hourly gamma and beta dose rate values given in the first two columns of Table 3H-11 should be multiplied by a factor of 4380 (4380 hours in a 6 month period) to obtain the integrated values in the last two columns). Explain why the integrated doses in the last two columns in this table are only a factor of 10 larger than the hourly doses shown (except for the integrated beta dose for the Wetwell, which is a factor of 12.4 higher).

b) Table 3.11-1 states that the equipment listed must remain available or operational for 72 hours. On the basis of the operating dose rates listed in Table 3H-11, the equipment located in various plant zones inside the containment vessel would receive an integrated dose of 1.9 E+9 rads for a 72-hour period. This integrated dose value exceeds the equipment qualification values for both electronic equipment (1E+4 rads) and other equipment (1E+6 rads) as stated in the footnote for Table 3H-6. Describe the plant design features which will be used inside the containment vessel to ensure that the radiation qualification limits of the equipment in these areas will not be exceeded.

GEH Response

a) The integrated dose values in Table 3H-11 were recalculated as described in the response to RAI 3.11-23. These doses take into account the radioactive decay over the integration period as the nuclear fission process has ended.

b) Specific plant design features to maintain radiation exposure to equipment below equipment qualification levels inside the containment during accident conditions will be evaluated during the detailed design process and in accordance with DCD Tier 1, Table 3.8-1. These analyses will evaluate each specific equipment location and determine if design features are needed to maintain integrated doses less than the required qualification criteria for electronic equipment. If the integrated dose exceeds the equipment qualification values after the detailed calculations, design features including shielding or other methods (e.g., required operating time analysis) to reduce the dose will be incorporated during the detailed design.

A detailed description of the radiation environment is addressed in DCD Subsection 3.11.3 and in regard to equipment exceeding integrated dose levels. (MFN 08-086 S42)

DCD Impact

DCD Tier 2, Subsection 3.11.6, Appendix 3H Subsection 3H.3.2, and Appendix 3H Table 3H-11 were revised and changes incorporated in Revision 5 of the DCD.

Attachment A
Dose Analysis Summation for Upper Area of the Lower Drywell Dose Point #1

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Attachment B Non-Proprietary
Example RADTRAD and MicroShield computer runs

Attachment B
RADTRAD Example
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Attachment B
Gamma Plateout Example

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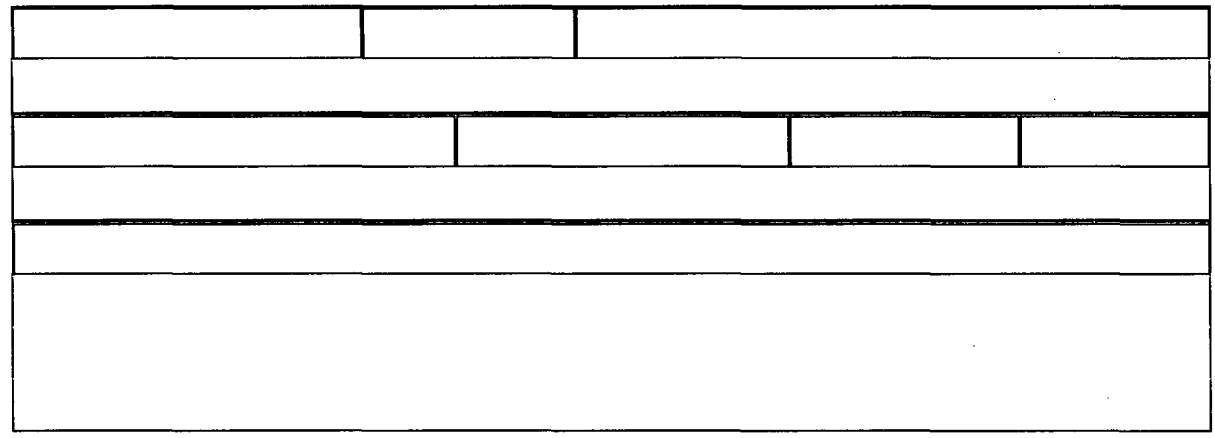

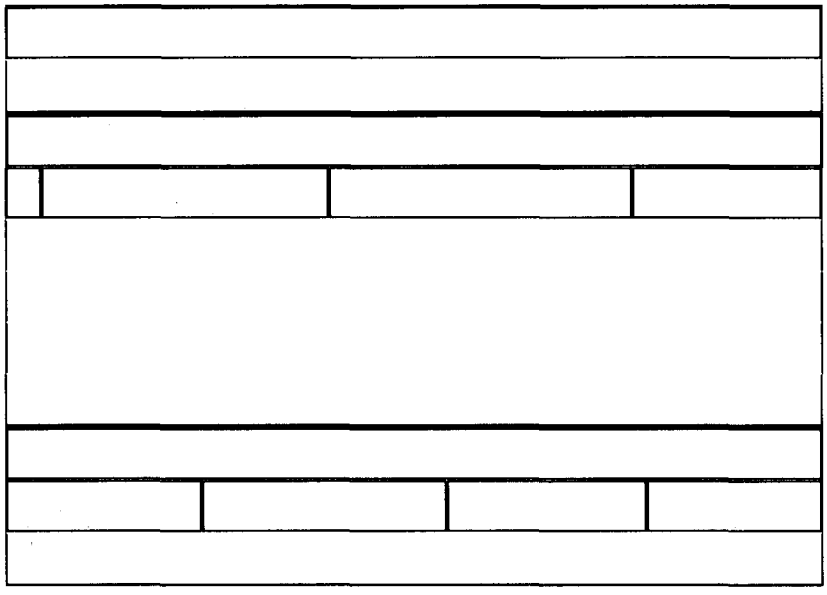

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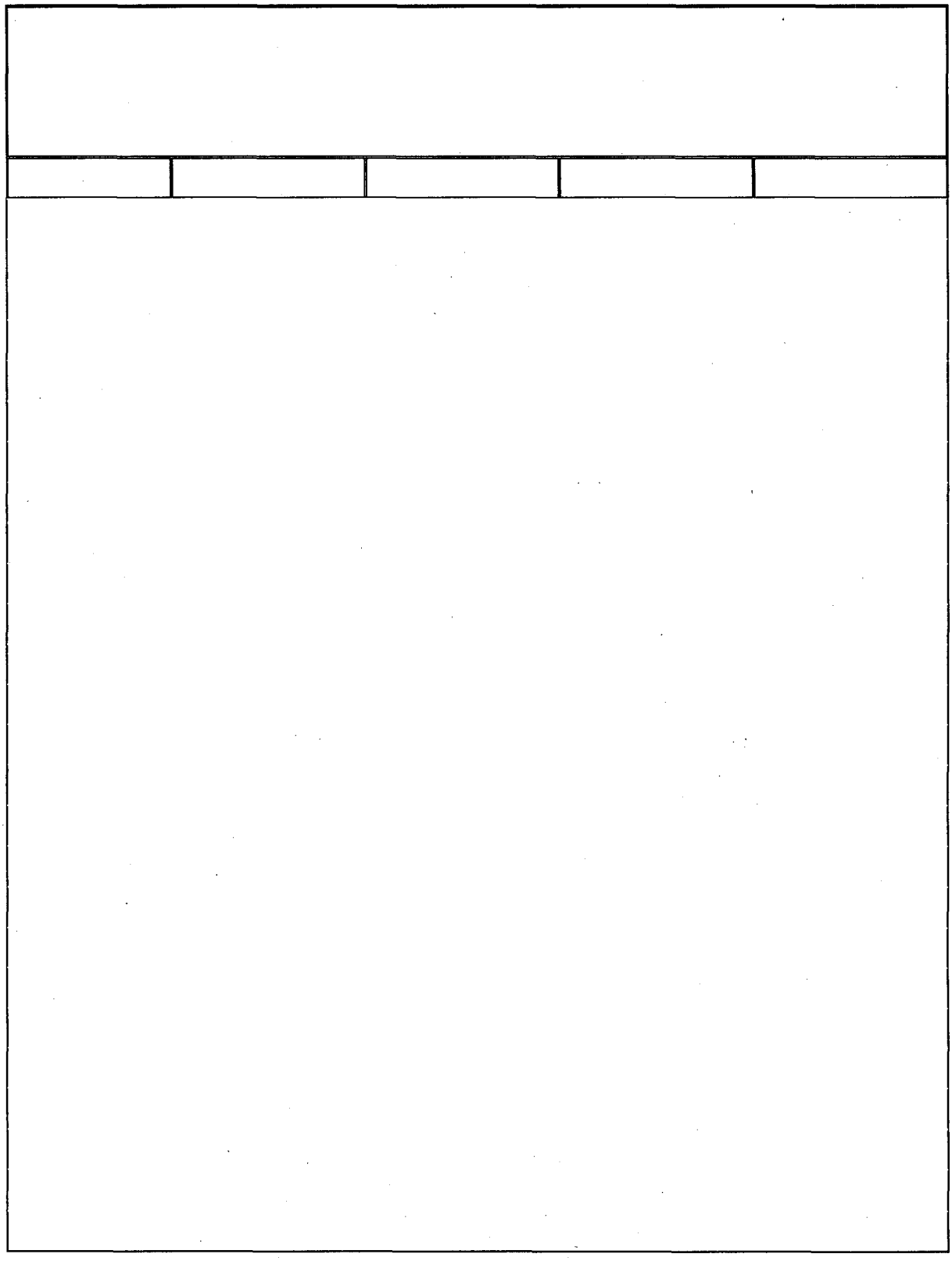
Gamma Plateout Example



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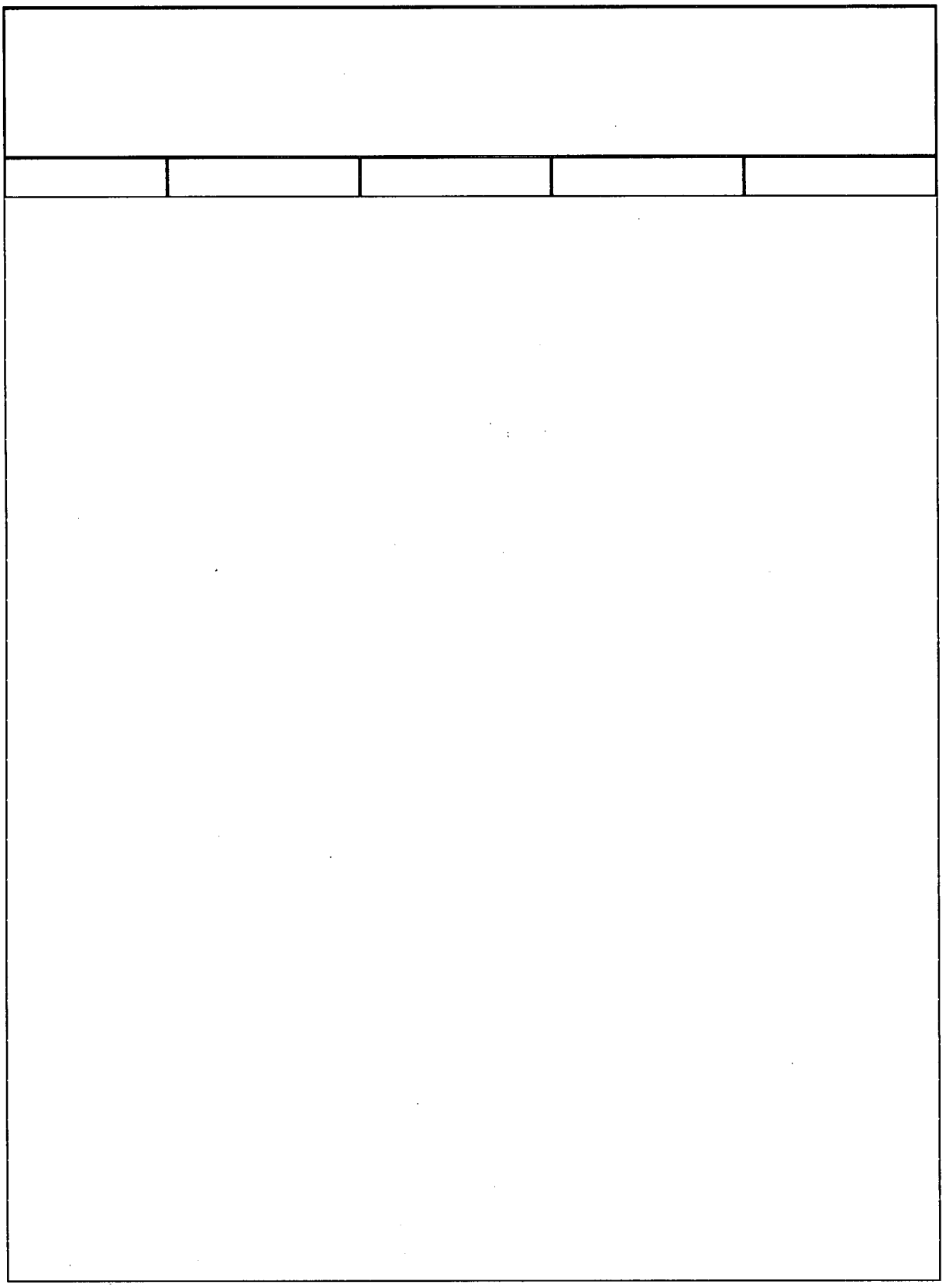

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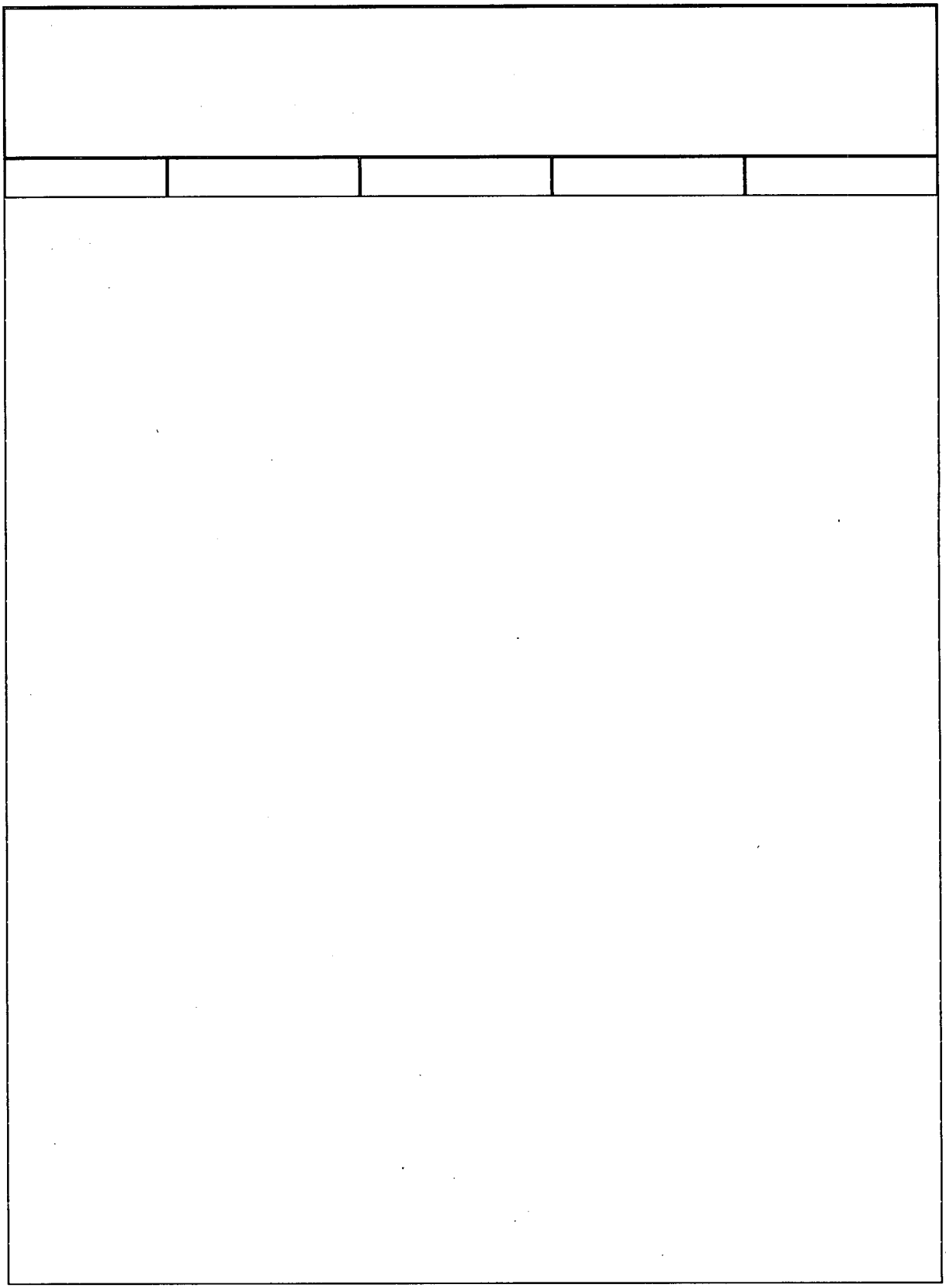

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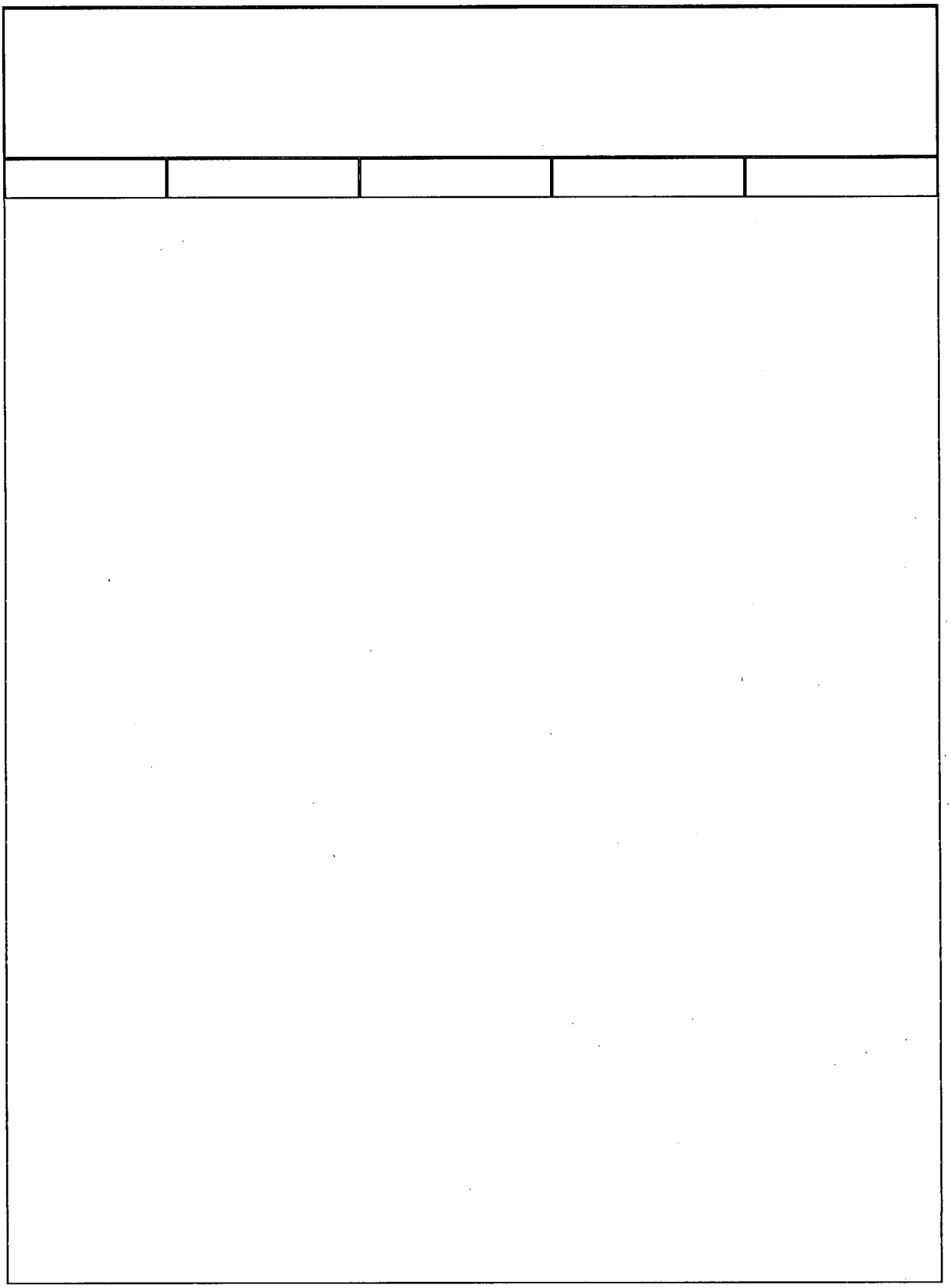

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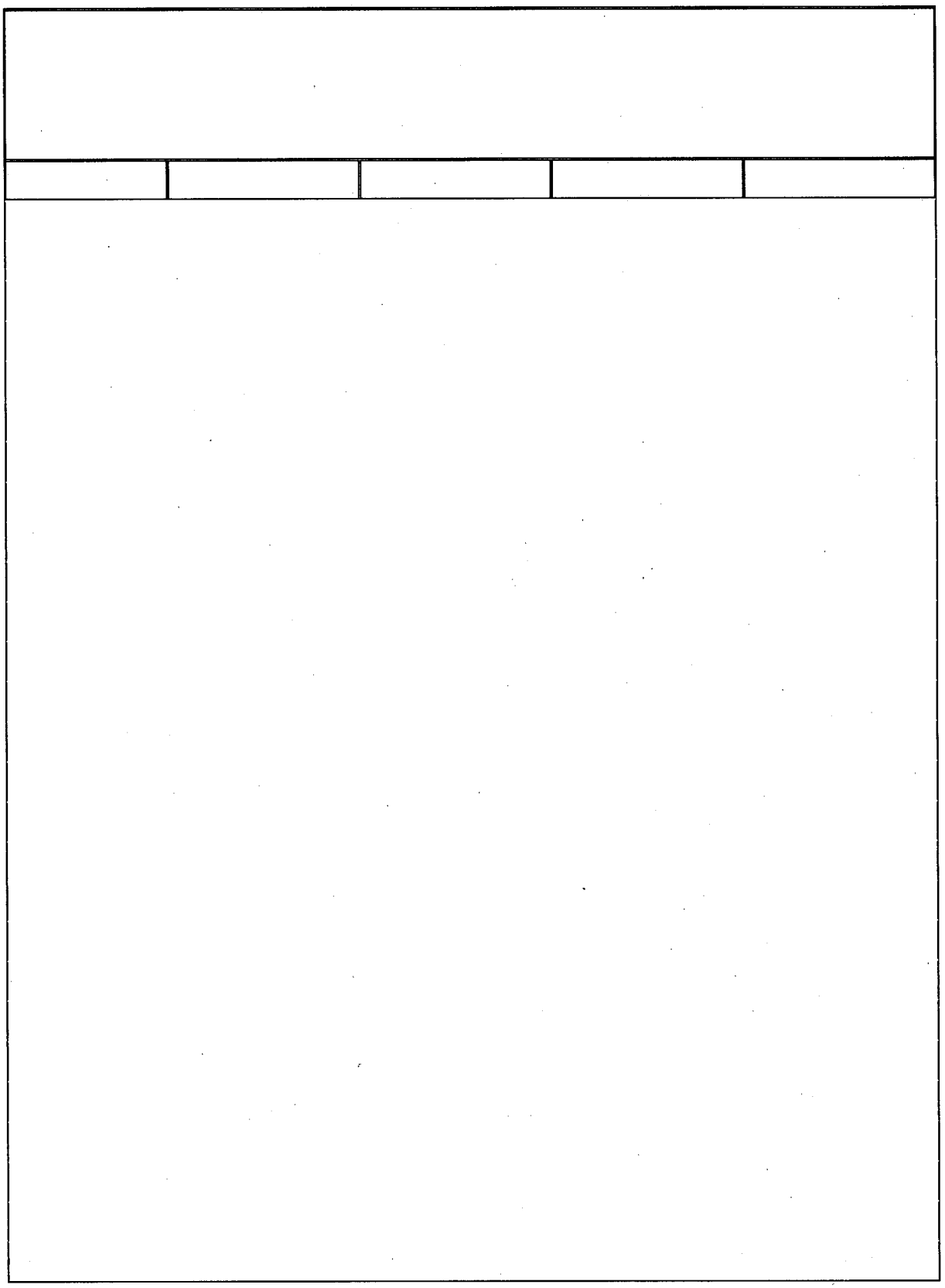

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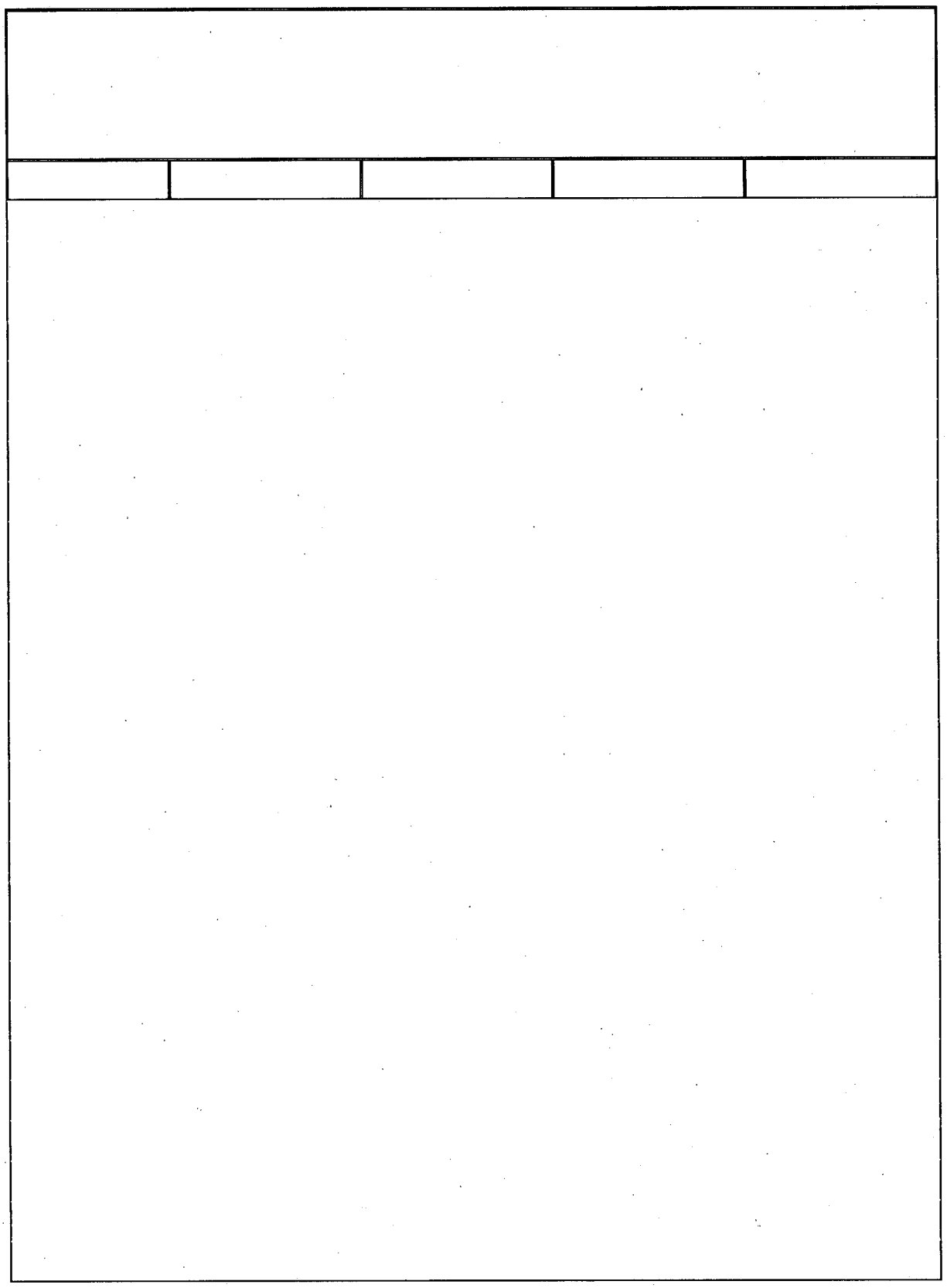

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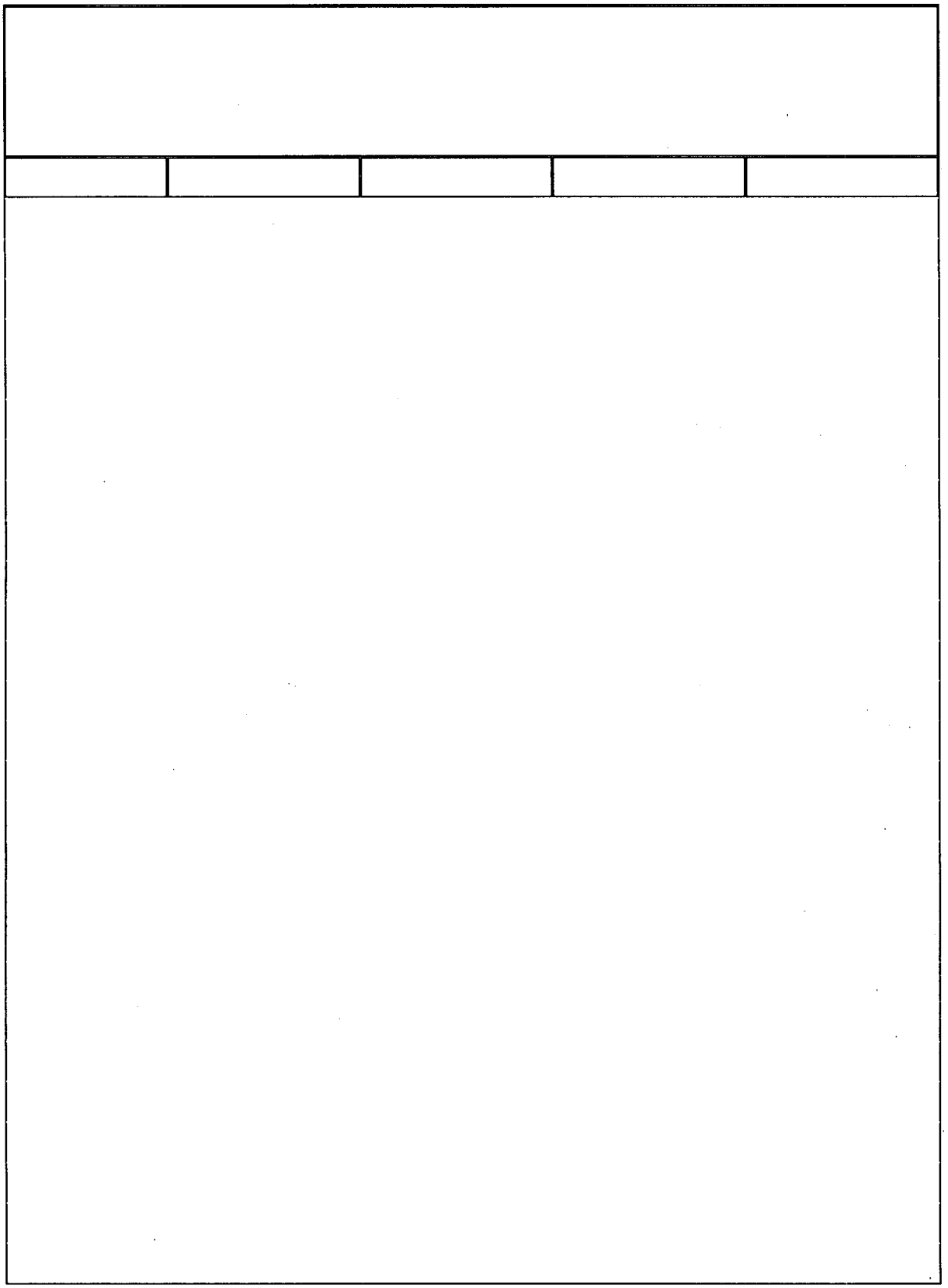

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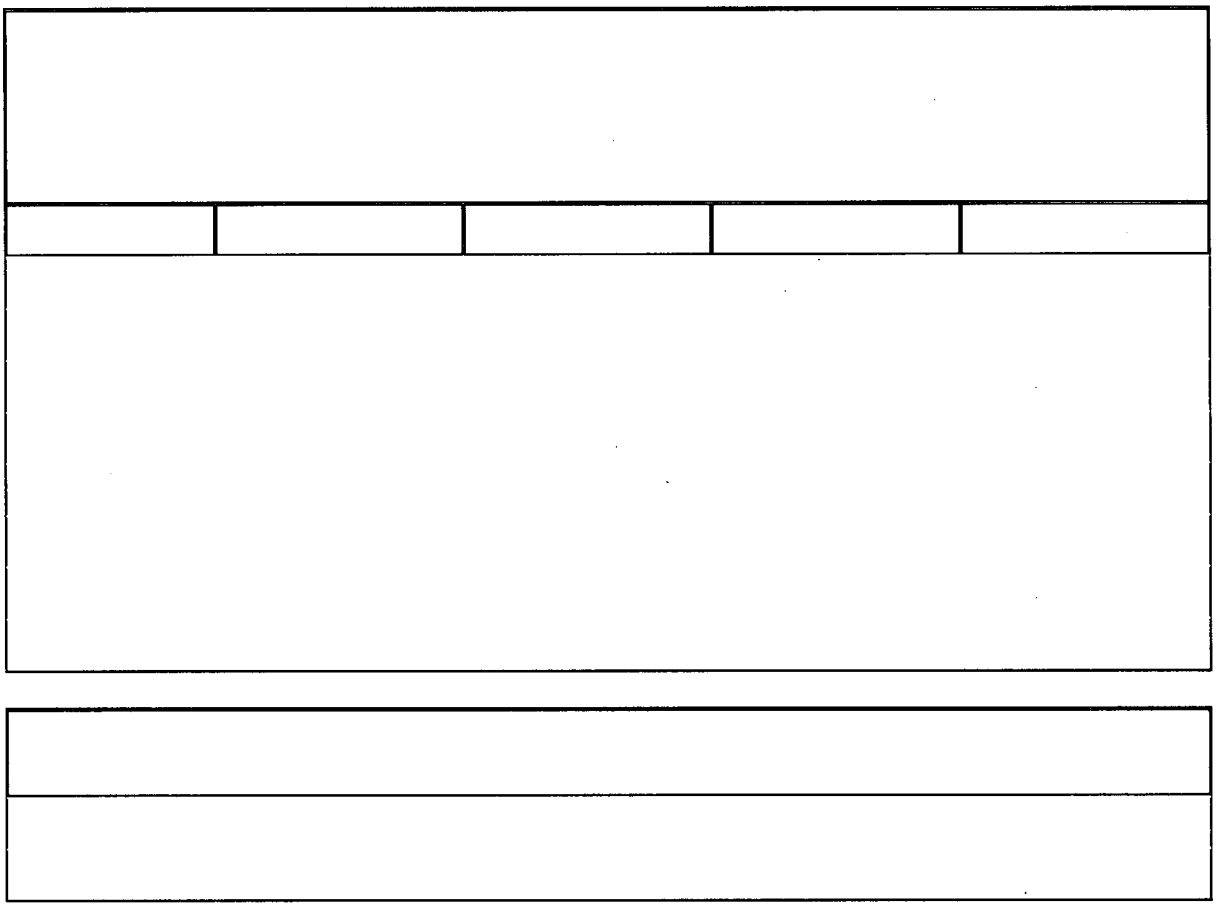

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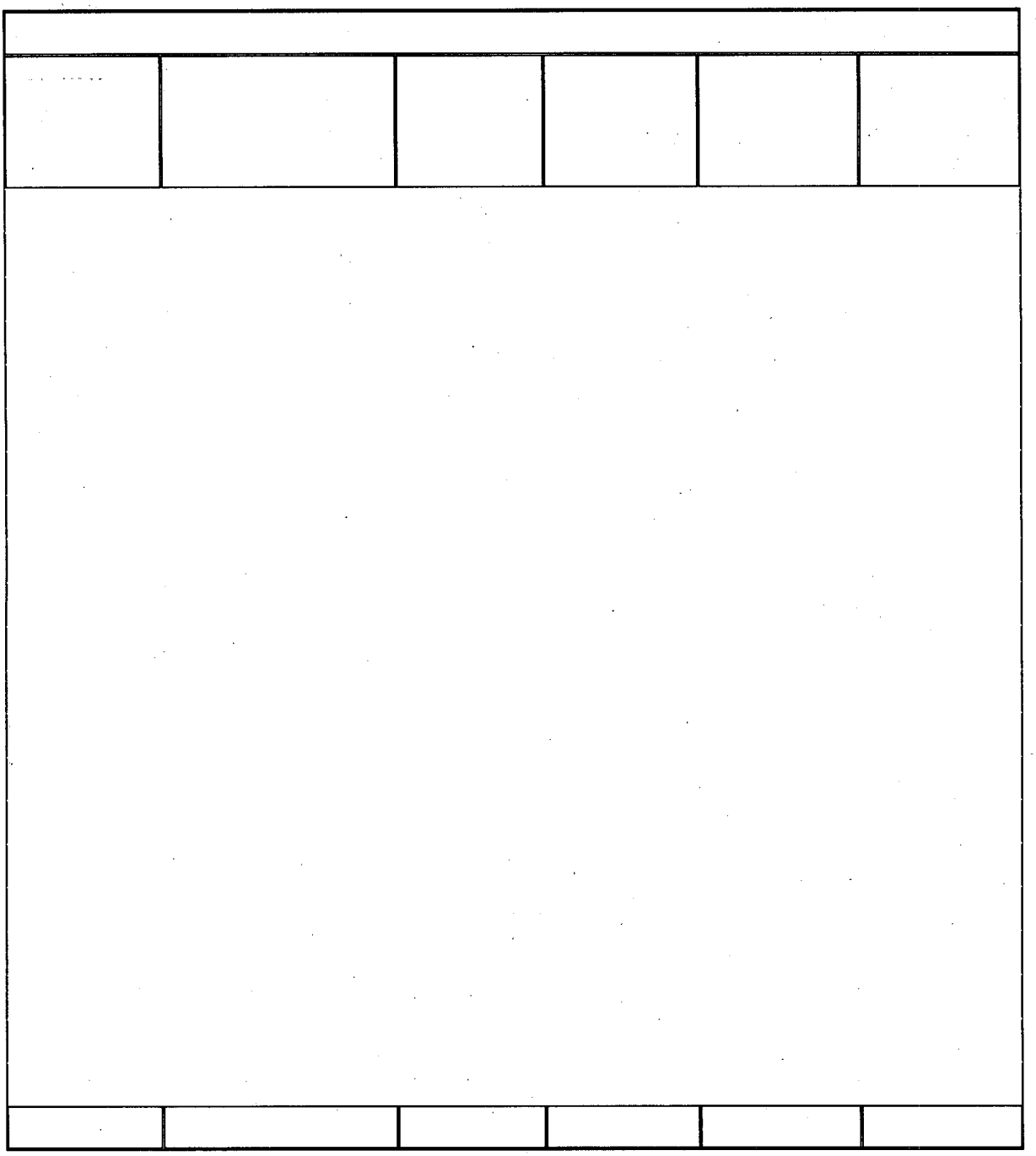

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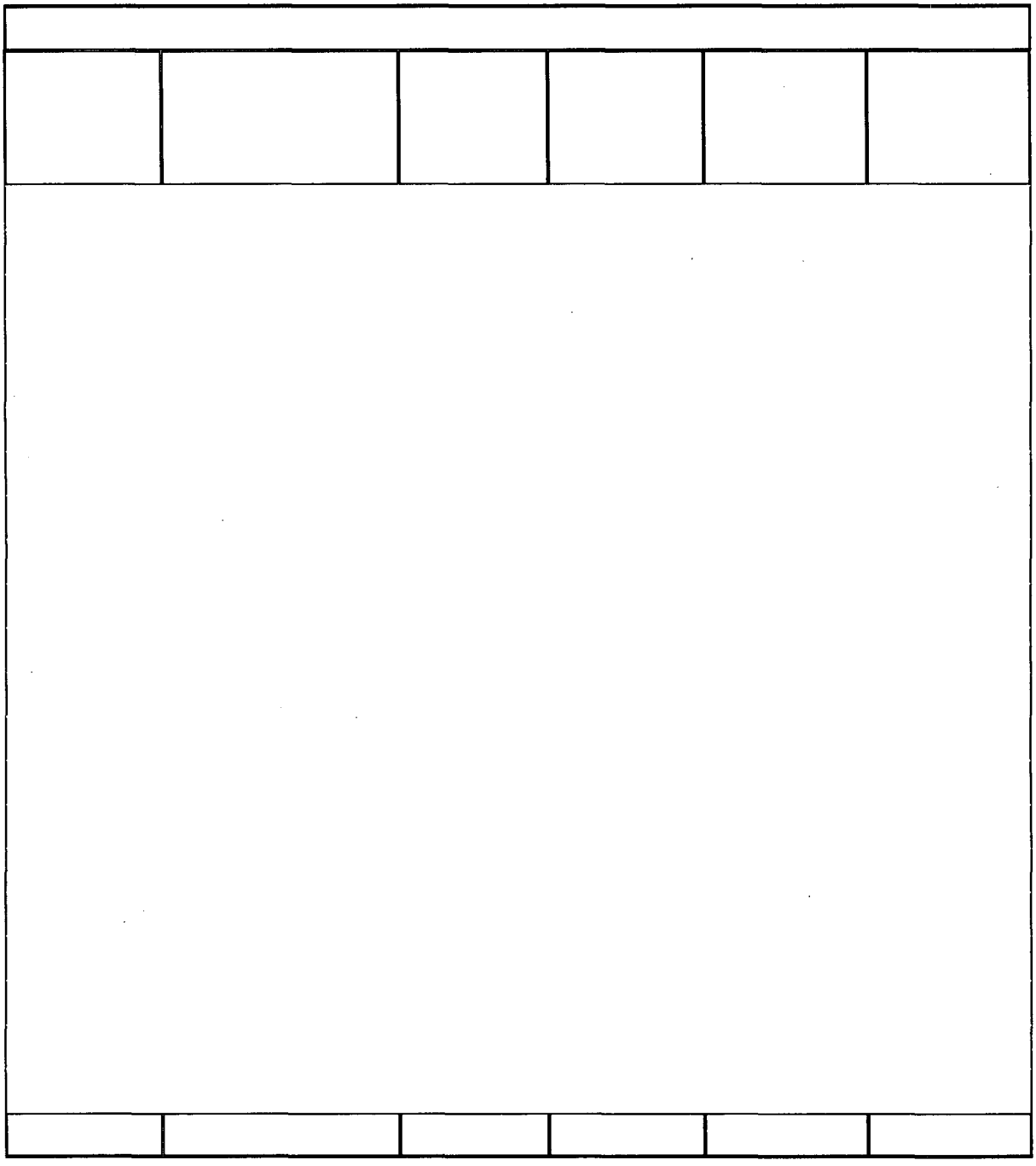

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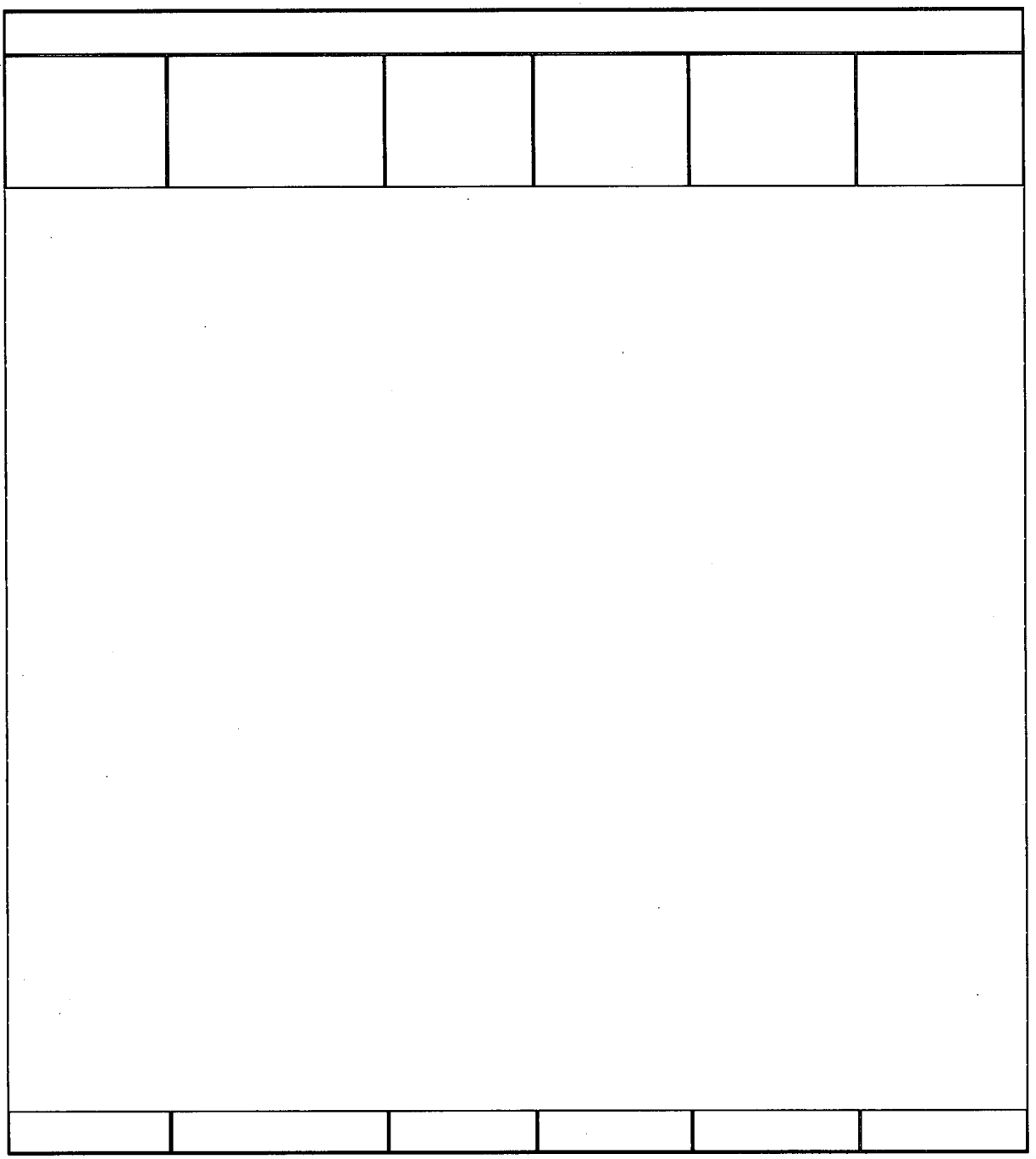

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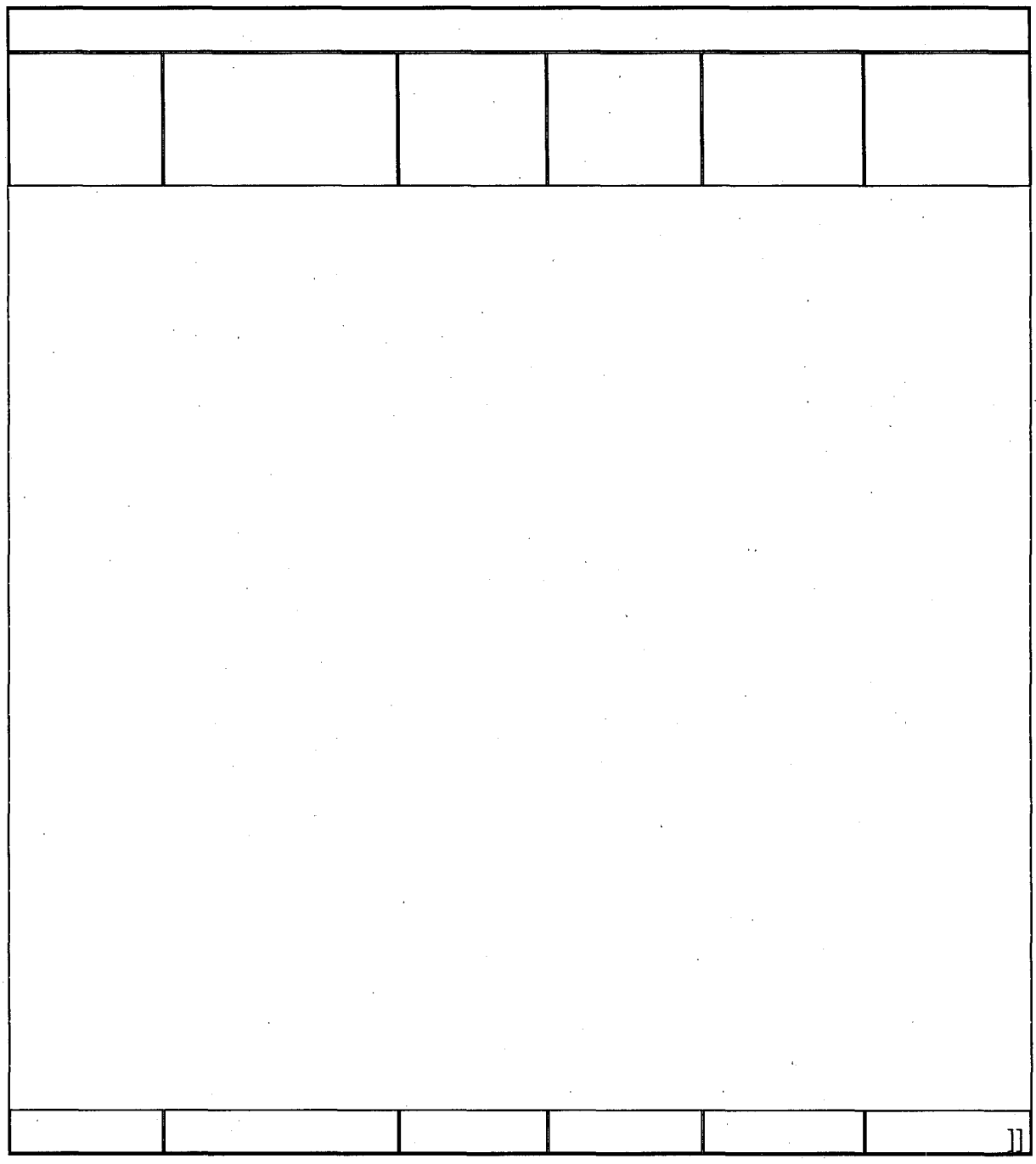
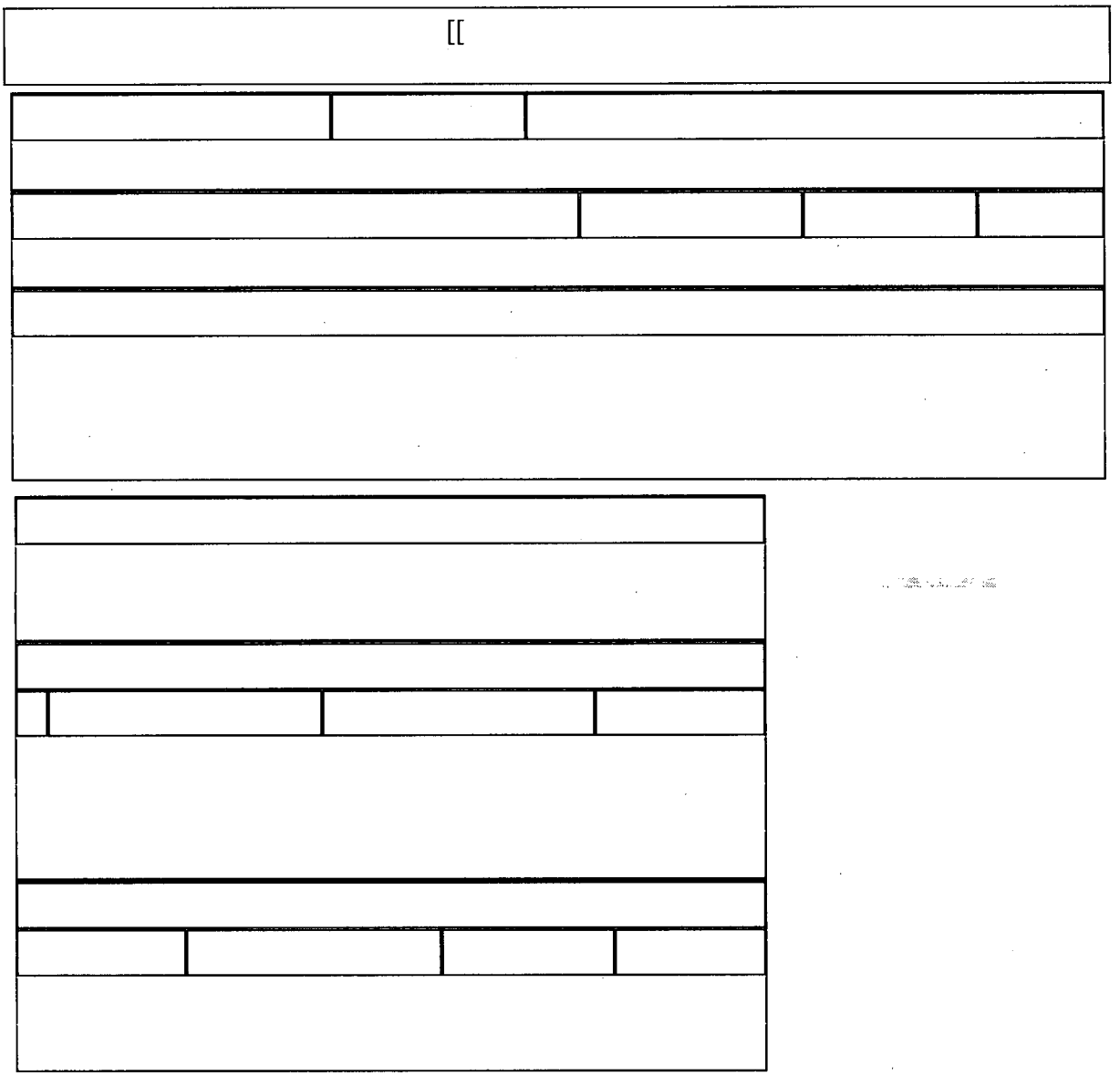


Attachment B
Sump Example



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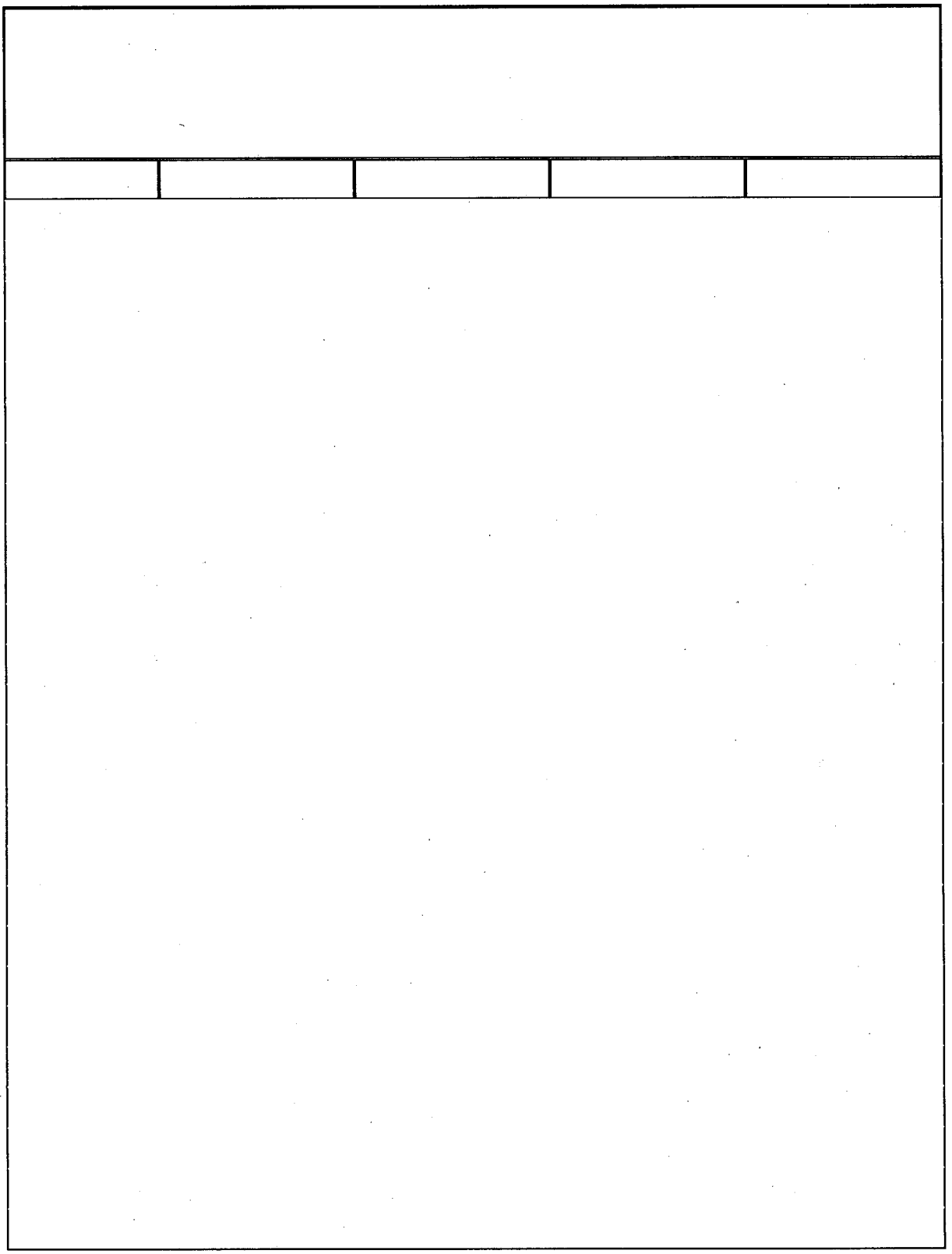

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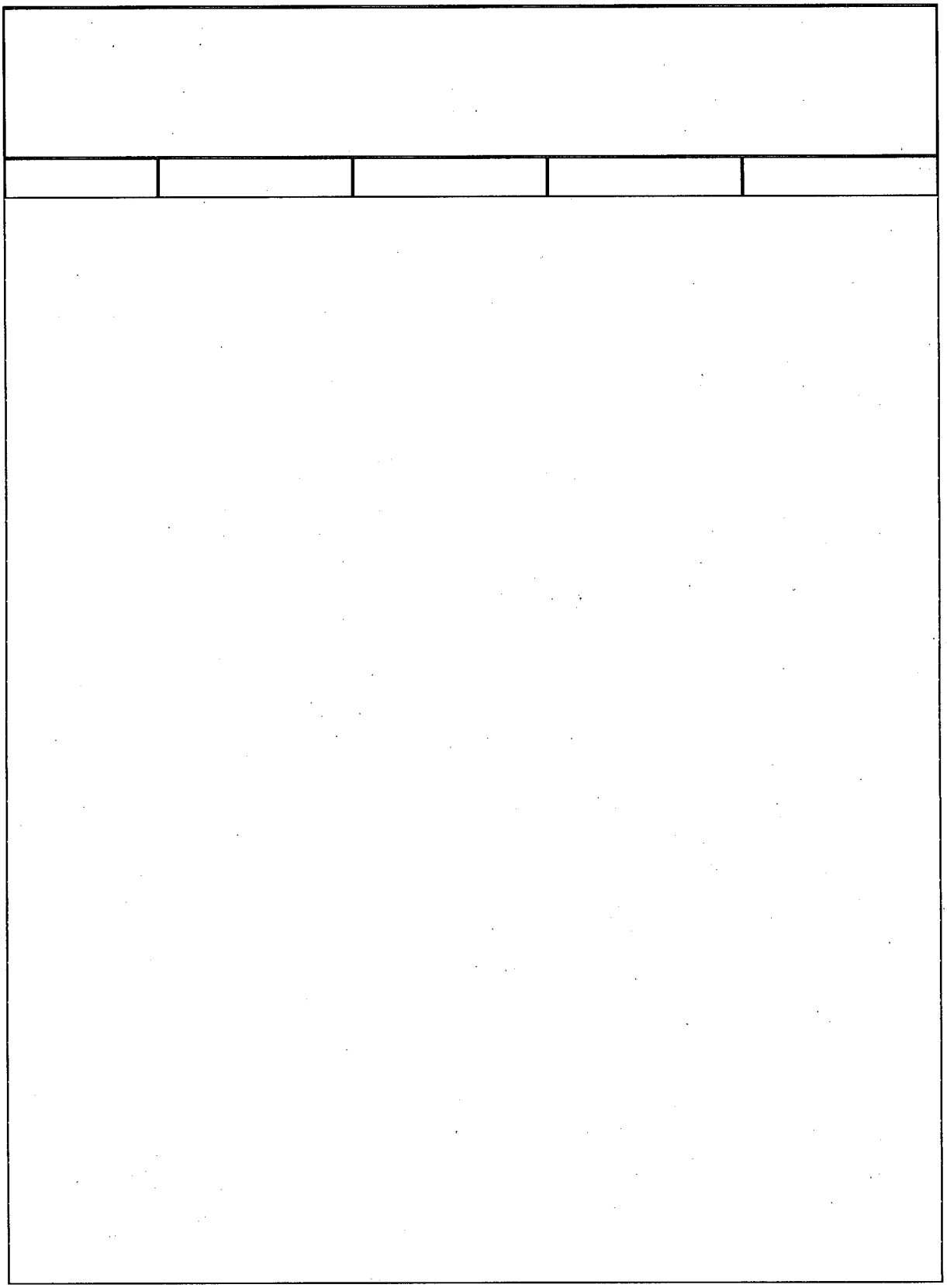
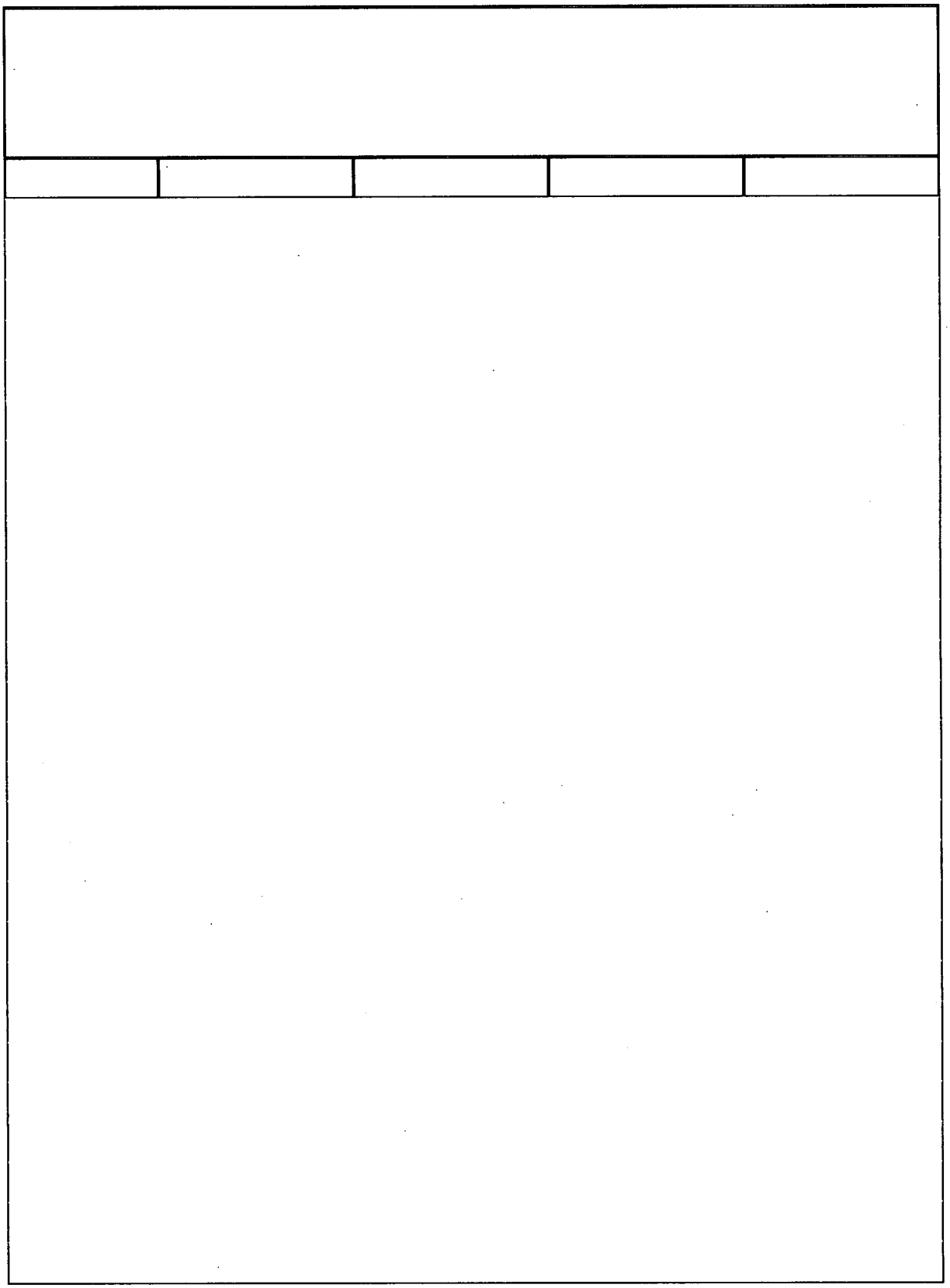


Attachment B
Sump Example



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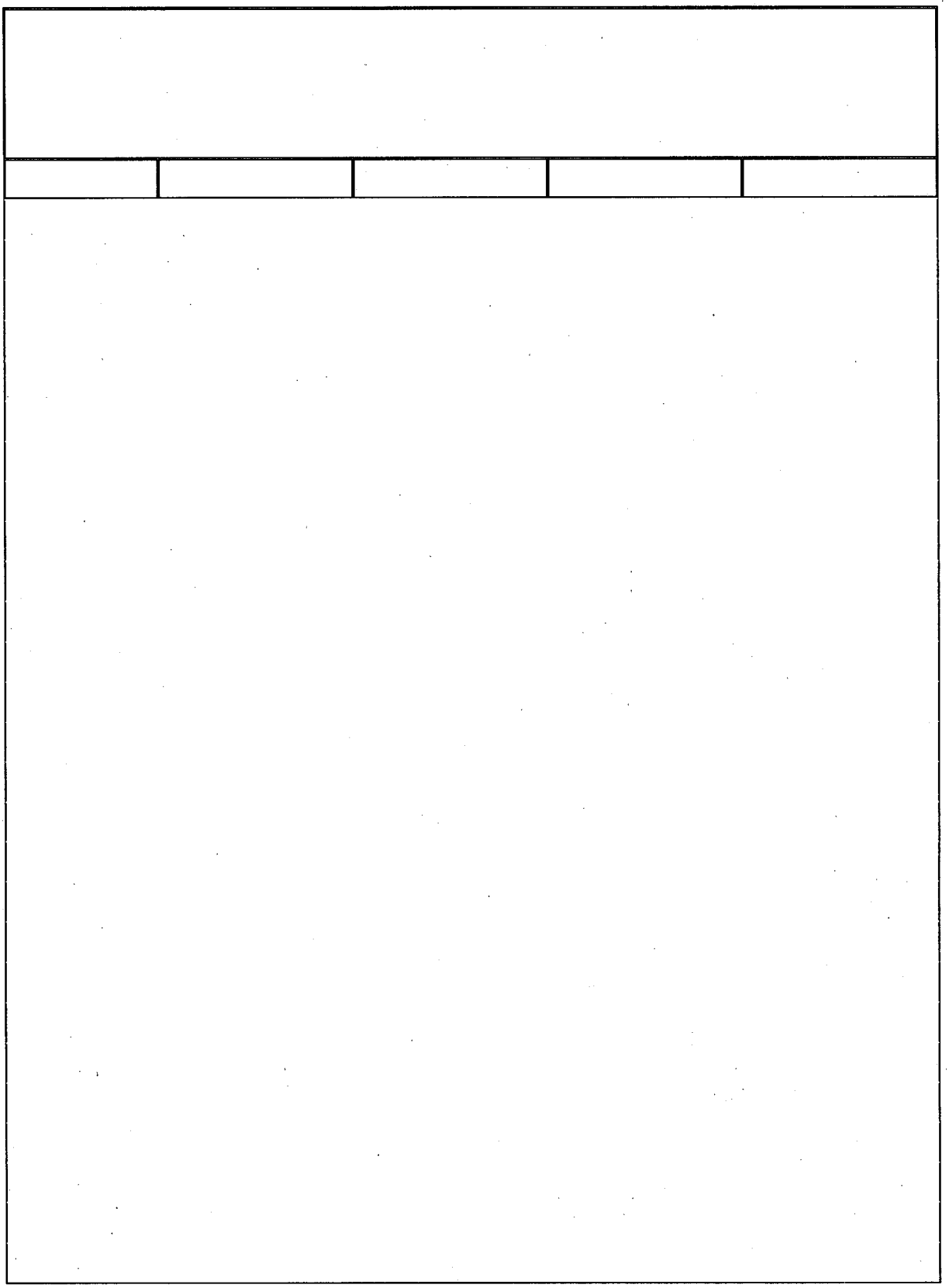
Sump Example



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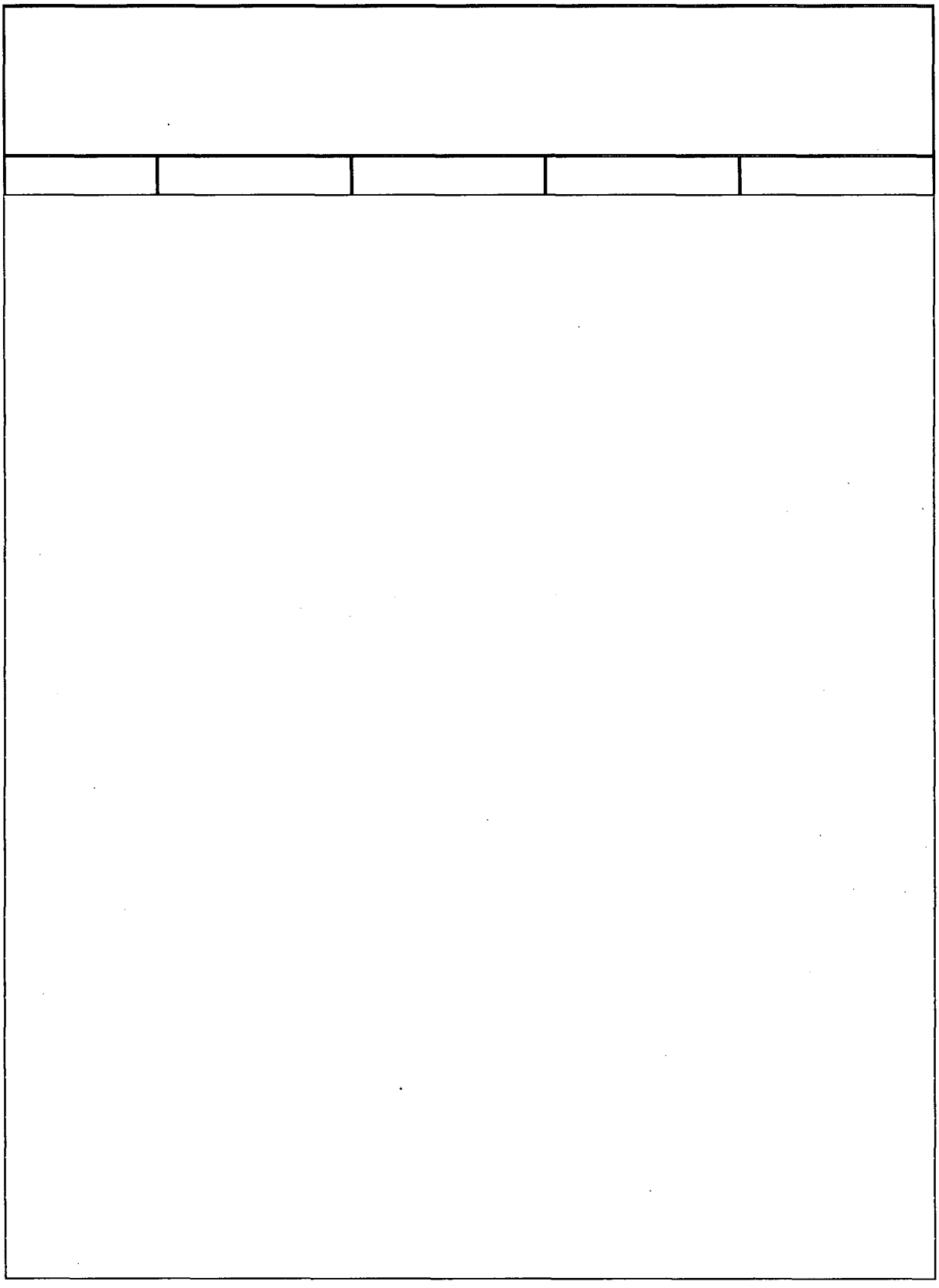

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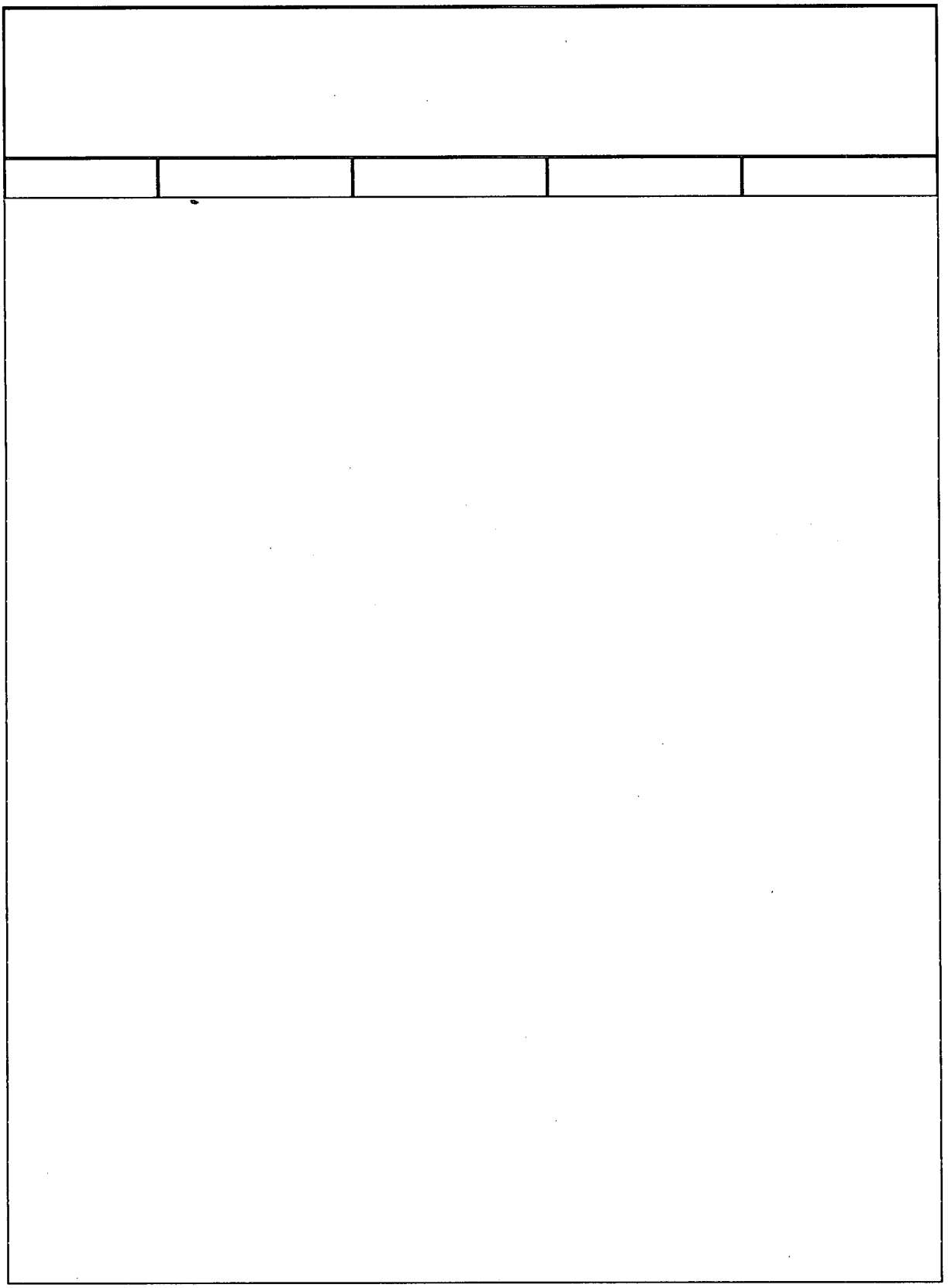

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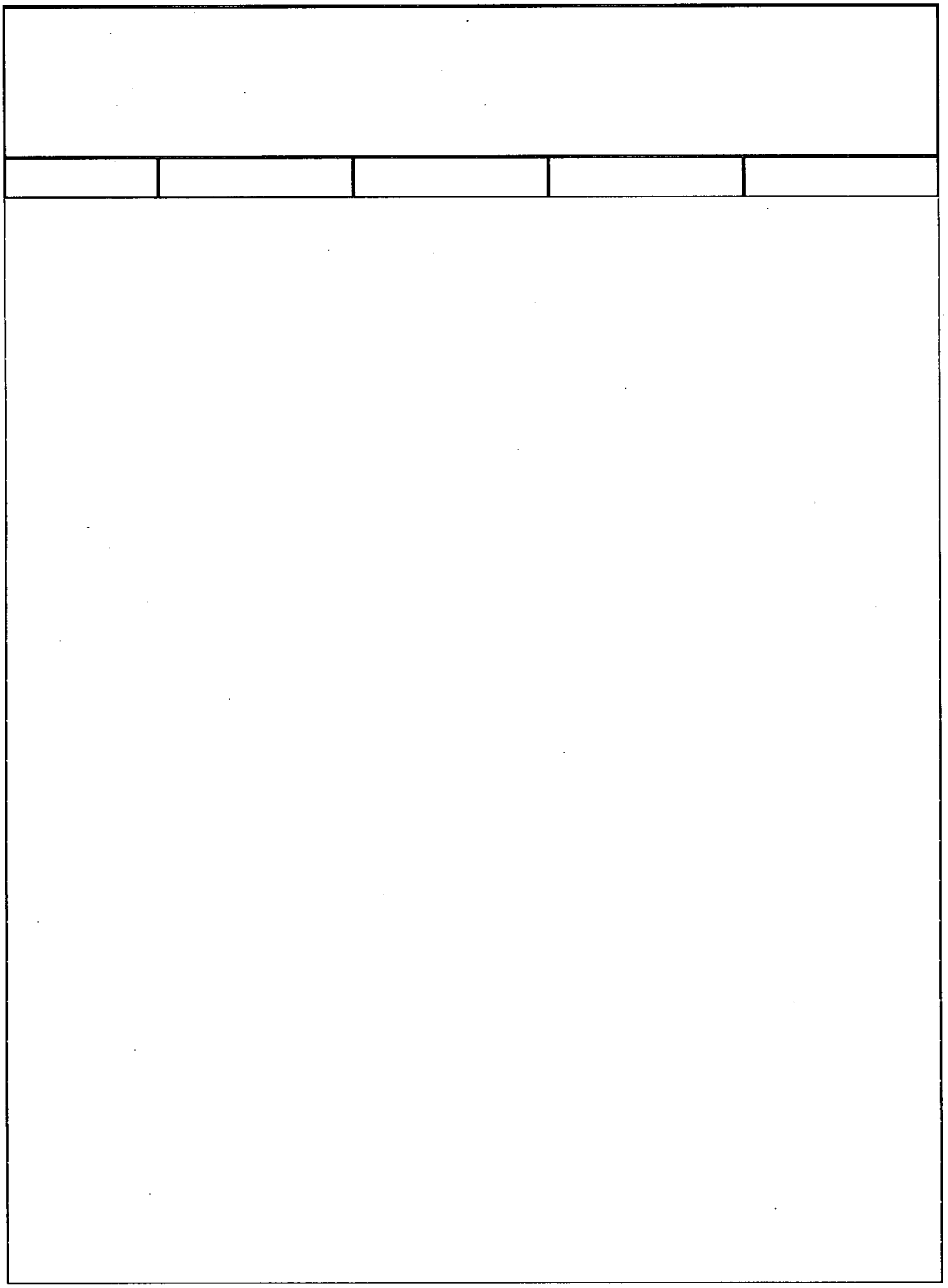

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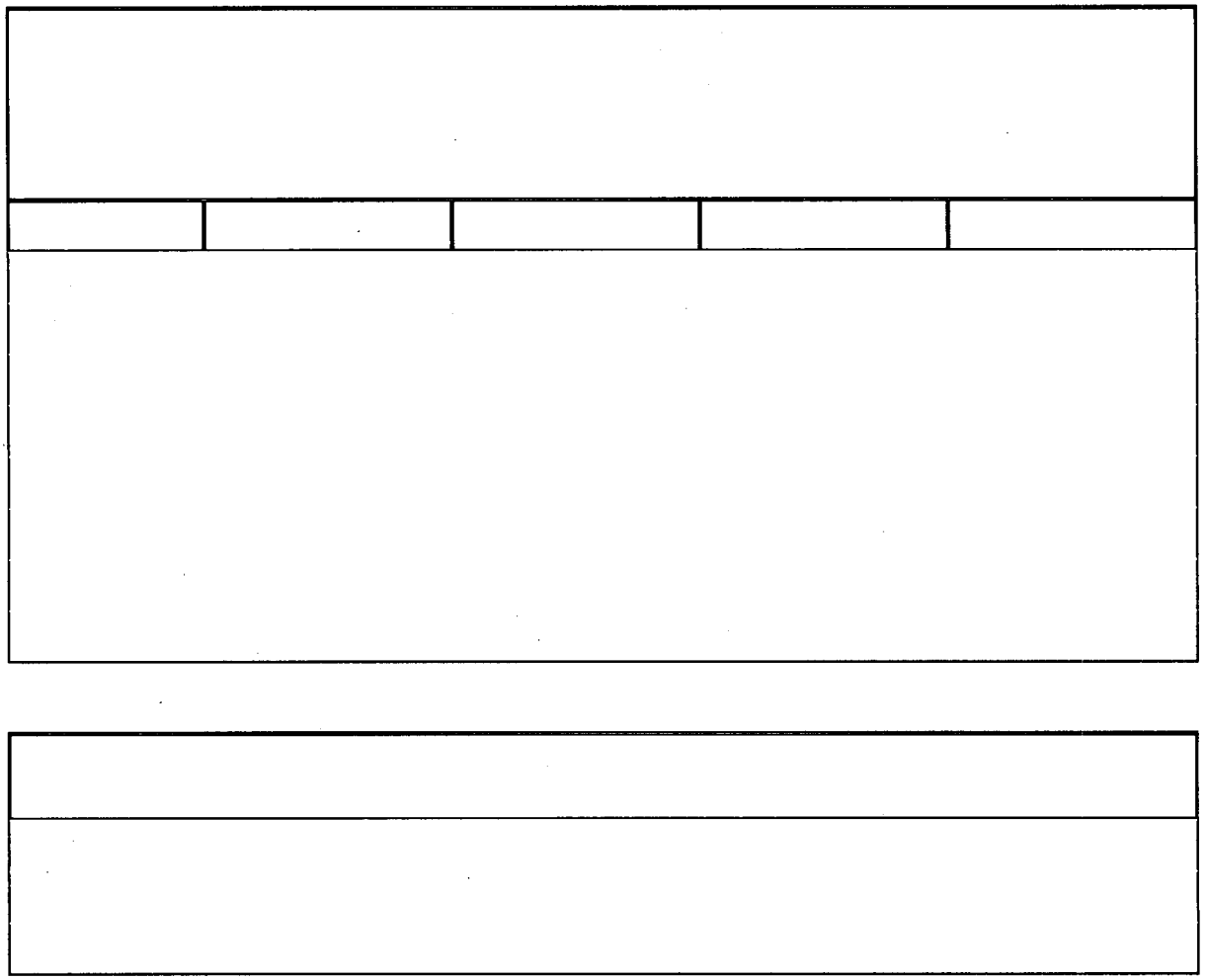
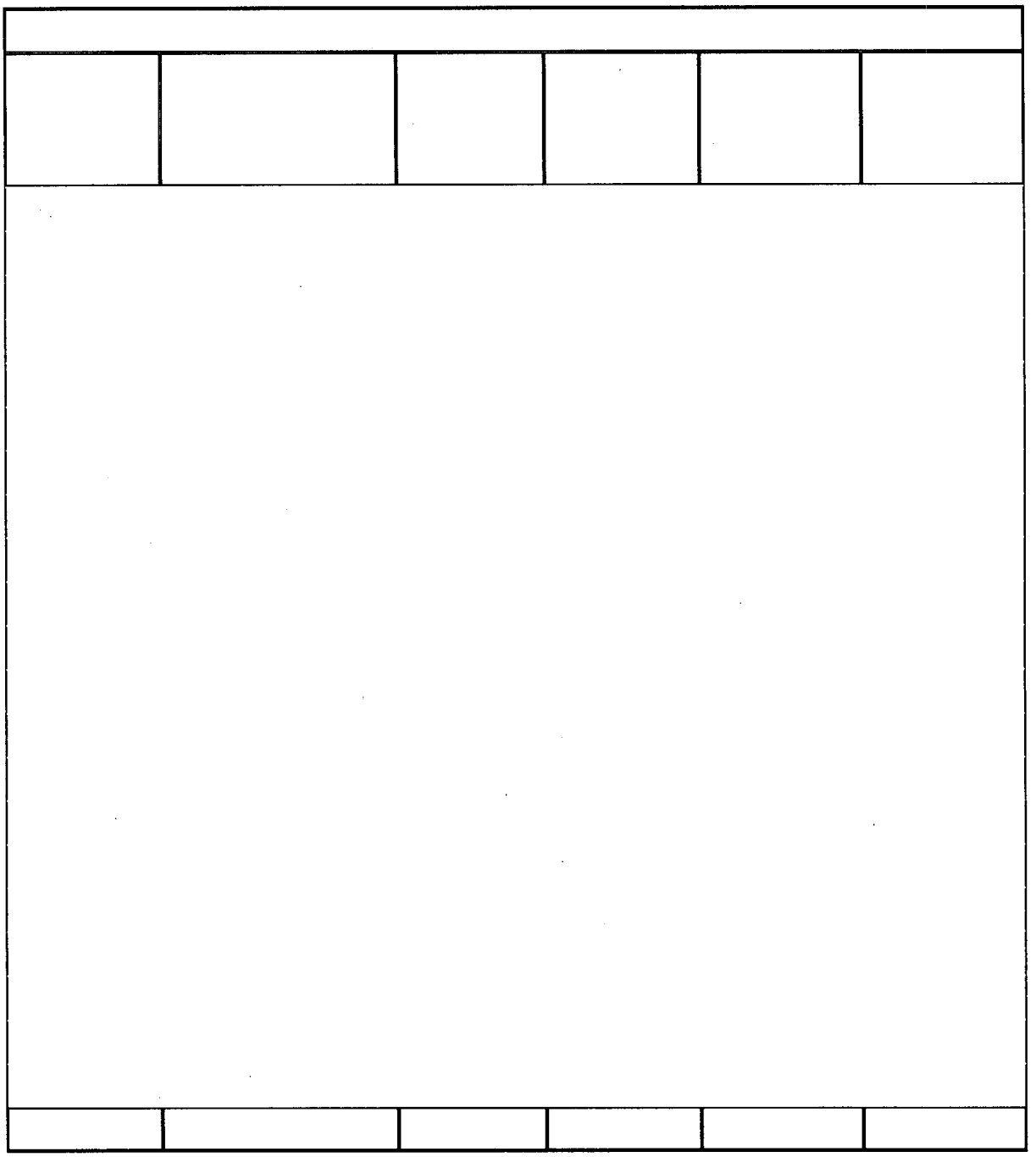
Sump Example



Attachment B
Sump Example



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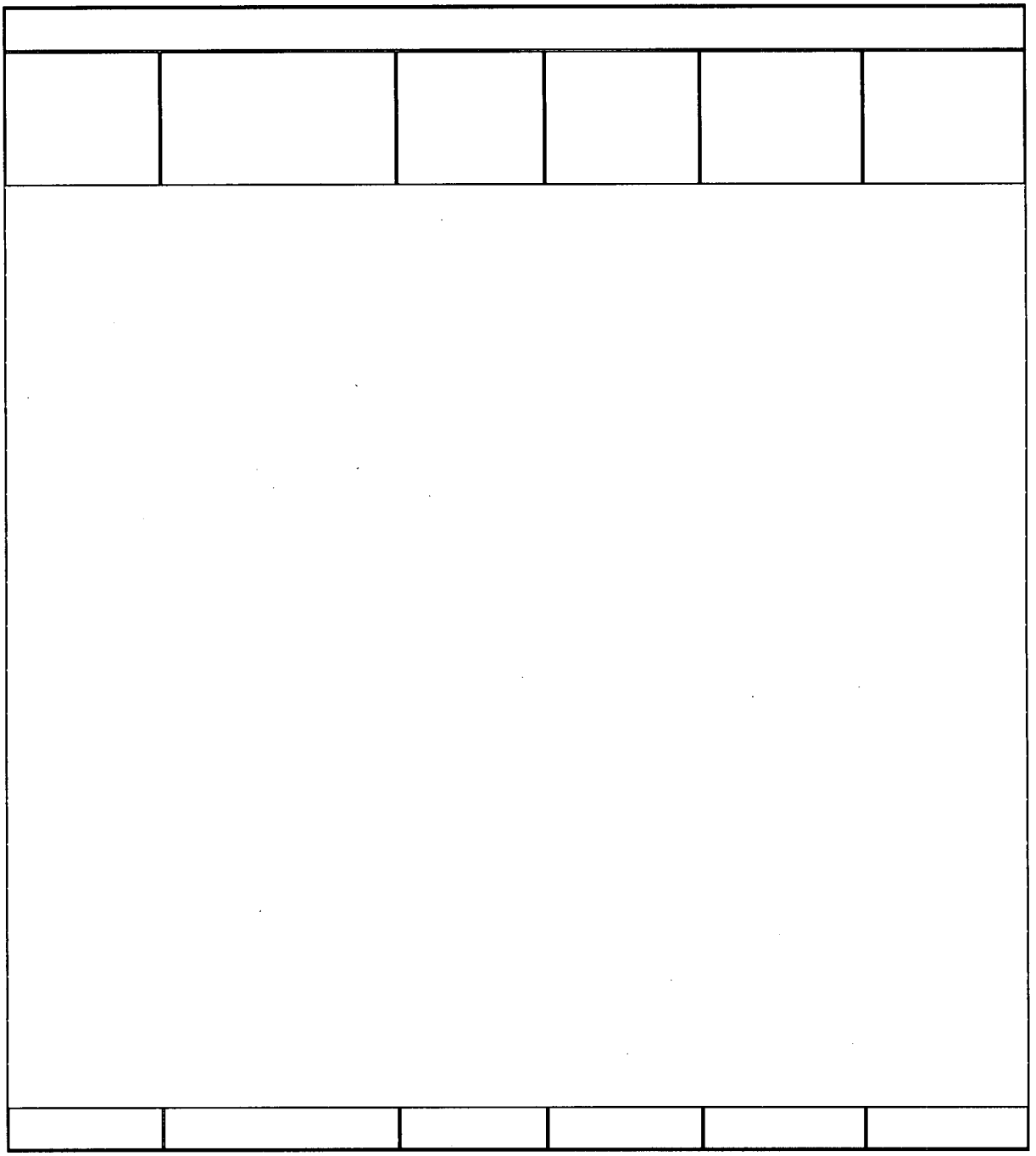

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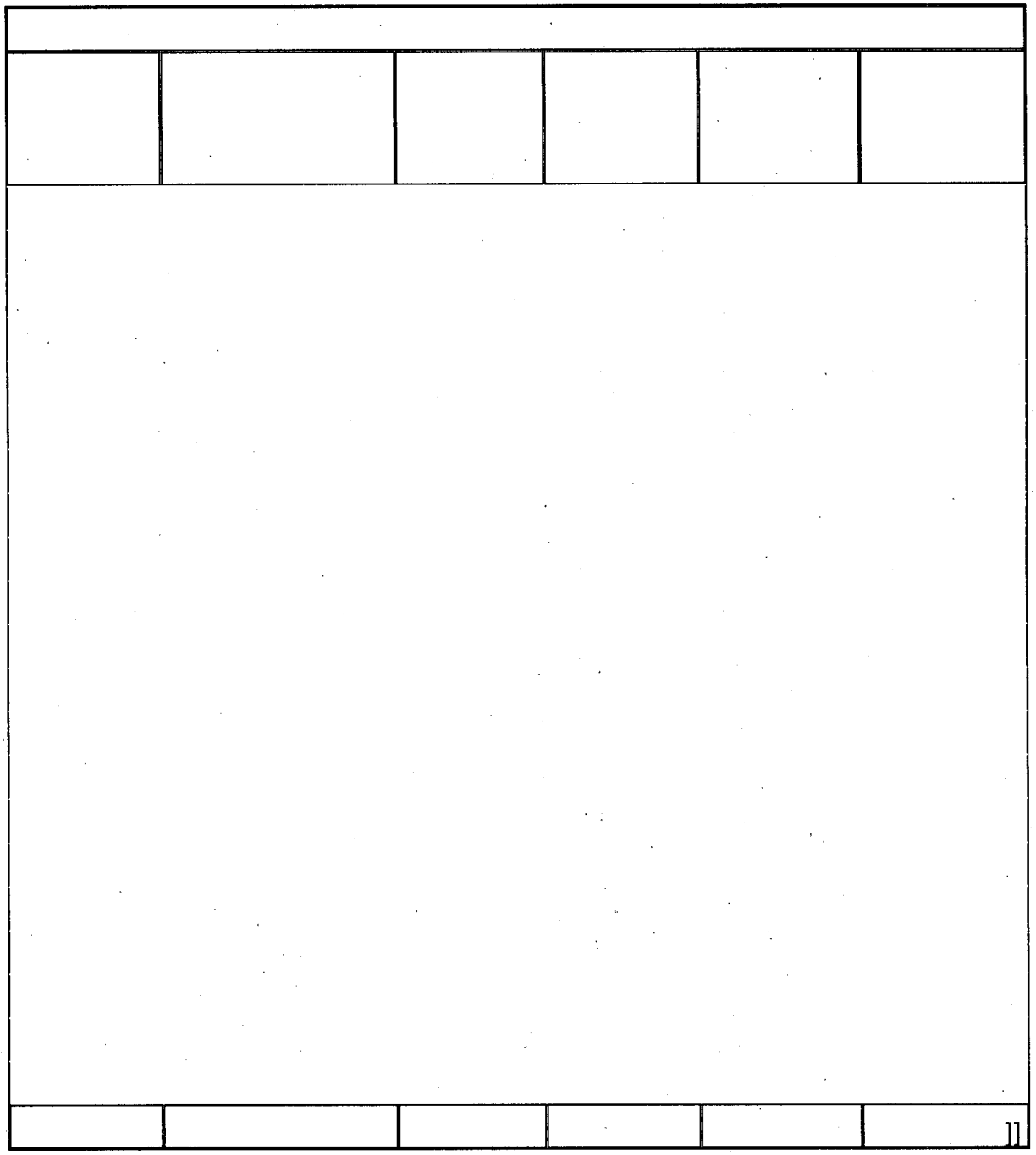

Enclosure 3

MFN 08-606

Response to Portion of NRC Request for

Additional Information Letter Nos. 160 and 166

Related to ESBWR Design Certification Application

Design of Structures, Components, Equipment, and Systems

RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, David H. Hinds, state as follows:

(1) I am the Manager, New Units Engineering, GE Hitachi Nuclear Energy ("GEH"), have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter MFN 08-606, Mr. Richard E. Kingston to U.S. Nuclear Regulatory Commission, entitled *Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Number 3.11-23, 3.11-24, 3.11-26 and 3.11-27,* dated October 31, 2008. The GEH proprietary information in Enclosure 1, which is entitled *Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Number 3.11-23, 3.11-24, 3.11-26 and 3.11-27 - GEH Proprietary Version,* is delineated by a [[dotted underline inside double square brackets.{3}]]. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination. A non-proprietary version of this information is provided in Enclosure 2, .*Response to Portion of NRC Request for Additional Information Letter Nos. 160 and 166 - Related to ESBWR Design Certification Application – Design of Structures, Components, Equipment, and Systems - RAI Numbers 3.11-23, 3.11-24, 3.11-26 and 3.11-27 - GEH Non - Proprietary Version.*

(3) In making this application for withholding of proprietary information of which it is the owner, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH competitors

without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used 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 of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it identifies detailed GE ESBWR design information for the Equipment

Qualification Program. GE utilized prior design information and experience from its fleet with significant resource allocation in developing the system over several years at a substantial cost.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 31st day of October 2008.

David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC