

TABLE OF CONTENTS

Page

3.5 UTILITY AND SUPPORT SYSTEMS.....	3.5-1
3.5.1 Building Ventilation.....	3.5-1
3.5.1.1 System Descriptions	3.5-2
3.5.1.2 Major Components.....	3.5-10
3.5.1.3 System Interfaces	3.5-10
3.5.1.4 Operational Characteristics	3.5-10
3.5.1.5 Safety Considerations	3.5-11
3.5.2 Electrical System.....	3.5-12
3.5.2.1 System Description	3.5-12
3.5.2.2 Major Components.....	3.5-13
3.5.2.3 Interfaces	3.5-15
3.5.2.4 Operating Characteristics.....	3.5-15
3.5.2.5 Safety Considerations	3.5-19
3.5.3 Compressed Air System.....	3.5-19
3.5.3.1 System Description	3.5-19
3.5.3.2 Major Components.....	3.5-20
3.5.3.3 System Interfaces	3.5-21
3.5.3.4 Operational Characteristics	3.5-21
3.5.3.5 Safety Considerations	3.5-22
3.5.4 Water Supply	3.5-22
3.5.4.1 Process Water System.....	3.5-22
3.5.4.2 Potable Water System.....	3.5-24
3.5.4.3 Deionized Water Supply and Distribution System.....	3.5-25
3.5.4.4 Hot Water System.....	3.5-27
3.5.5 Cooling Water Systems.....	3.5-31
3.5.5.1 HVAC Cooling Water System.....	3.5-31
3.5.5.2 Centrifuge Cooling Water System	3.5-34
3.5.5.3 Centrifuge Cooling Water Distribution System.....	3.5-36
3.5.6 Septic System	3.5-38
3.5.6.1 System Description	3.5-38
3.5.6.2 Safety Considerations	3.5-39
3.5.7 Communication and Alarm Annunciation Systems	3.5-39
3.5.7.1 Communication Systems Description.....	3.5-39
3.5.7.2 System Interfaces	3.5-41
3.5.7.3 Major Components.....	3.5-41
3.5.7.4 Operational Characteristics	3.5-41
3.5.7.5 Safety Considerations	3.5-42
3.5.8 Not Used.....	3.5-42
3.5.9 Control Systems.....	3.5-42
3.5.9.1 Functional Requirements	3.5-42
3.5.9.2 System Description	3.5-43
3.5.9.3 Safety Considerations	3.5-48
3.5.10 Standby Diesel Generator System	3.5-49
3.5.10.1 System Description	3.5-49
3.5.10.2 Major Components.....	3.5-50

TABLE OF CONTENTS

	Page
3.5.10.3 System Interfaces	3.5-50
3.5.10.4 Operational Characteristics	3.5-50
3.5.10.5 Safety Considerations	3.5-51
3.5.10.6 Diesel Fuel Spill Control and Leak Detection.....	3.5-51
3.5.11 Nitrogen System.....	3.5-51
3.5.11.1 System Description	3.5-51
3.5.11.2 Major Components	3.5-52
3.5.11.3 System Interfaces	3.5-52
3.5.11.4 Operational Characteristics	3.5-53
3.5.11.5 Safety Considerations	3.5-54
3.5.12 Liquid Effluent Collection and Treatment System	3.5-54
3.5.12.1 Aqueous Liquid Effluents.....	3.5-54
3.5.12.2 Non-Aqueous Liquid Effluents.....	3.5-60
3.5.13 Solid Waste Collection System.....	3.5-62
3.5.13.1 Wet Solid Wastes.....	3.5-62
3.5.13.2 Dry Solid Wastes.....	3.5-65
3.5.14 Decontamination Workshop	3.5-71
3.5.14.1 System Description	3.5-71
3.5.14.2 Major Components.....	3.5-73
3.5.14.3 Interfaces	3.5-73
3.5.14.4 Operating Characteristics.....	3.5-74
3.5.14.5 Safety Considerations	3.5-78
3.5.15 Fomblin Oil Recovery System	3.5-79
3.5.15.1 System Description	3.5-79
3.5.15.2 Major Components.....	3.5-80
3.5.15.3 Interfaces	3.5-80
3.5.15.4 Operating Characteristics.....	3.5-81
3.5.15.5 Safety Considerations	3.5-81
3.5.16 Laundry System	3.5-82
3.5.16.1 System Description	3.5-82
3.5.16.2 Major Components.....	3.5-83
3.5.16.3 Interfaces	3.5-83
3.5.16.4 Operating Characteristics.....	3.5-83
3.5.16.5 Safety Considerations	3.5-84
3.5.17 Ventilated Room.....	3.5-84
3.5.17.1 System Description	3.5-84
3.5.17.2 Major Components.....	3.5-85
3.5.17.3 Interfaces	3.5-86
3.5.17.4 Safety Considerations	3.5-86
3.5.18 Chemical Laboratory	3.5-87
3.5.18.1 System Description	3.5-87
3.5.18.2 Major Components.....	3.5-88
3.5.18.3 Interfaces	3.5-89
3.5.18.4 Safety Considerations	3.5-89
3.5.19 Cylinder Preparation Room	3.5-90
3.5.19.1 System Description	3.5-90

TABLE OF CONTENTS

	Page
3.5.19.2 Major Components.....	3.5-91
3.5.19.3 Interfaces	3.5-91
3.5.19.4 Safety Considerations	3.5-91
3.5.20 References.....	3.5-92

LIST OF TABLES

Table 3.5-1	Codes And Standards
Table 3.5-2	Compressed Air System Design Parameters
Table 3.5-3	Average Water Consumption
Table 3.5-4	Deionized Water Supply and Distribution System Design Parameters
Table 3.5-5	Hot Water System Design Parameters
Table 3.5-6	HVAC Cooling Water System Design Parameters
Table 3.5-7	Centrifuge Cooling Water Distribution System Design Parameters
Table 3.5-8	Nitrogen System Design Parameters
Table 3.5-9	Liquid Effluent Collection and Treatment System, Collection Tanks
Table 3.5-10	Liquid Effluent Collection and Treatment System, Monitoring and Treatment Tanks
Table 3.5-11	Items Processed in the Decontamination Workshop
Table 3.5-12	Volume, Exhaust Flow and Area Leakage Inputs to the NEF Consequence Calculation

LIST OF FIGURES

Figure 3.5-1	Flow Diagram Separations Building Module First Floor Electrical Room HVAC System
Figure 3.5-2	Flow Diagram "Link" Corridor First and Second Floor HVAC System
Figure 3.5-3	Flow Diagram Process Services Area Above Cascade HVAC System
Figure 3.5-4	Flow Diagram Process Services Areas First, Second and Third Floor HVAC System
Figure 3.5-5	Flow Diagram UF ₆ Handling Area HVAC System
Figure 3.5-6	Flow Diagram Blending & Liquid Sampling Area HVAC System
Figure 3.5-7	Flow Diagram TSB Contamination Workshops HVAC System
Figure 3.5-8	Flow Diagram TSB Non-Contaminated Areas HVAC System
Figure 3.5-9	Flow Diagram TSB Offices and Control Room HVAC System
Figure 3.5-10	Flow Diagram TSB Labs HVAC System
Figure 3.5-11	Code and Area Classifications Technical Services Building HVAC Pressurization
Figure 3.5-12	Flow Diagram CAB Centrifuge Component Storage Area HVAC System
Figure 3.5-13	Flow Diagram CAB Centrifuge Storage & Misc Areas HVAC System
Figure 3.5-14	Flow Diagram CAB Offices & Miscellaneous Rooms HVAC System
Figure 3.5-15	Flow Diagram CAB Centrifuge Assembly Area HVAC System
Figure 3.5-16	Flow Diagram Cylinder Rec. & Dispatch Bld. HVAC System
Figure 3.5-17	Flow Diagram Administration Building HVAC System
Figure 3.5-18	Flow Diagram Central Utilities Building HVAC System
Figure 3.5-19	Electrical Single Line Diagram Overall System Utility Substation and 13 kV Distribution (Sheet 1 of 6)
Figure 3.5-19	Electrical Single Line Diagram Overall System Central Utilities Normal Loads (Sheet 2 of 6)
Figure 3.5-19	Electrical Single Line Diagram Overall System Short Break and UPS Power (Sheet 3 of 6)
Figure 3.5-19	Electrical Single Line Diagram Overall System Normal Loads (Sheet 4 of 6)
Figure 3.5-19	Electrical Single Line Diagram Overall System Cascade Hall – Variable Frequency Drives (Sheet 5 of 6)
Figure 3.5-19	Electrical Single Line Diagram Overall System Services – Normal Loads (Sheet 6 of 6)
Figure 3.5-20	Process Flow Diagram Compressed Air System (Sheet 1 of 2)
Figure 3.5-20	Process Flow Diagram Compressed Air Distribution (Sheet 2 of 2)
Figure 3.5-21	Process Flow Diagram Process Water Distribution System
Figure 3.5-22	Process Flow Diagram DI Water Supply and Distribution System
Figure 3.5-23	Process Flow Diagram Boilers and Hot Water Distribution System
Figure 3.5-24	Process Flow Diagram HVAC Cooling Water System Chillers/Pumps

LIST OF FIGURES

Figure 3.5-25	Process Flow Diagram HVAC Cooling Tower Water System Cooling Towers and Pumps (Sheet 1 of 2)
Figure 3.5-25	Process Flow Diagram Centrifuge Cooling Water System Cooling Towers and Pumps (Sheet 2 of 2)
Figure 3.5-26	Process Flow Diagram Centrifuge Cooling Water Distribution System
Figure 3.5-27	Plant Control System Central Control System (Sheet 1 of 3)
Figure 3.5-27	Plant Control System Local Control System (Sheet 2 of 3)
Figure 3.5-27	Plant Control System Local Control System (Sheet 3 of 3)
Figure 3.5-28	Process Flow Diagram Nitrogen System (Sheet 1 of 3)
Figure 3.5-28	Process Flow Diagram Gaseous Nitrogen System (Sheet 2 of 3)
Figure 3.5-28	Process Flow Diagram Gaseous Nitrogen System (Sheet 3 of 3)
Figure 3.5-29	Liquid Effluent Collection and Treatment Room Equipment Arrangement
Figure 3.5-30	Process Flow Diagram Spent Citric Acid
Figure 3.5-31	Process Flow Diagram Degreaser Water
Figure 3.5-32	Process Flow Diagram Miscellaneous Effluent
Figure 3.5-33	Process Flow Diagram Laundry Effluent
Figure 3.5-34	Process Flow Diagram Hand Wash/Shower Effluent
Figure 3.5-35	Process Flow Diagram Precipitation/Treatment
Figure 3.5-36	Process Flow Diagram Evaporator/Dryer
Figure 3.5-37	Process Flow Diagram Treated Effluent Polishing
Figure 3.5-38	Decontamination Workshop Equipment Arrangement
Figure 3.5-39	Process Flow Diagram Equipment Decontamination System
Figure 3.5-40	Process Flow Diagram Decontamination System for Sample Bottles
Figure 3.5-41	Process Flow Diagram Decontamination System for Flexible Hoses
Figure 3.5-42	Process Flow Diagram Fomblin Oil Recovery System
Figure 3.5-43	Piping & Instrumentation Diagram Cylinder Pressure Test & Pump Out
Figure 3.5-44	Process Flow Diagram Cylinder Preparation Vacuum Pump and Trap Set System (Sheet 1 of 2)
Figure 3.5-44	Process Flow Diagram Cylinder Preparation Vacuum Pump and Trap Set System (Sheet 2 of 2)

3.5 UTILITY AND SUPPORT SYSTEMS

Louisiana Energy Services' (LES) National Enrichment Facility (NEF) utility and support systems are described in this section. The information provided for each system emphasizes capacities, redundancies, and other provisions for coping with routine and non-routine events.

The Separations Building consists of three units called Separations Building Modules. Some of the utility and support systems are duplicated in each Separations Building Module while other systems serve the entire facility. The descriptions and flow diagrams of duplicated systems presented in this section represent Separations Building Module 1 systems, which are generally identical in Separations Building Modules 2 and 3. Any differences are clearly indicated in the text and figures.

The system descriptions provided for each system include functional requirements, design capacities, system interfaces, and descriptions of major components. In addition, operational characteristics are discussed for both routine operations and non-routine operations. Supporting information is provided in the form of flow diagrams to facilitate an understanding of the system design.

Finally, safety considerations are described for each system. The calculated values of k_{eff} provided in the following sections were obtained using the criticality code MONK8A (SA, 2001), in conjunction with the JEF2.2 nuclear data library. All values of k_{eff} given in the following sections are equal to $k_{calc} + 3 \sigma_{calc}$ with a safety limit of 0.95. The health and safety of the public are protected such that a failure or inadvertent operation of any of the utility systems would not result in a release of hazardous quantities of chemicals or radiation. The basis for this conclusion is presented in Section 3.7, General Types of Accident Sequences, and Section 3.8, Items Relied on for Safety (IROFS).

Although many of the utility and support systems do not contain items relied on for safety, appropriate design and operating features that enhance public safety, worker safety, and facility reliability are provided for each system. Items relied on for safety, which are associated with utility and support systems, are listed in Section 3.8, Items Relied On For Safety (IROFS). The Codes and Standards generally applicable to the utility and support systems are listed in Table 3.5-1, Codes and Standards.

In the following sections, the design process parameter values are specified with a datum of standard atmospheric pressure at sea level. These values will be finalized to reflect the site-specific NEF elevation during the design phase and the ISA Summary will be revised accordingly.

3.5.1 Building Ventilation

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[illegible]

[illegible]

Abstract

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

...and the fact that the *Journal* is a journal of the American Psychological Association, the largest and most prestigious of the professional organizations in the field, is a source of great pride and honor for me.

1000

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Revision 3, September 2004
Page 3.5-9

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



■

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

3.5.4.2 Potable Water System

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

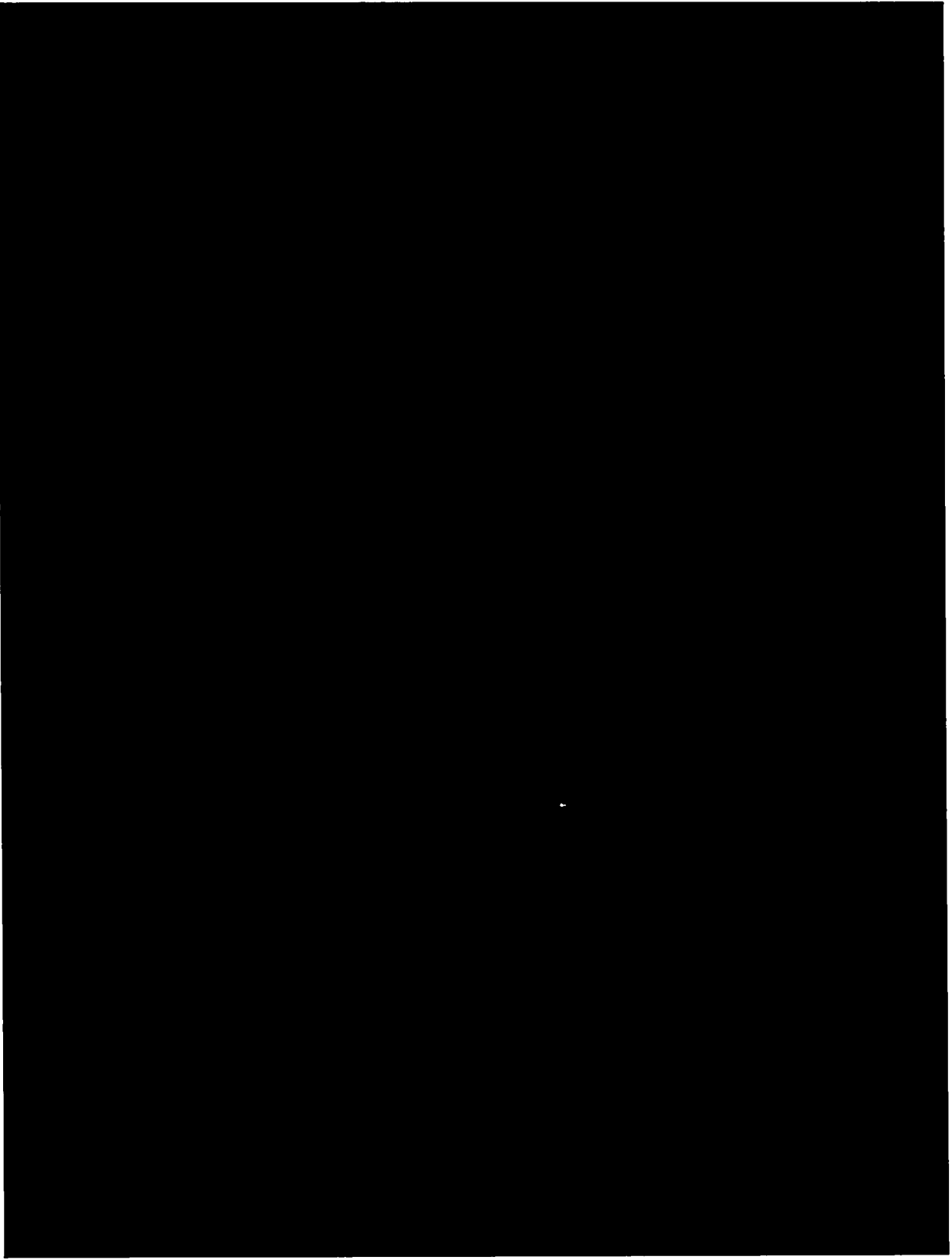
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Revision 3, September 2004
Page 3.5-32

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

☐ ☐

Author's address: Department of Psychology, University of York, UK

[illegible]

[REDACTED]

2 [REDACTED]

[REDACTED]

[REDACTED]:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

B. Provide operators [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

• [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



3.5.20 References

ANSI, 2001. Uranium Hexafluoride - Packing for Transport, ANSI N14.1-2001, American National Standards Institute, February 1, 2001.

ASME, 2002. Process Piping, ASME 31.3-2002, Revision 2, American Society of Mechanical Engineers, 2002.

CFR, 2003a. Title 10, Code of Federal Regulations, Section 61.56, Waste Characteristics, 2003.

CFR, 2003b. Title 40, Code of Federal Regulations, Section 261.3, Definition of Hazardous Waste, 2003.

CFR, 2003c. Title 40, Code of Federal Regulations, Section 261.7, Residues of Hazardous Waste in Empty Containers, 2003.

CFR, 2003d. Title 10, Code of Federal Regulations, Part 61, Licensing Requirement for Land Disposal of Radioactive Waste, 2003.

CFR, 2003e. Title 40, Code of Federal Regulations, Part 261, Identification and Listing of Hazardous Waste, 2003.

CFR, 2003f. Title 10, Code of Federal Regulations, Part 71, Packaging and Transport of Radioactive Material, 2003.

IEEE, 2002. National Electrical Safety Code, IEEE C2-2002, Institute of Electrical and Electronics Engineers, 2002.

NFPA, 2000. Standard for Electrical Safety Requirements for Employee Workplaces, NFPA 70E, National Fire Protection Association, 2000.

NFPA, 1996. National Electrical Code, NFPA 70, National Fire Protection Association, 1996.

~ NRC, 1985. Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants, Regulatory Guide 4.16, Revision 1, U.S. Nuclear Regulatory Commission, December 1985.

SA, 2001. Serco Assurance, ANSWERS Software Service, "Users Guide for Version 8 ANSWERS/MONK(98) 6," 1987-2001.

TABLES

(This page intentionally left blank)

Table 3.5-1 Codes And Standards
Page 1 of 3

ACI 318-99, Building Code Requirements for Structural Concrete, 1999.
ACI 349-90, Code Requirements for Nuclear Safety Related Concrete Structures, 1990.
AIChE, Guidelines for Hazard Evaluation Procedures, 1992.
AISC Manual of Steel Construction – Allowable Stress Design, Ninth Edition, 1989
ANSI N14.1-2001, American National Standard for Nuclear Materials - Uranium Hexafluoride Packaging for Transport, 2001.
ANSI N15.5-1972, Statistical Terminology and Notation for Nuclear Materials Management, 1972.
ASCE 58, Structural Analysis and Design of Nuclear Plant Facilities, Manuals and Reports on Engineering Practice, 1980.
ASCE 7-98, Minimum Design Loads for Building and Other Structures, 1998.
ASME B31.3-2002, Process Piping, 2002.
ASME, Boiler and Pressure Vessel Code, Section VIII, Division 1, 1999.
ASME, NQA-1-1994, Quality Assurance Requirements for Nuclear Facility Applications, 1994.
ASME, NQA-1a-1995, Addenda to ASME NQA-1-1994 Edition, Quality Assurance Requirements for Nuclear Facility Applications, 1995.
ASTM C761-01 - Standard Test Methods for Chemical, Mass Spectrometric, Spectrochemical, Nuclear, and Radiochemical Analysis of Uranium Hexafluoride, 2001.
ASTM E 814, Fire Tests of Through-Penetration Fire Stops.
ERDA 76-21, Nuclear Air Cleaning Handbook, 1976.
IEEE 336, Standard Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities, 1991.
IEEE C2-2002, National Electrical Safety Code, 2002.

Table 3.5-1 Codes And Standards

Page 2 of 3

ISO 668: 1995, Series 1 Freight Containers - Classification, Dimensions and Ratings, 1995.
NFPA 1, Fire Prevention Code, 1997.
NFPA 10, Portable Fire Extinguishers, 1994.
NFPA 101, Life Safety Code, 1997.
NFPA 12, Carbon Dioxide Systems, 1993.
NFPA 13, Installation of Sprinkler Systems, 1996.
NFPA 14, Standpipe, Private Hydrant and Hose Systems, 1996.
NFPA 15, Water Spray Fixed Systems for Fire Protection, 1996.
NFPA 20, Installation of Stationary Pumps, 1996.
NFPA 2001, Clean Agent Fire Extinguishing Systems, 1996.
NFPA 22, Water Tanks for Private Fire Protection, 1996.
NFPA 221, Fire Walls and Fire Barrier Walls, 1997.
NFPA 24, Private Fire Service Mains and Their Appurtenances, 1995.
NFPA 25, Water Based Fire Protection Systems, 1995.
NFPA 30, Flammable and Combustible Liquids Code, 2003.
NFPA 5000, Building Construction and Safety Code, 2003.
NFPA 54, National Fuel Gas Code, 1996.
NFPA 55, Compressed & Liquefied Gases in Cylinders, 1993.
NFPA 58, Liquefied Petroleum Gas Code, 2001.
NFPA 600 Industrial Fire Brigades, 1996.
NFPA 70, National Electric Code, 1996.
NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response, 2001.
NFPA 72, National Fire Alarm Code, 1996.
NFPA 75, Electronic Computer/Data Processing Systems, 1995.
NFPA 780, Lightning Protection Systems, 1997.
NFPA 80, Fire Doors and Fire Windows, 1995.
NFPA 801, Fire Protection for Facilities Handling Radioactive Materials, 2003.
NFPA 80A, Exterior Fire Exposures, 1993.
NFPA 90A, Installation of Air Conditioning and Ventilating Systems, 1996.
NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems, 1996.

Table 3.5-1 Codes And Standards

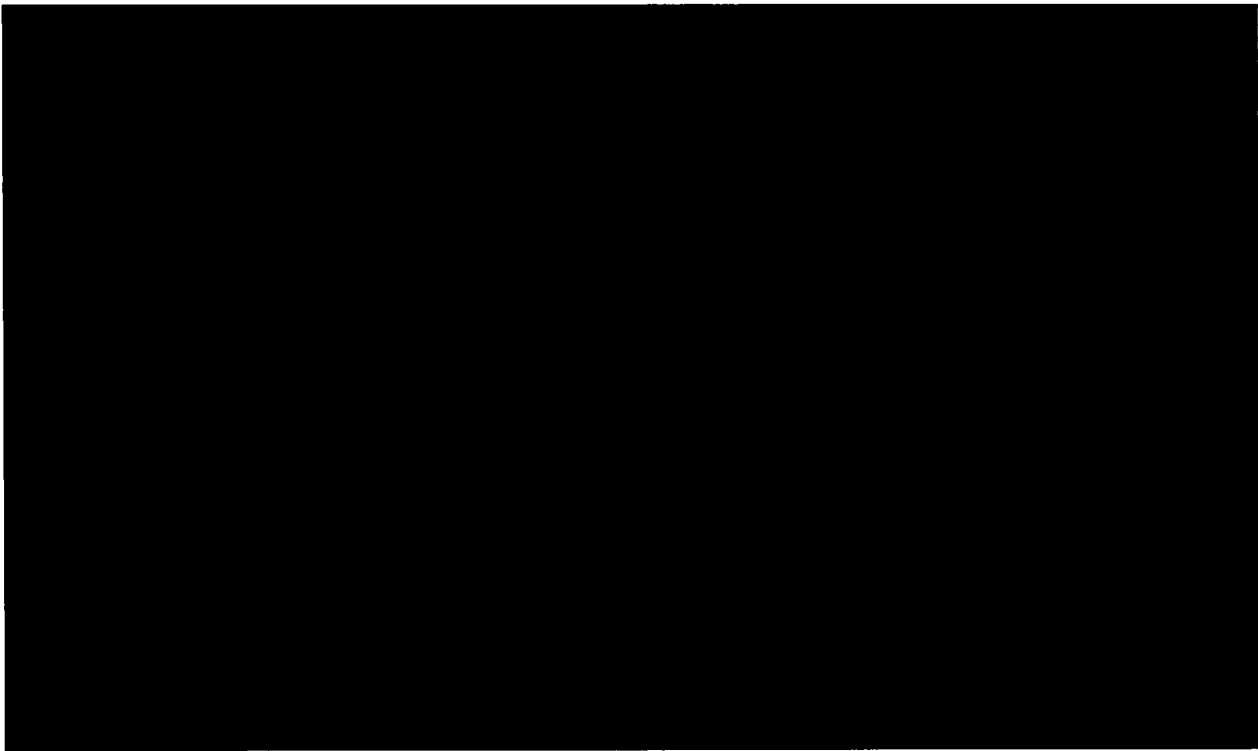
Page 3 of 3

NFPA 91, Exhaust Systems for Air Conveying of Materials, 1995.
NFPA, Fire Protection Handbook, 18 th Edition, Section 9, Chapter 30, Nuclear Facilities, 1997.
NFPA 110, Standard for Emergency and Standby Power Systems, 2002.
NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems, 2001.
NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, 2000.
NFPA 79, Electrical Standard for Industrial Machinery, 1997.
PCI Design Handbook, Fifth Edition, 1999.
Uniform Building Code (UBC), 1997.
Uniform Mechanical Code (UMC), 1997.
Uniform Plumbing Code (UPC), 1997.

Table 3.5-2 Compressed Air System Design Parameters
Page 1 of 1

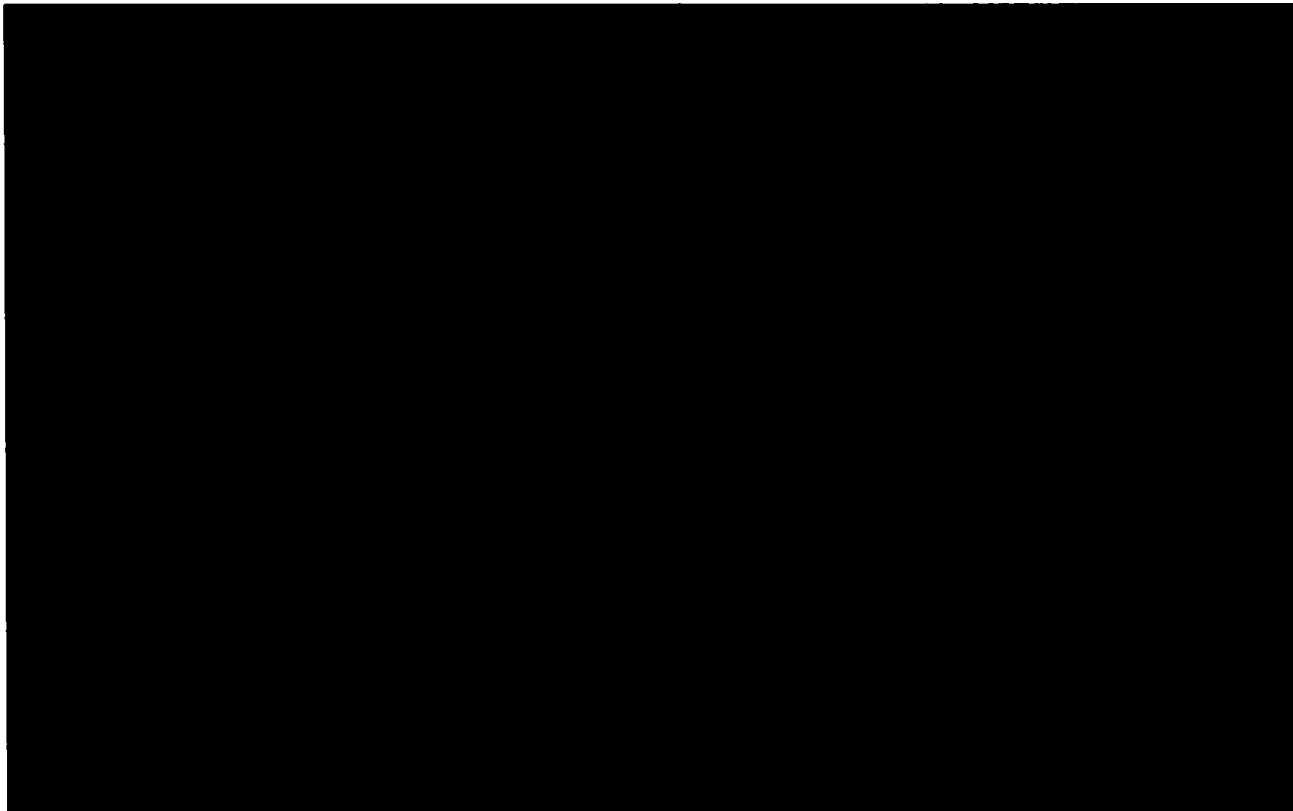
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

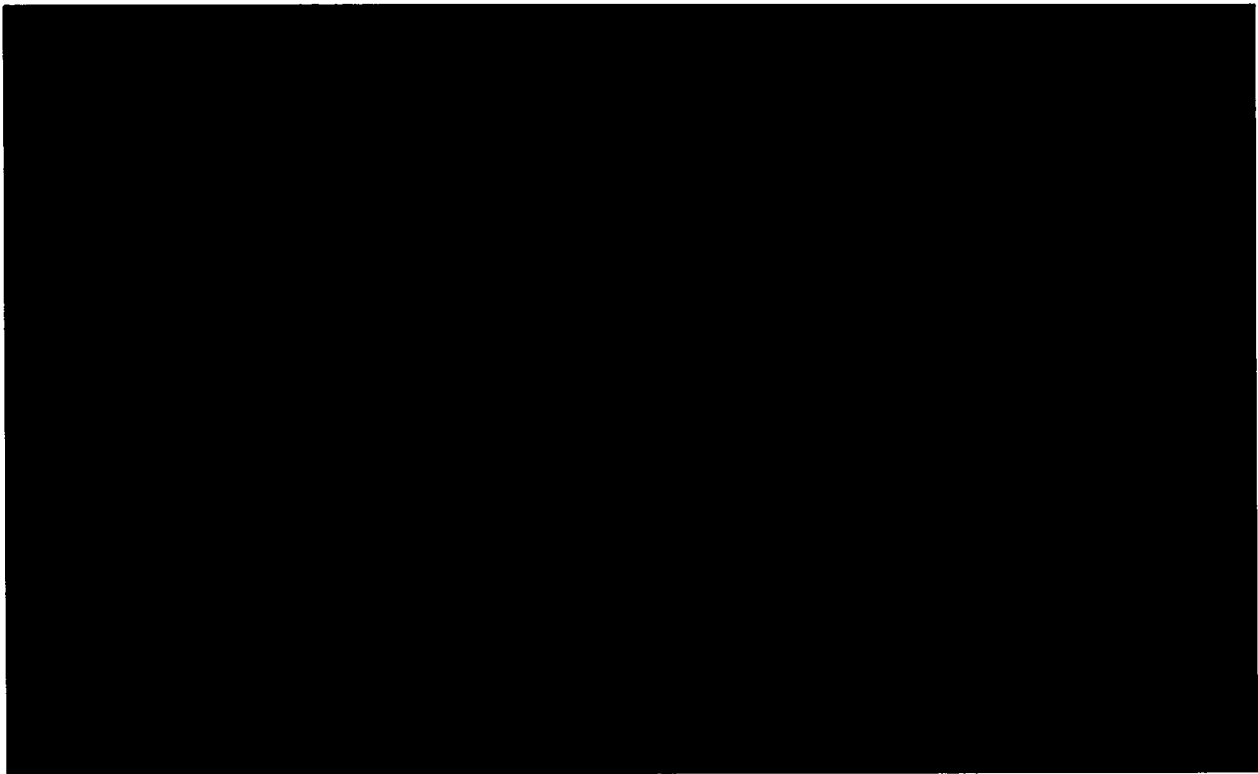


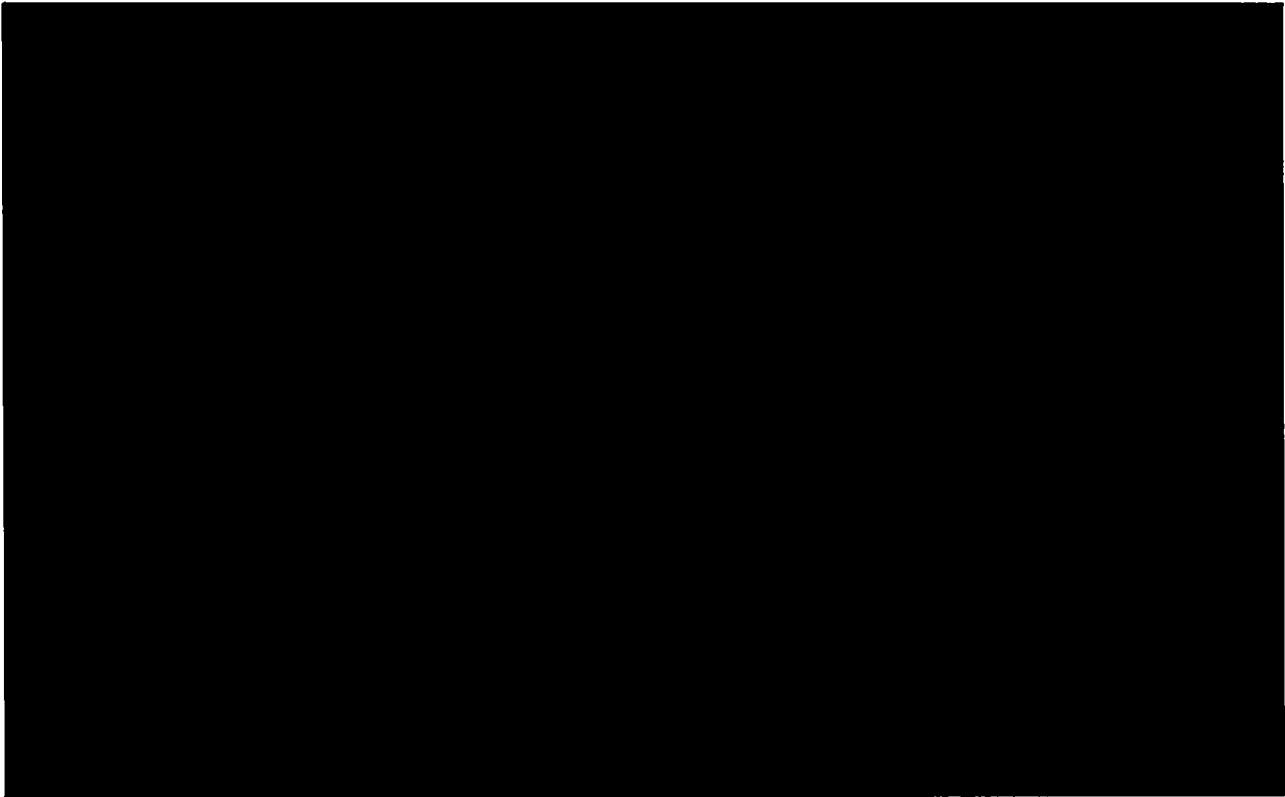


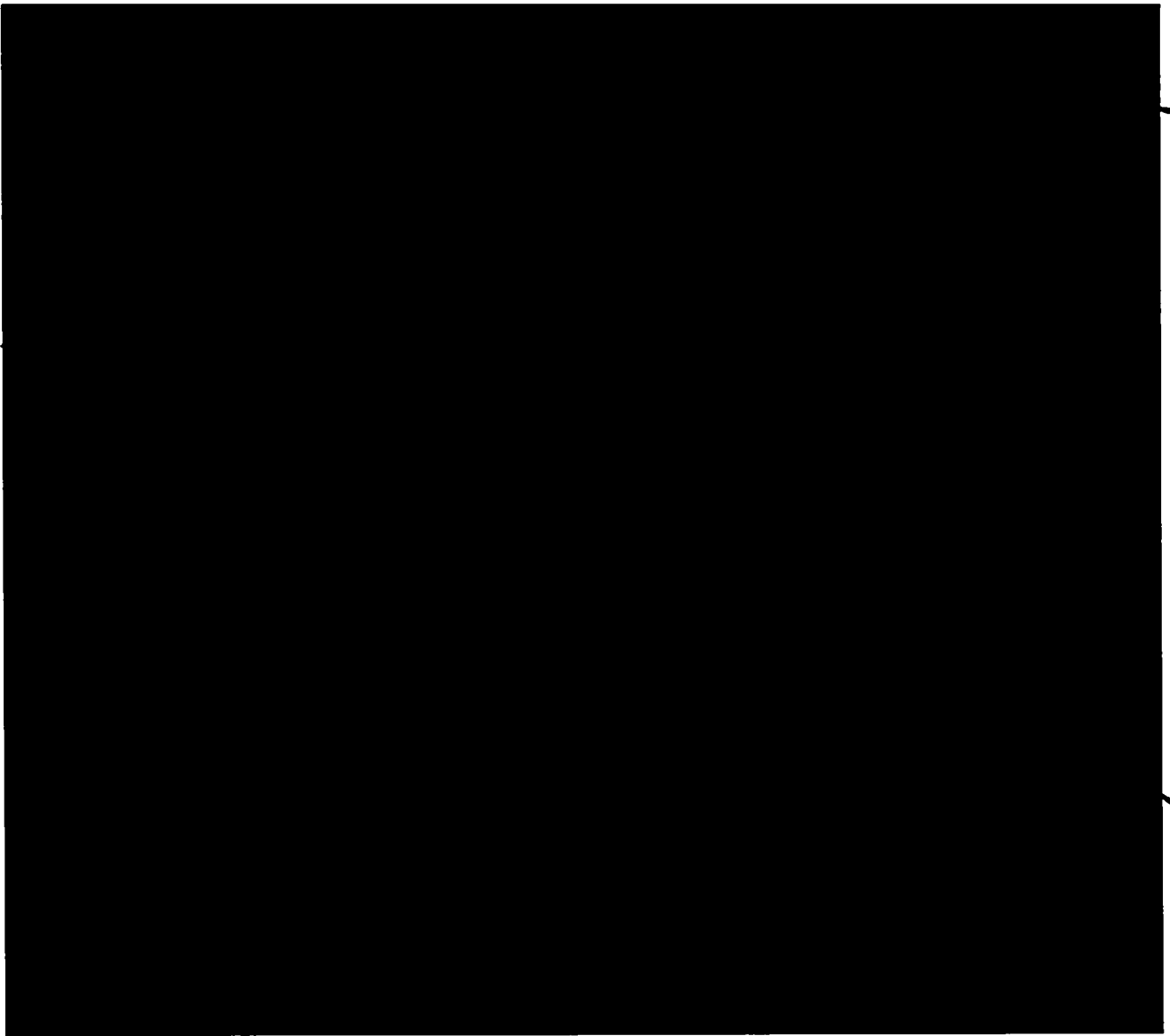


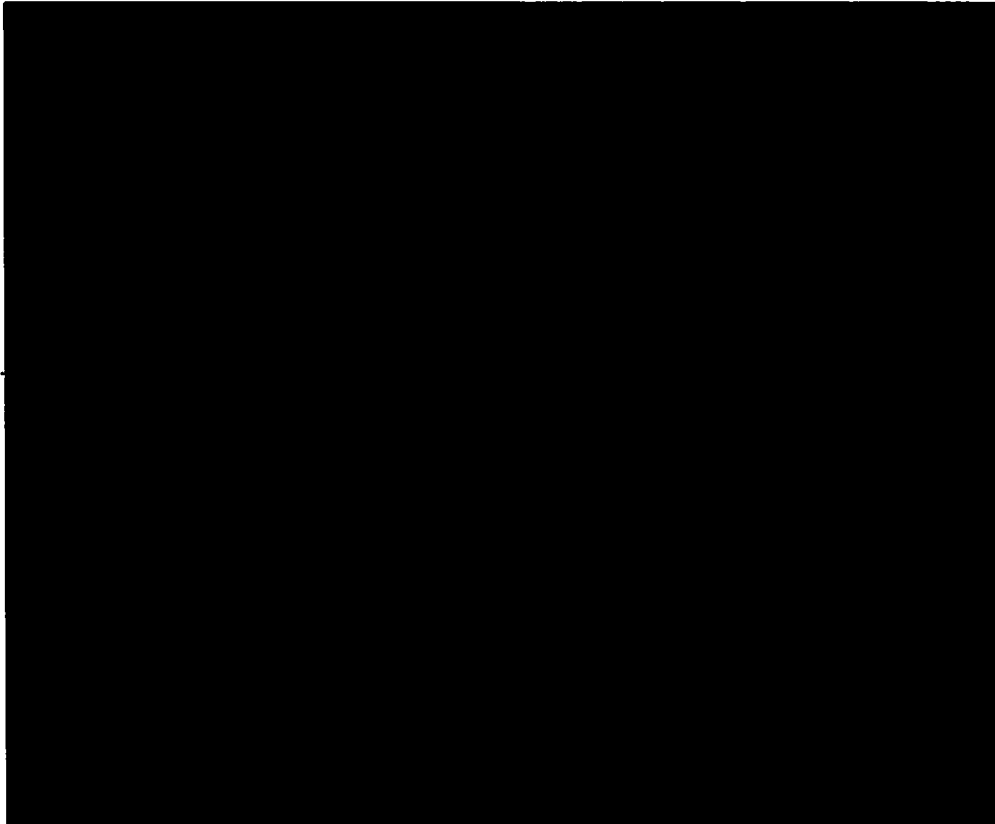














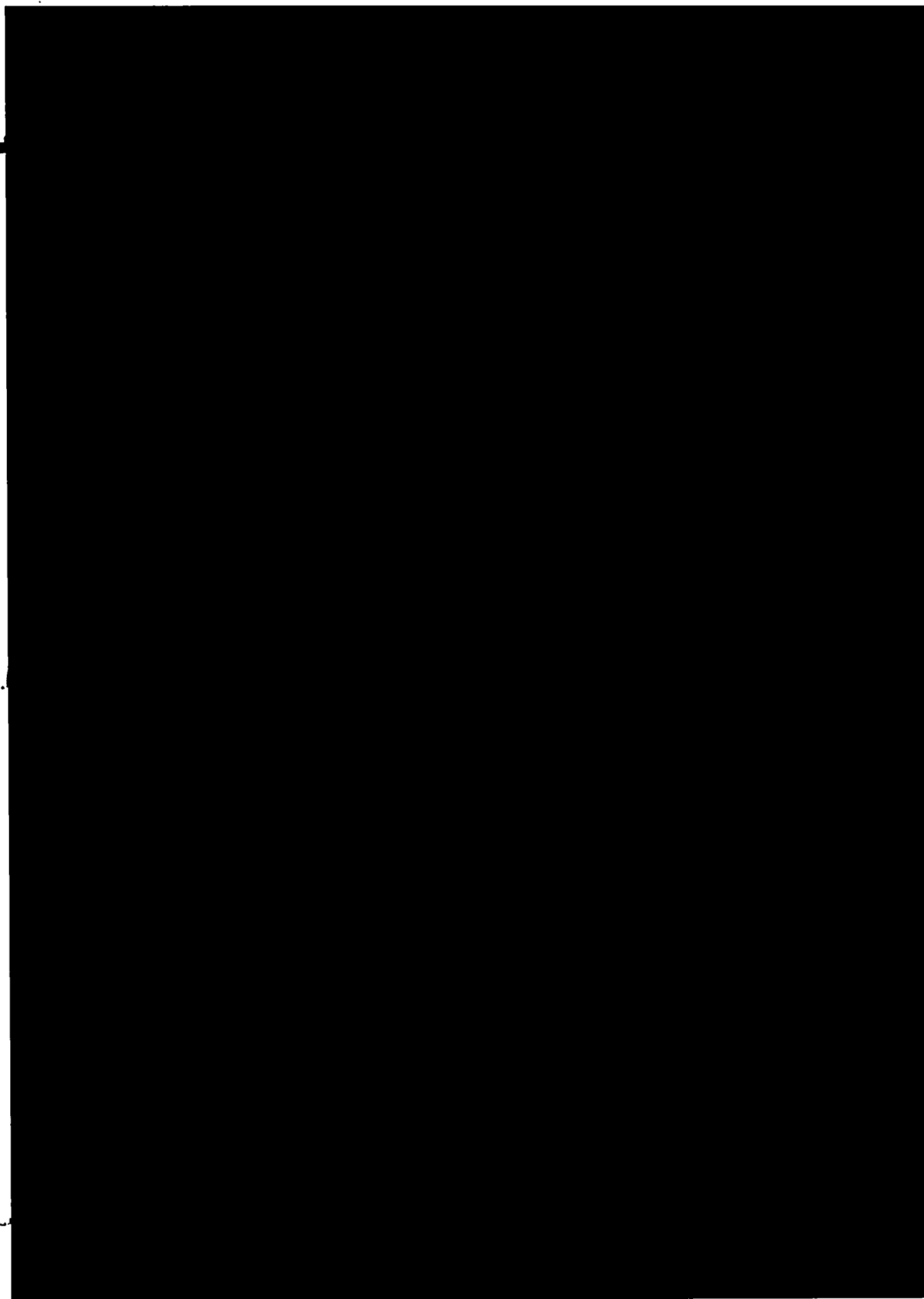
FIGURES

(This page intentionally left blank)

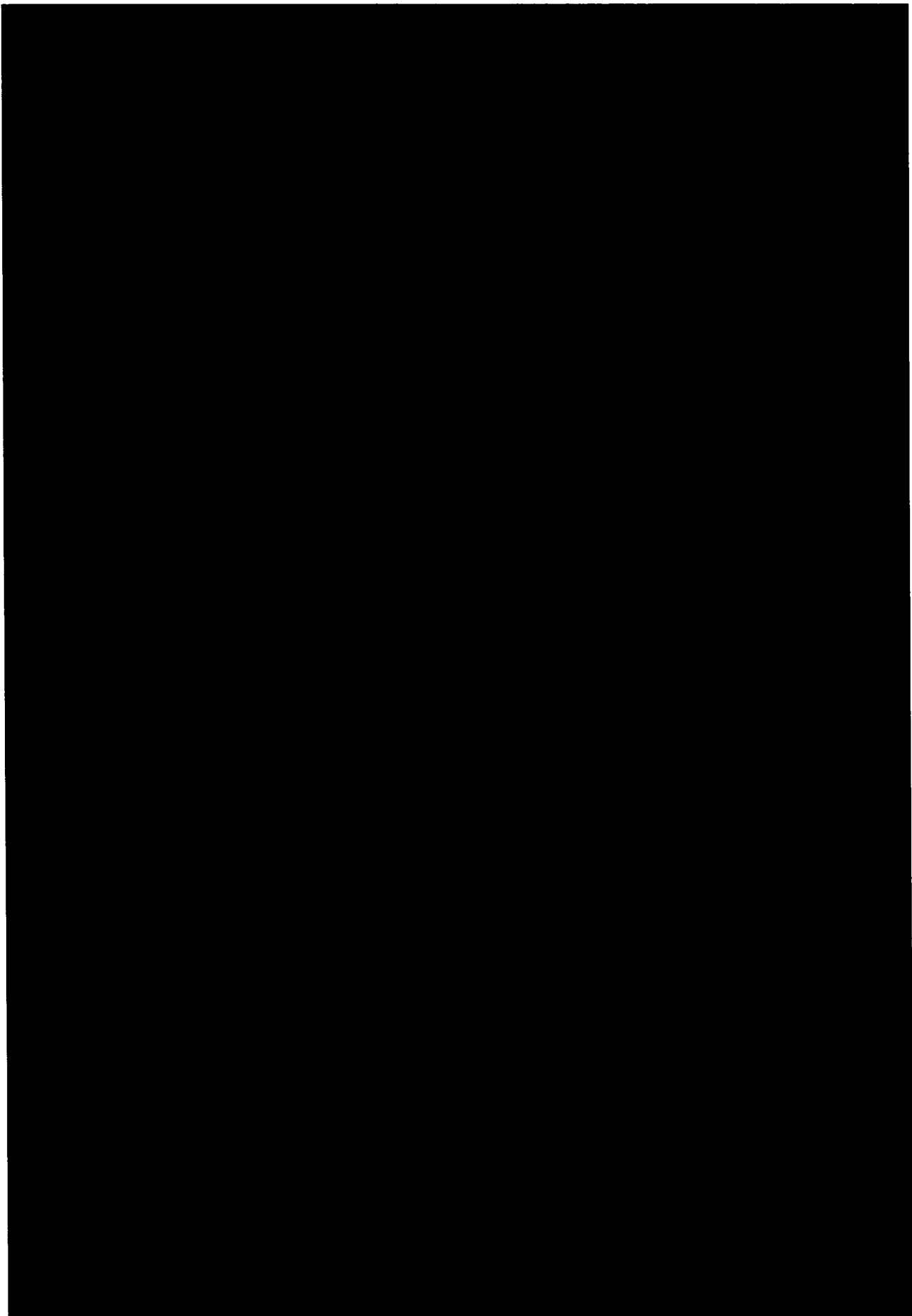
111

112

113







(b)(7)(D)

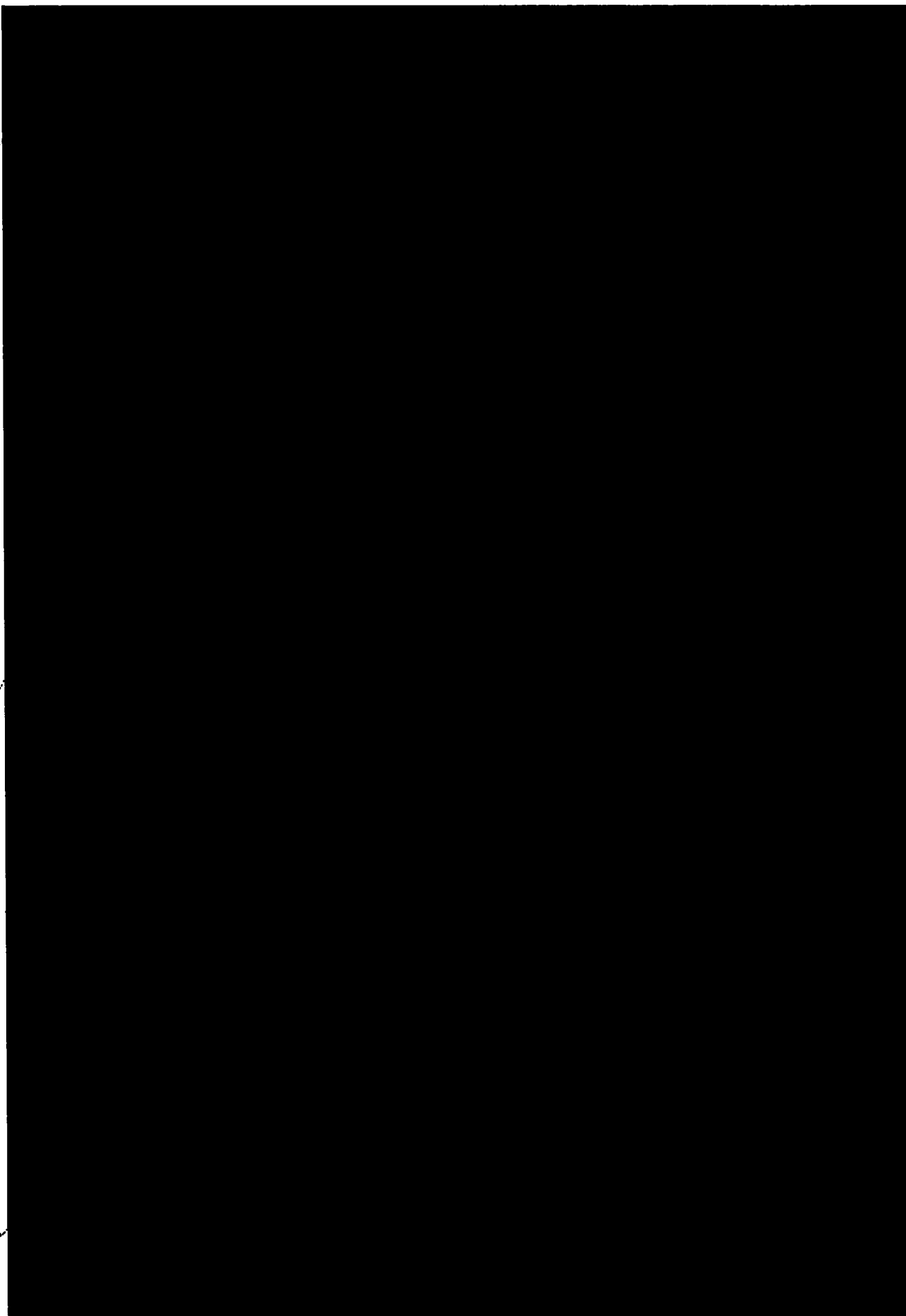
(b)(7)(D)

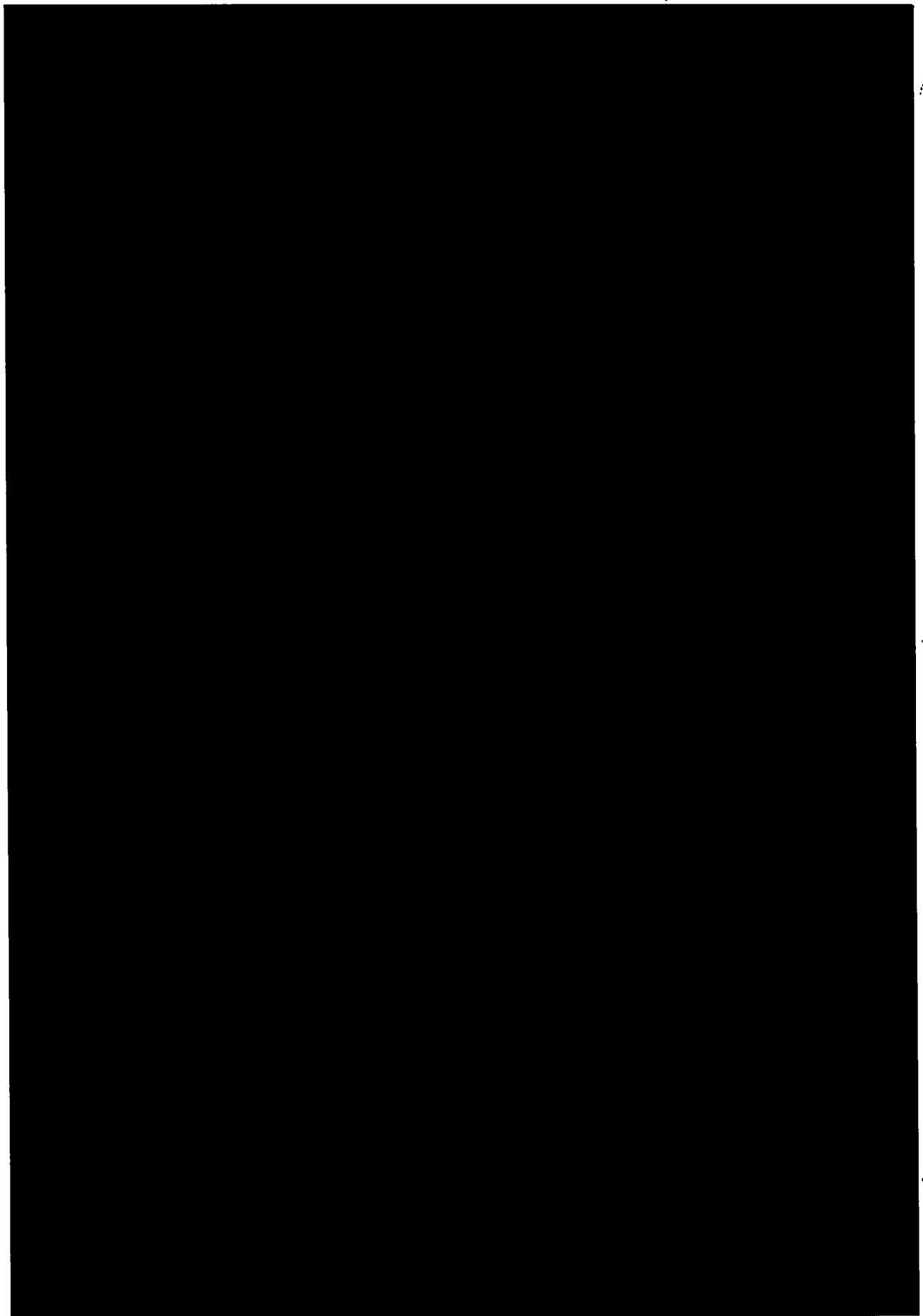
(b)(7)(D)

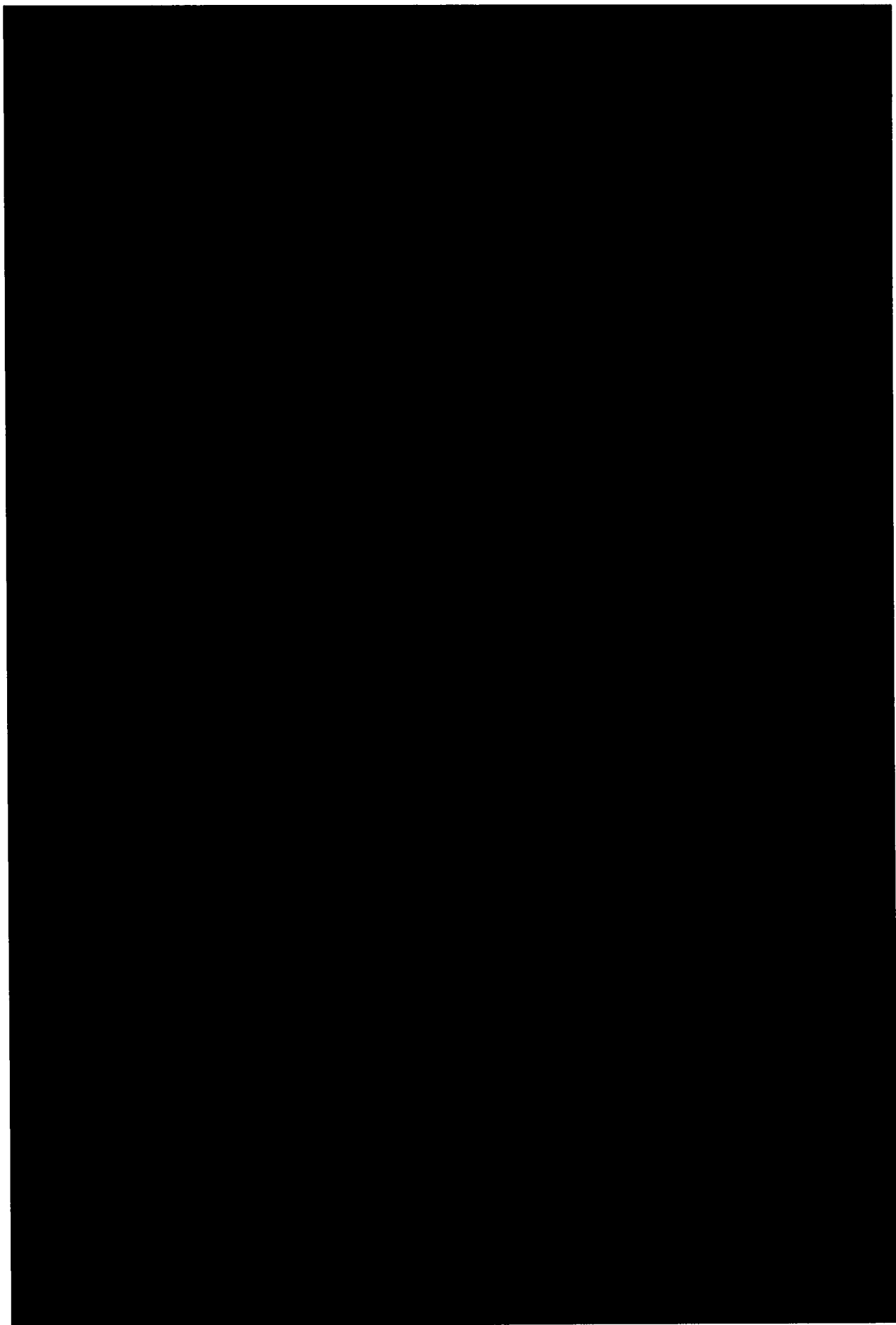
17

18

19



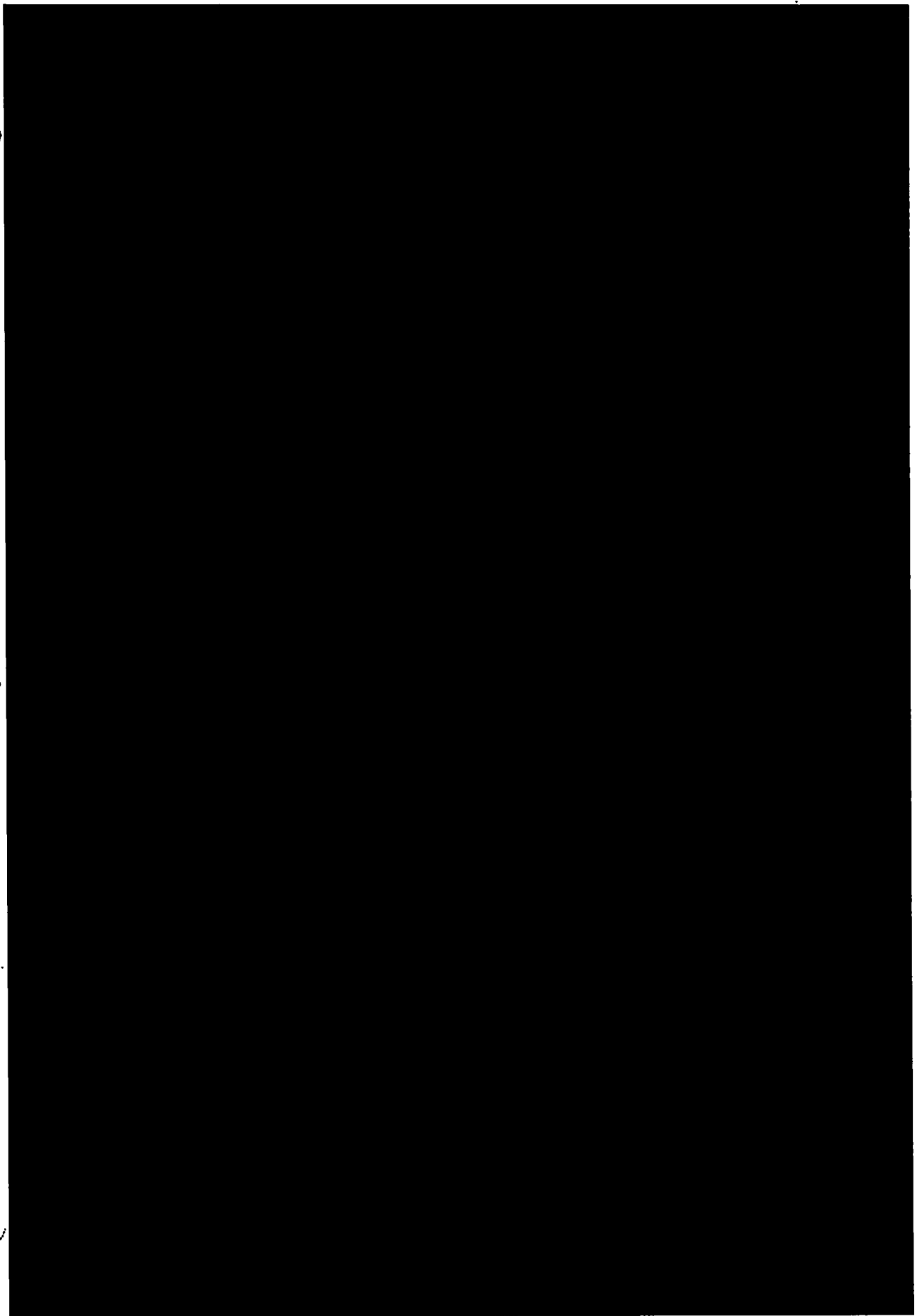




41.1

41.1

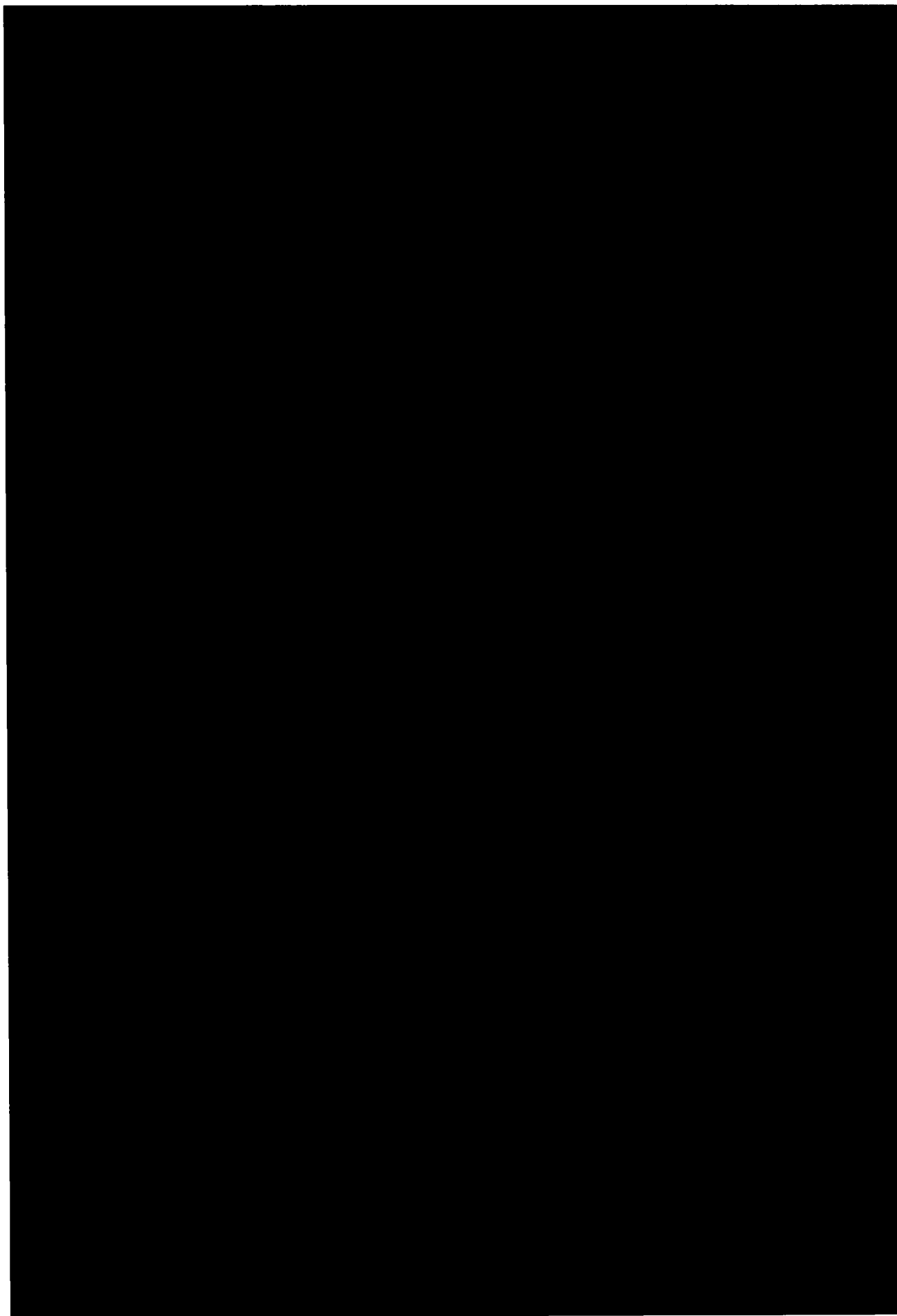
41.1



61

62

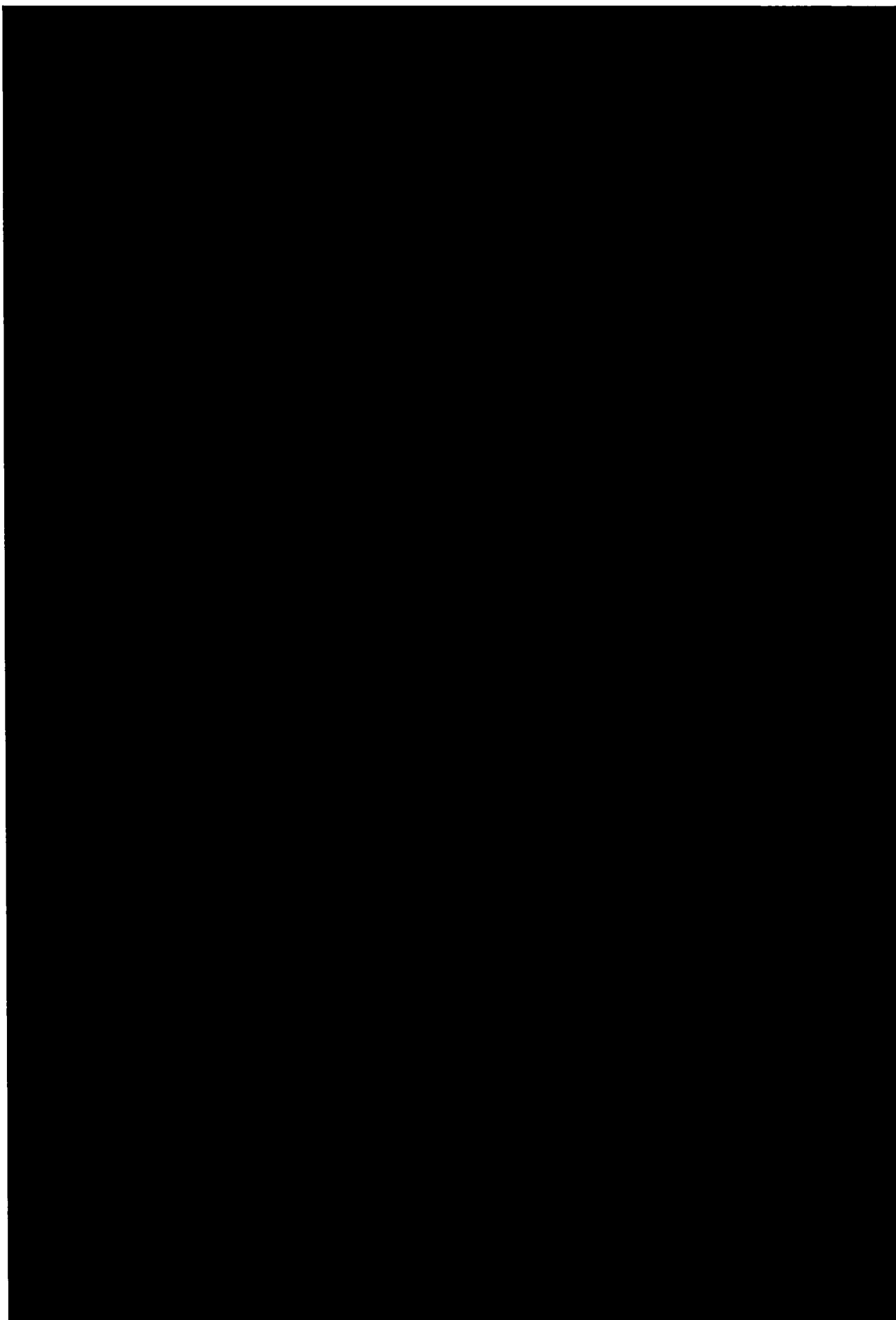
63



U

U

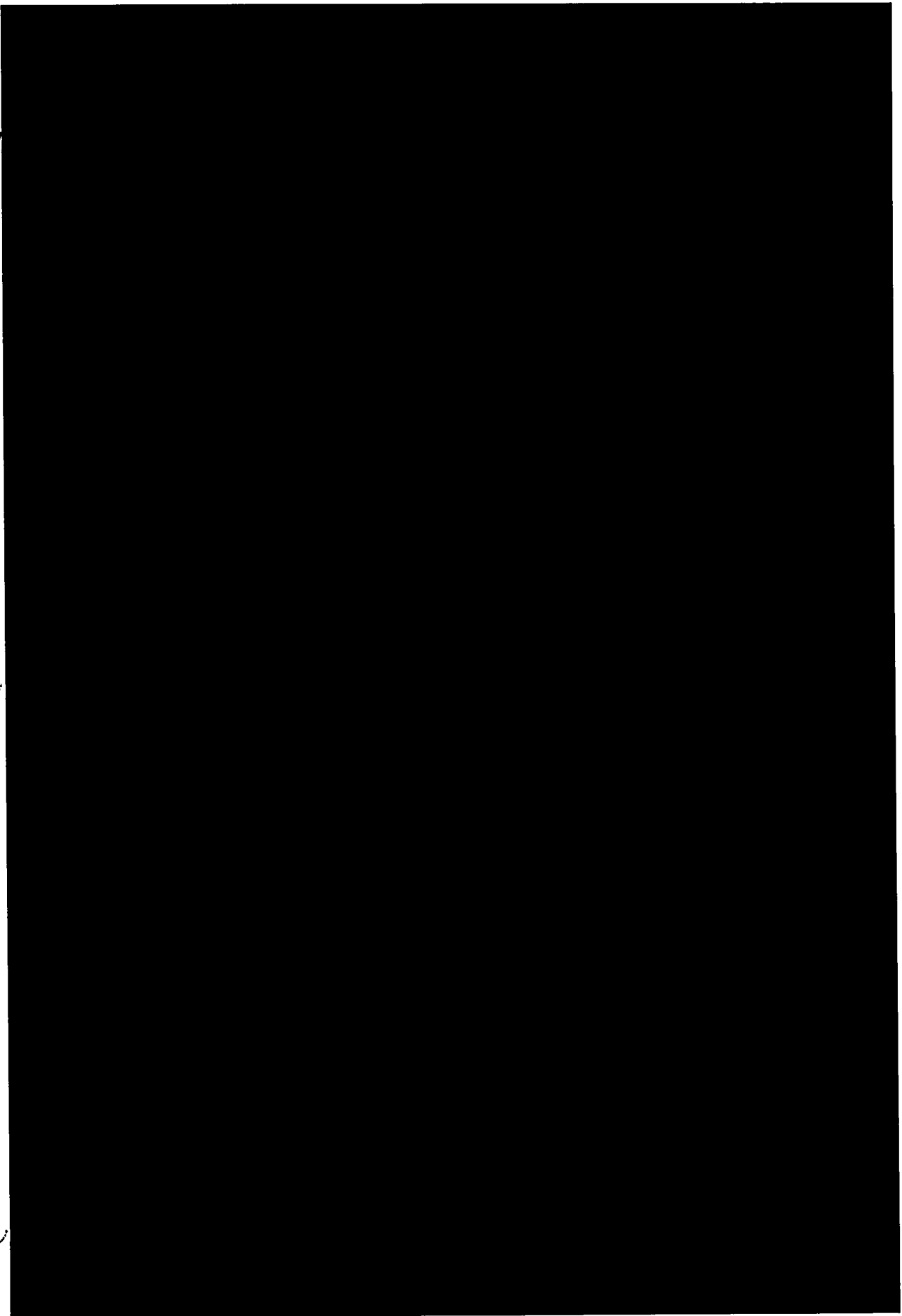
U

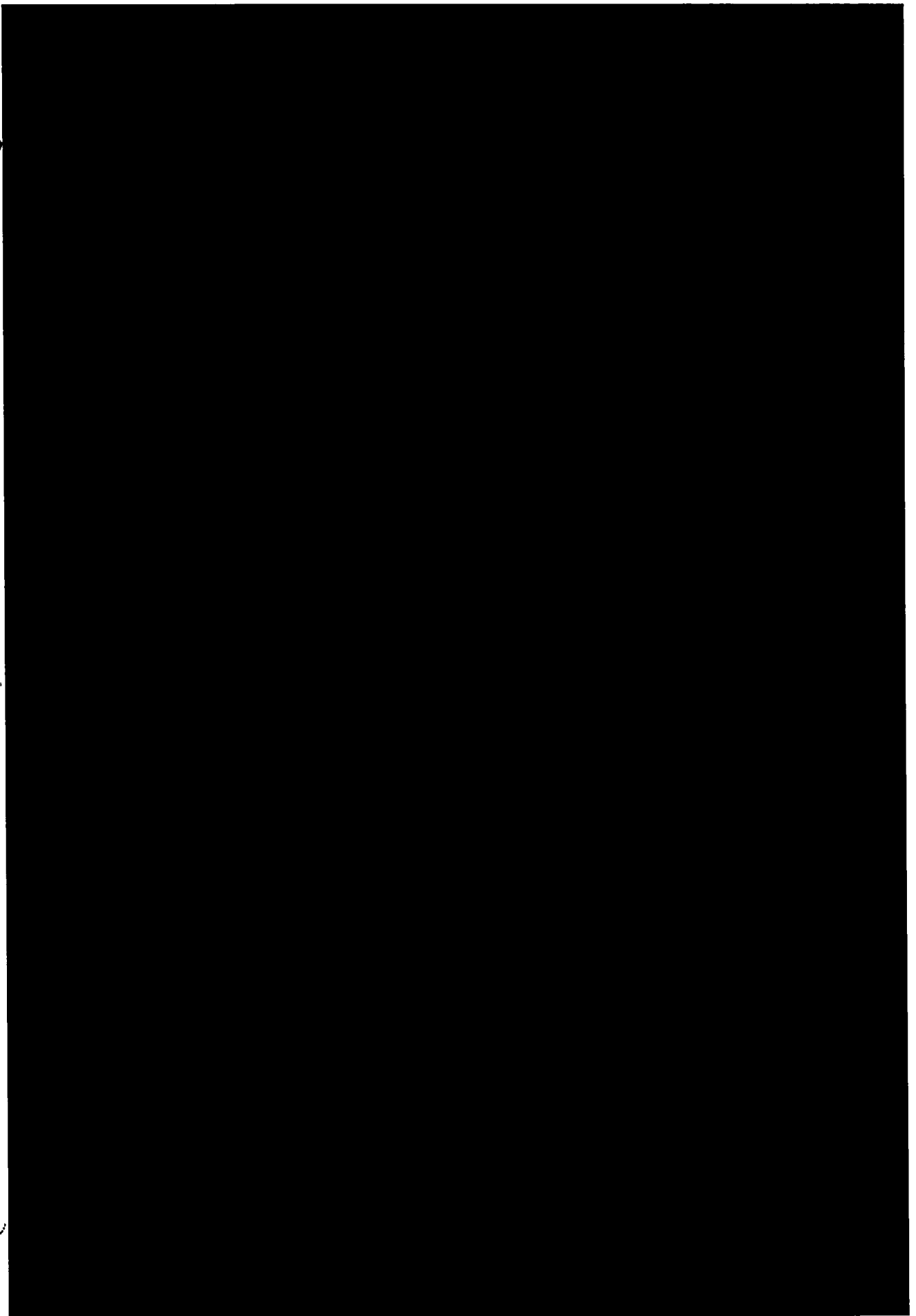


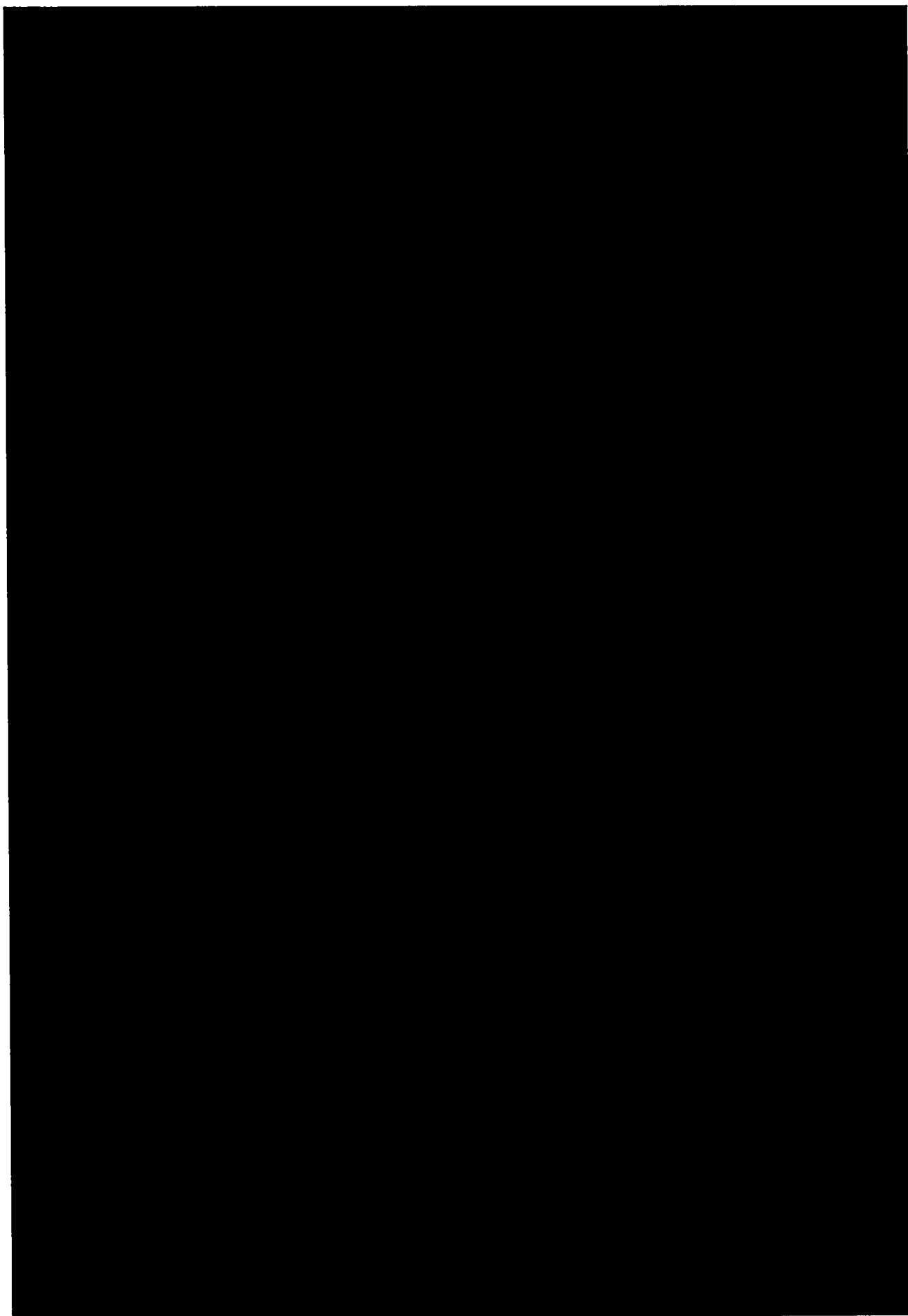
1

2

3



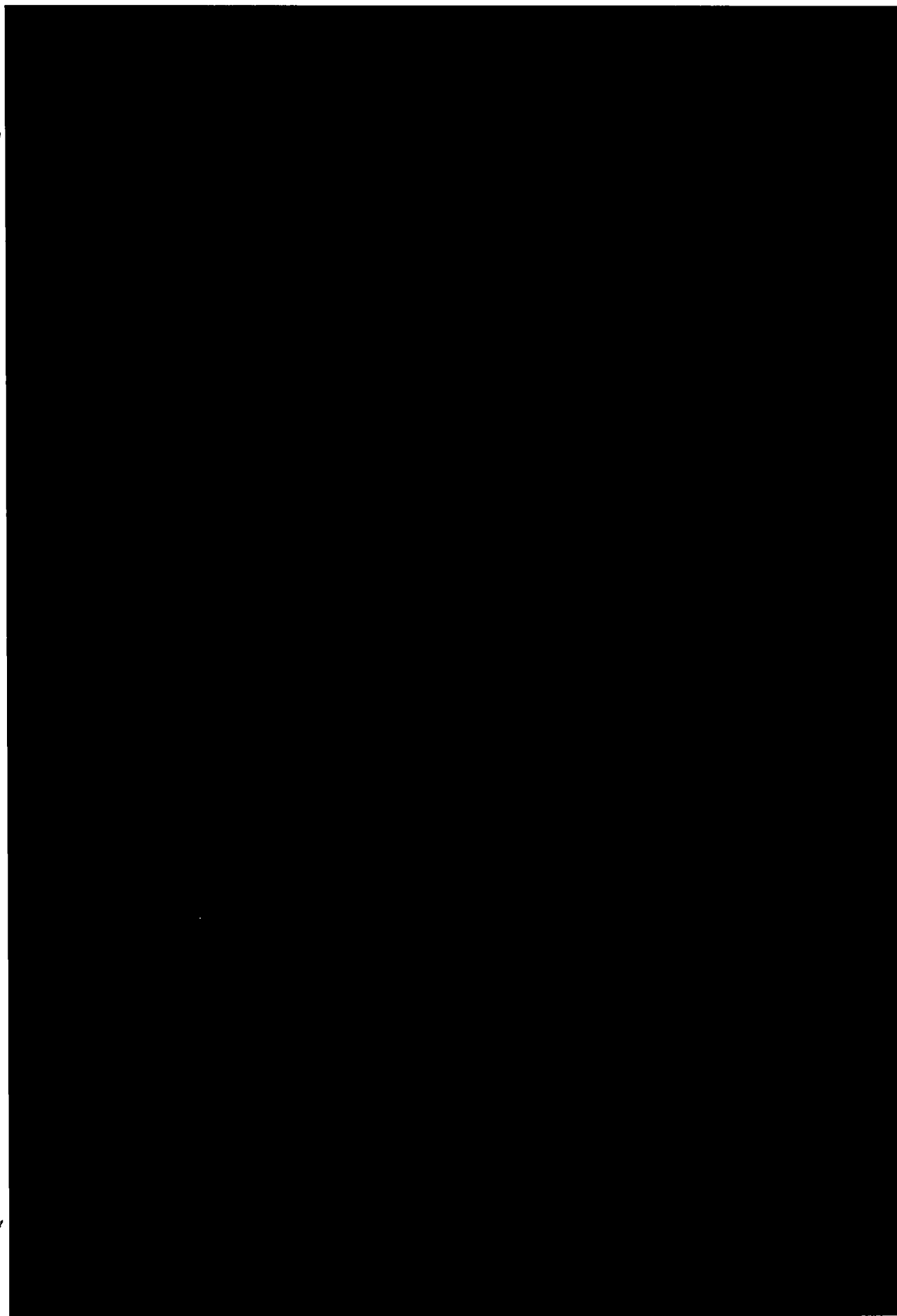


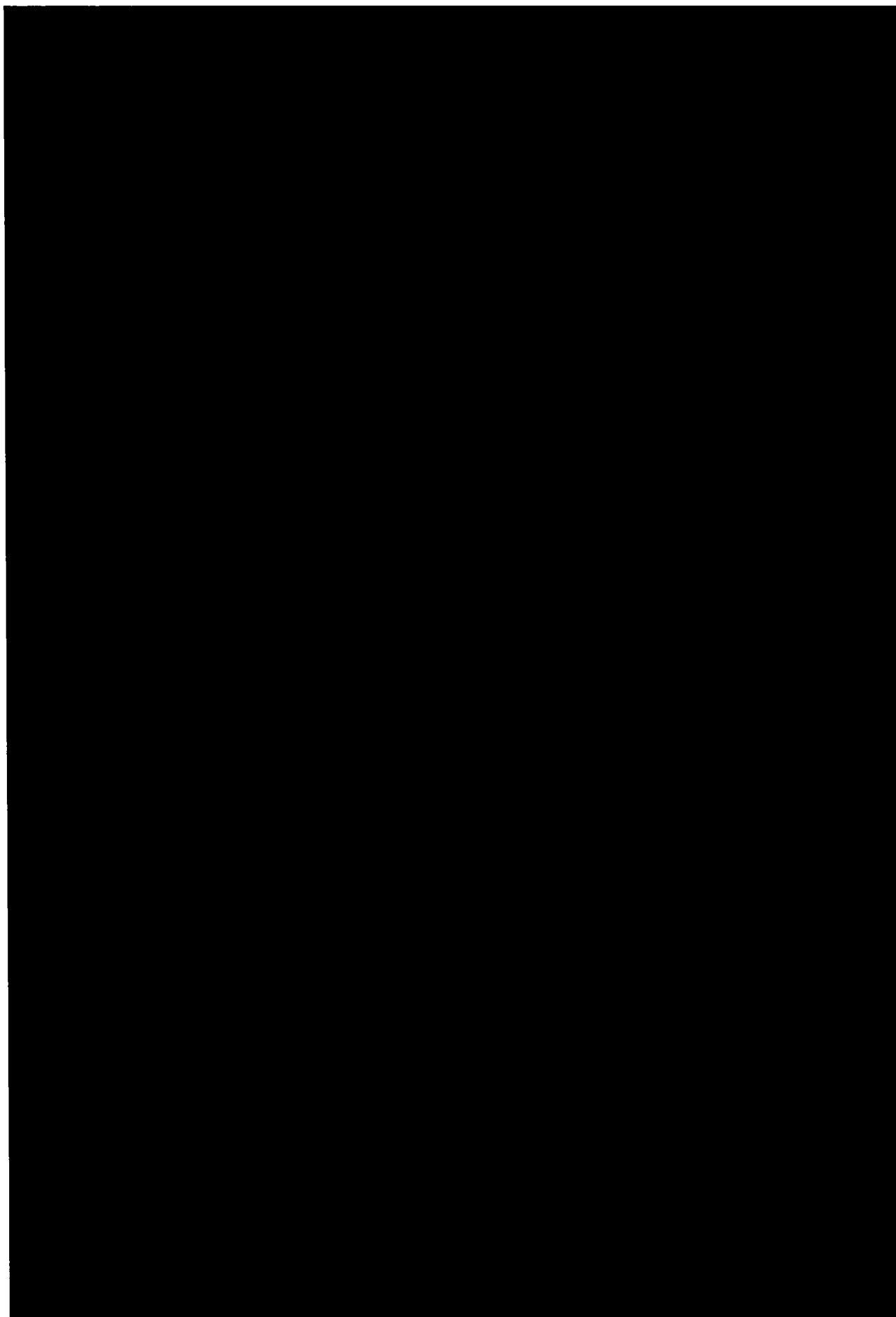


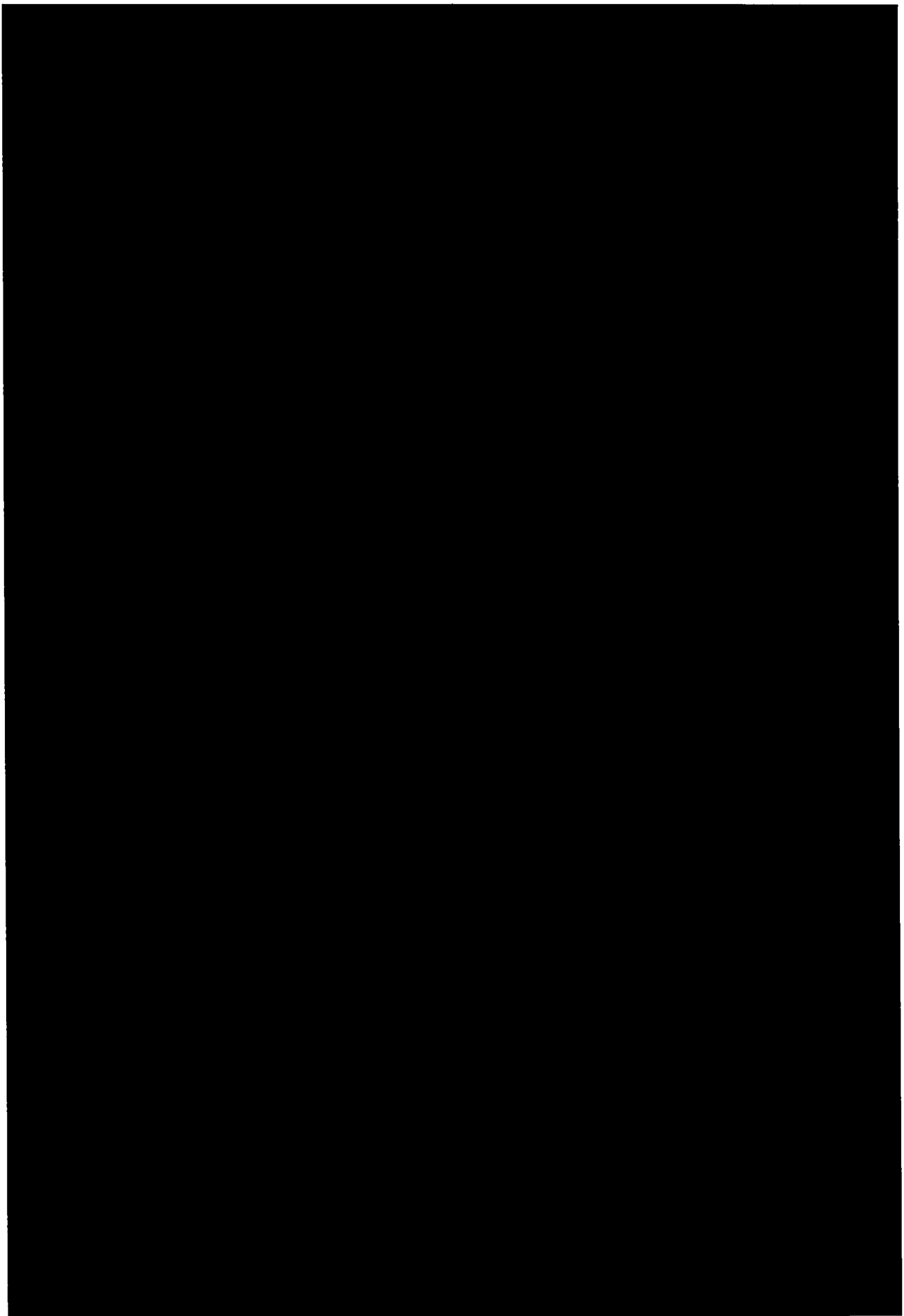
WILL

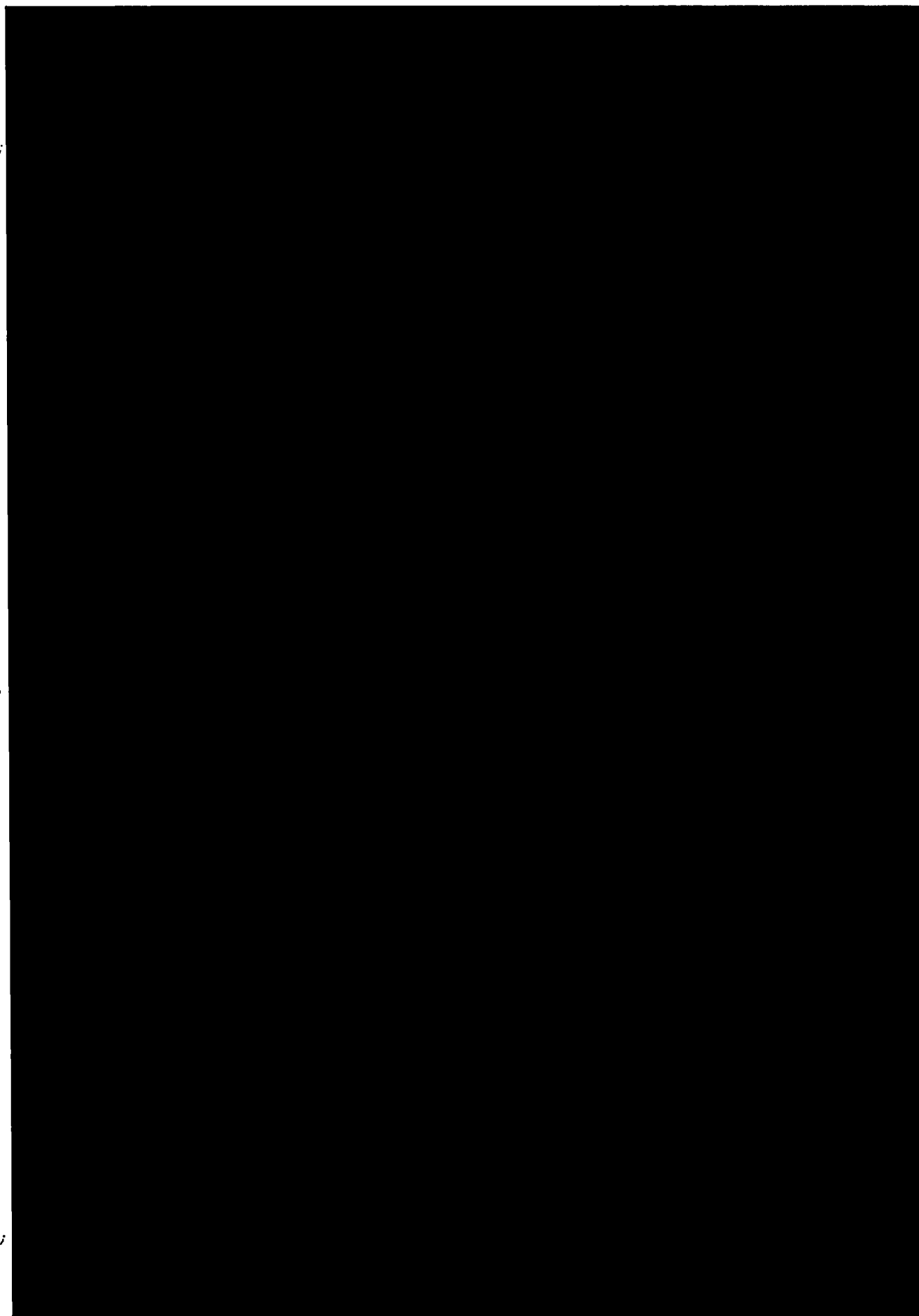
WILL

WILL





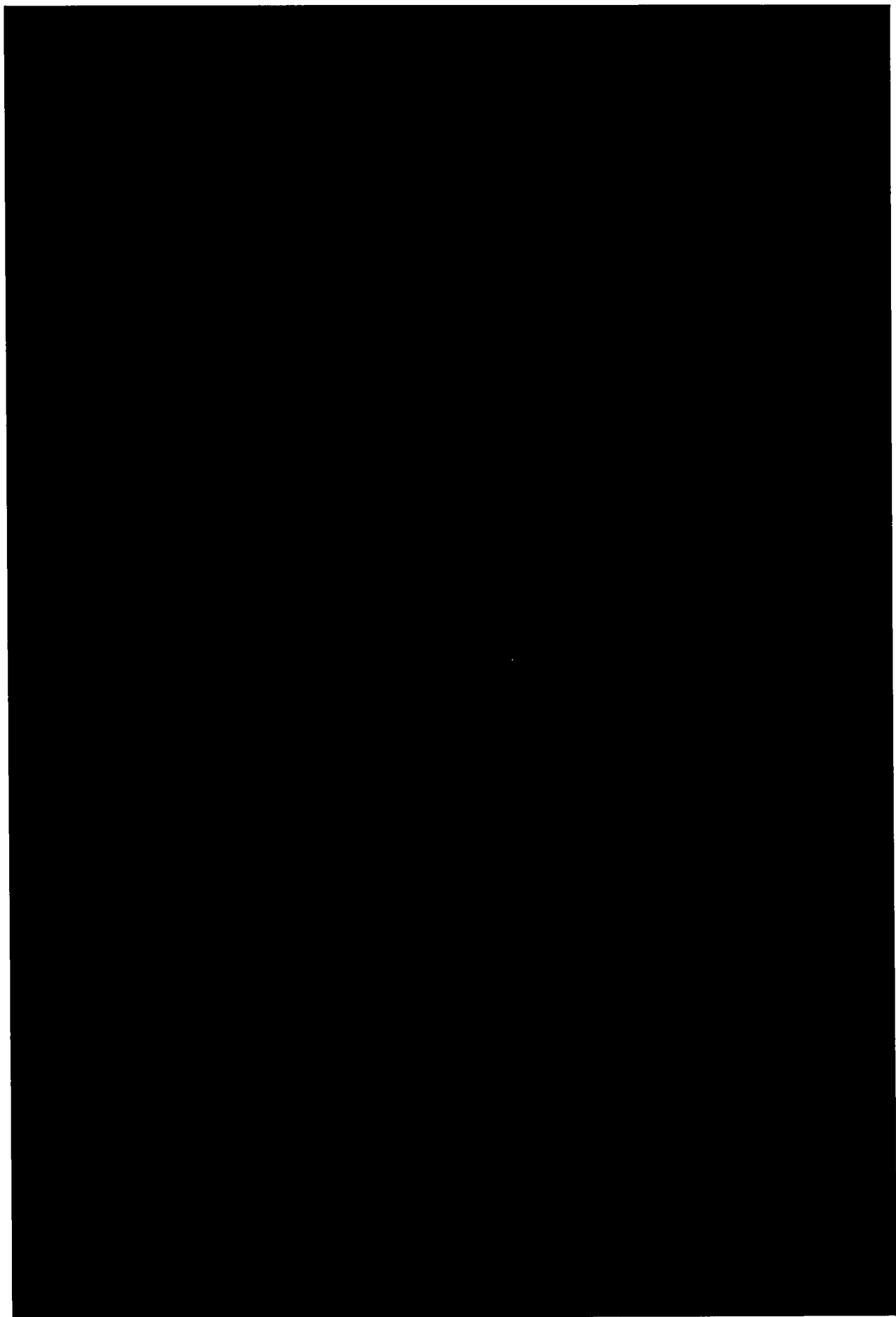




11

12

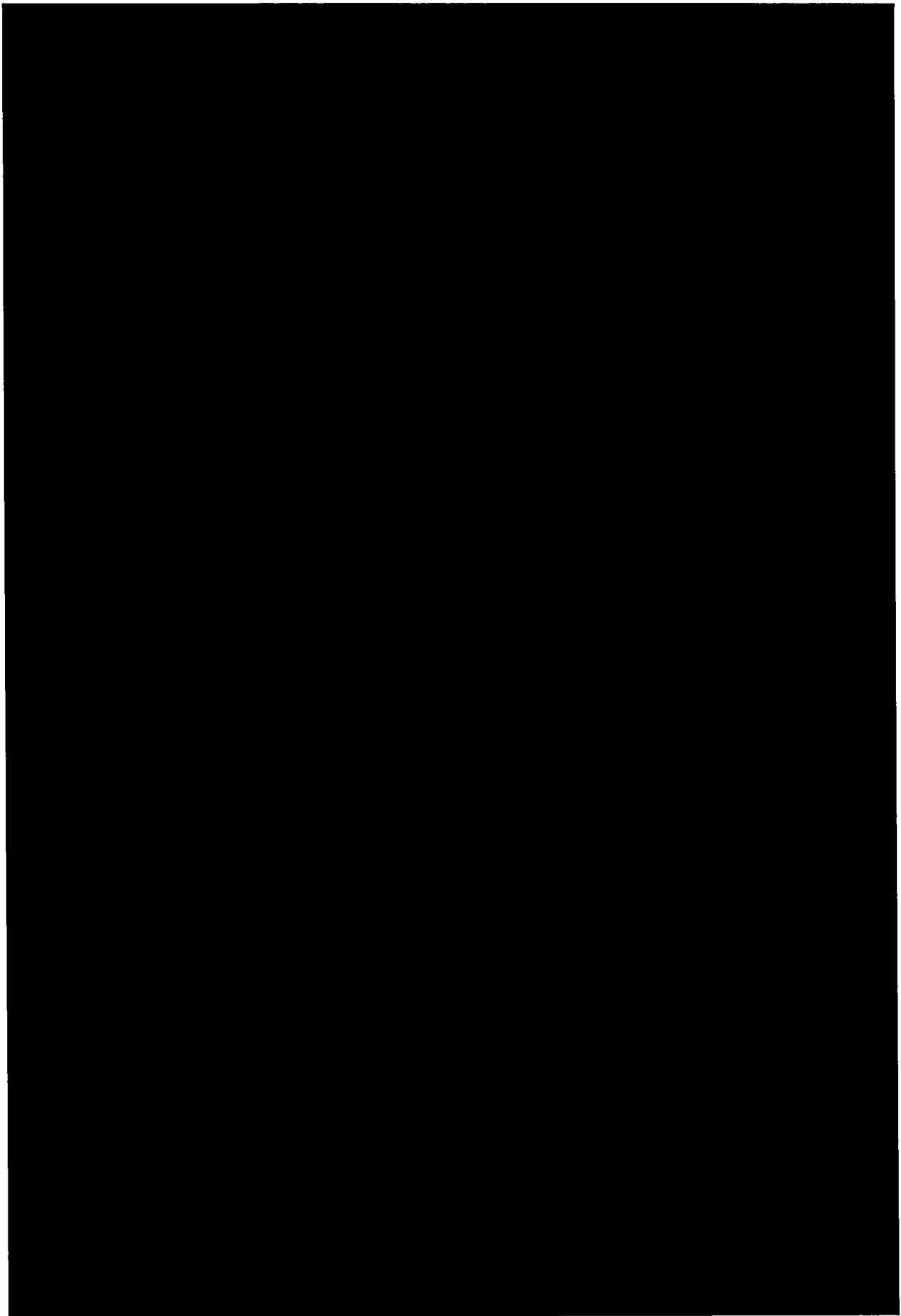
13

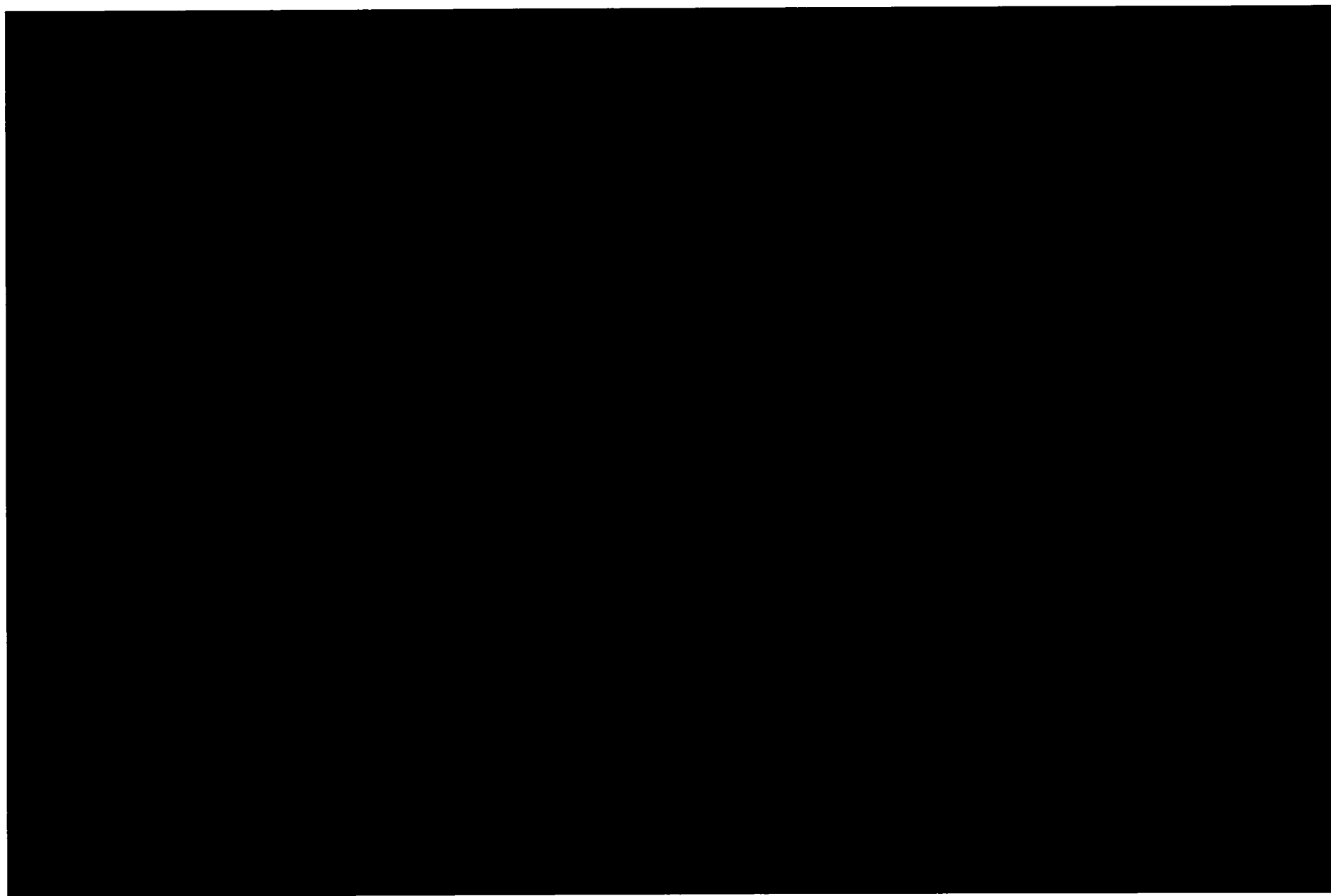


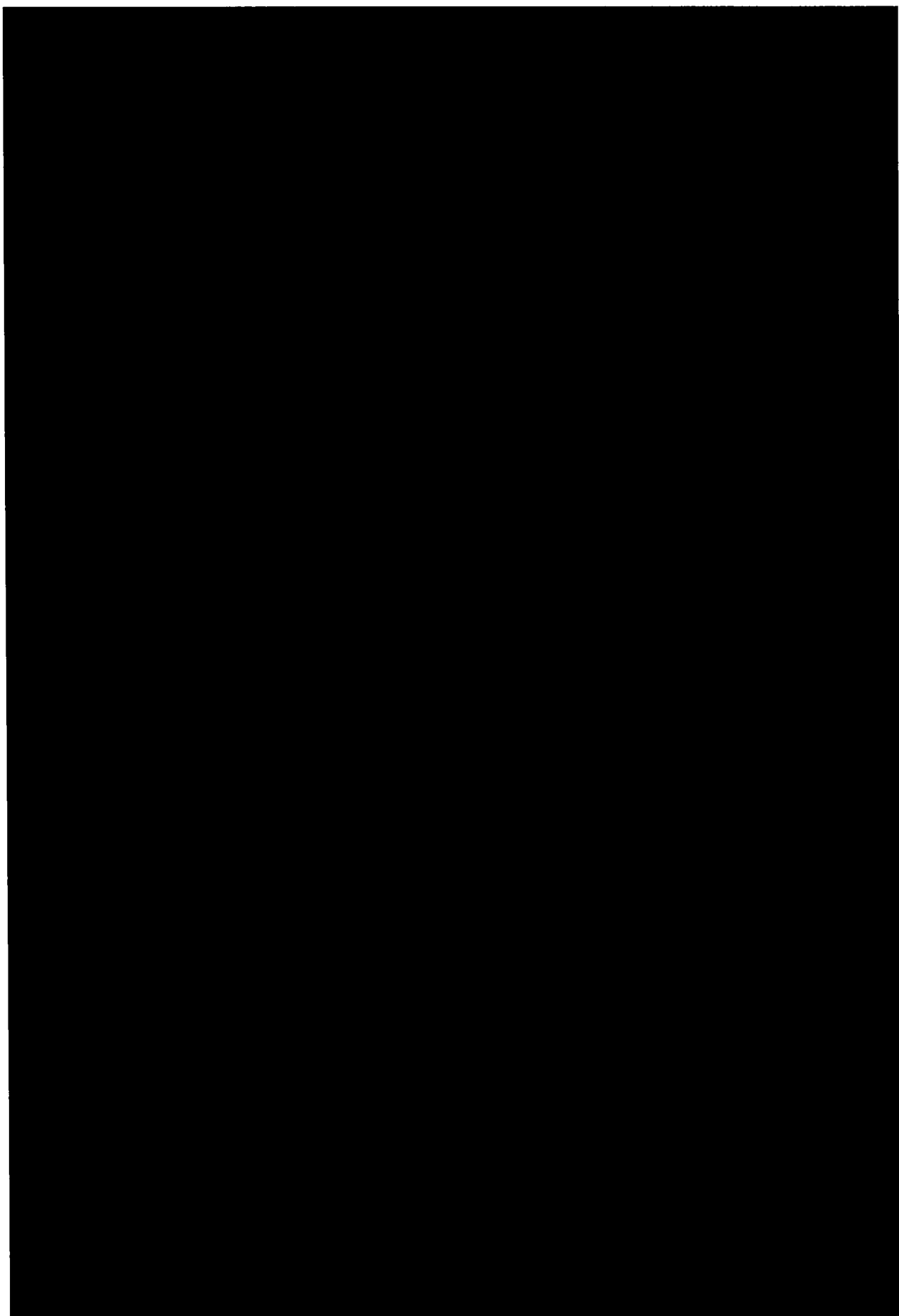
WJW

WJW

WJW



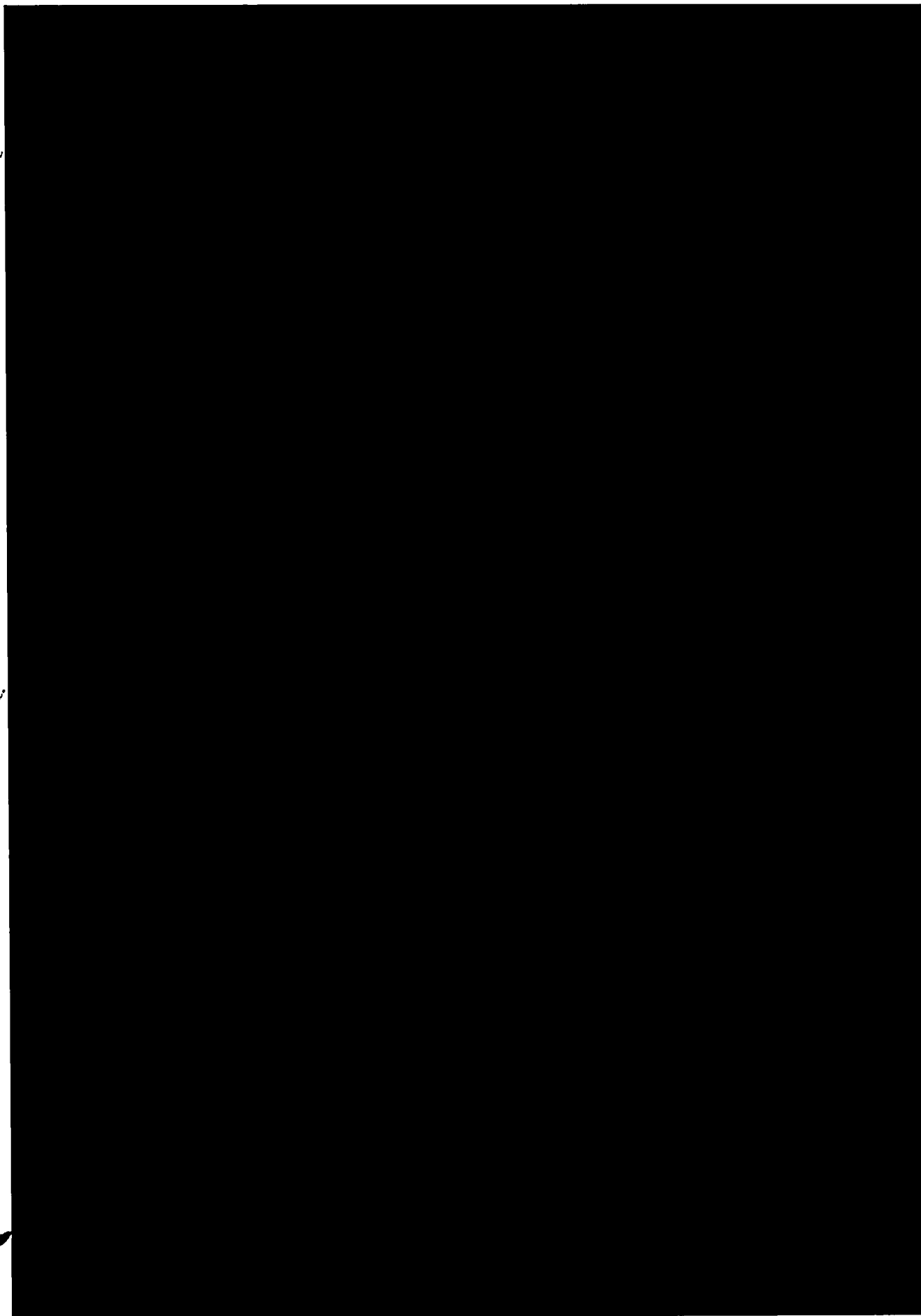


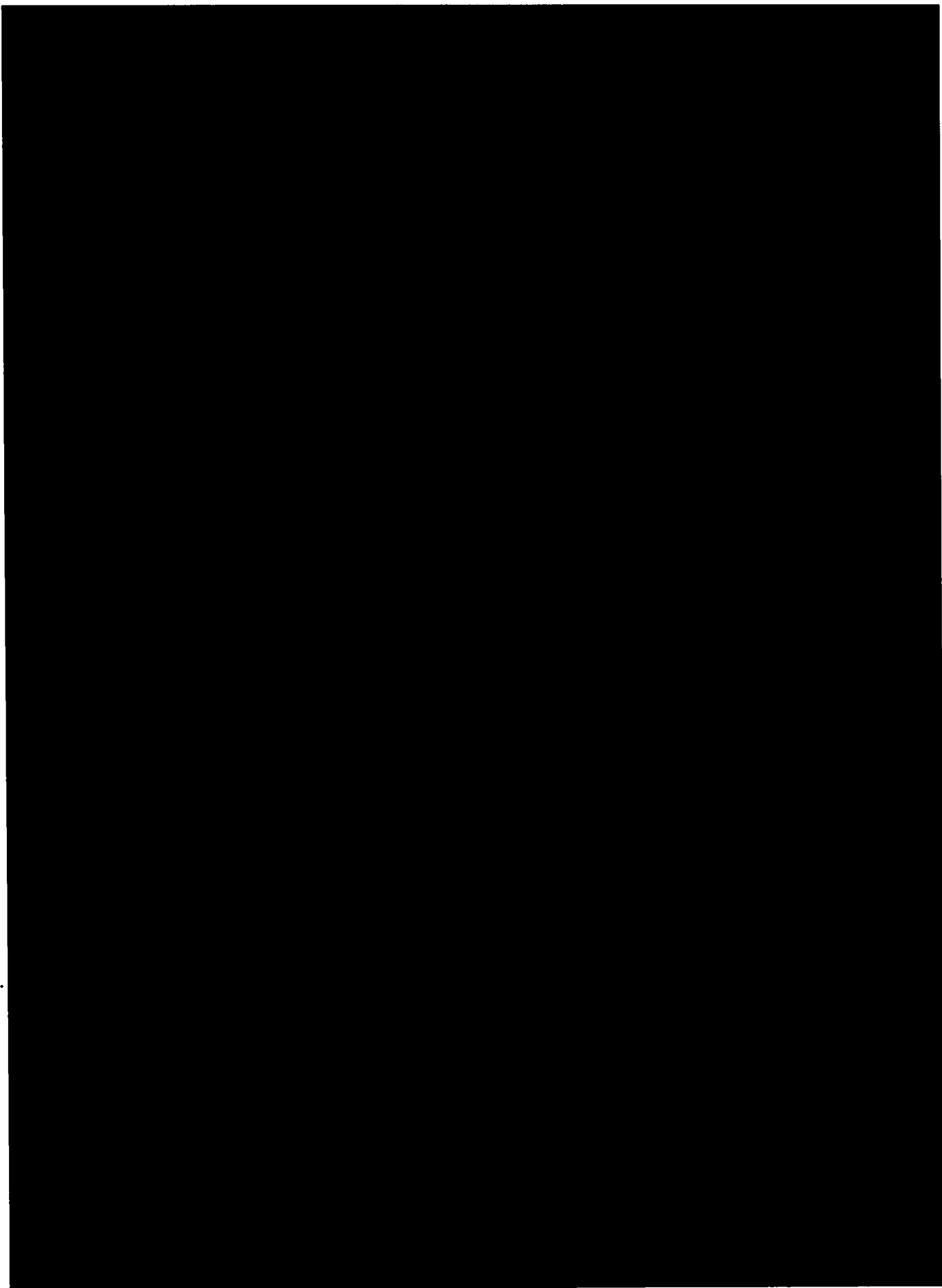


(b)(7)(D)

(b)(7)(D)

(b)(7)(D)

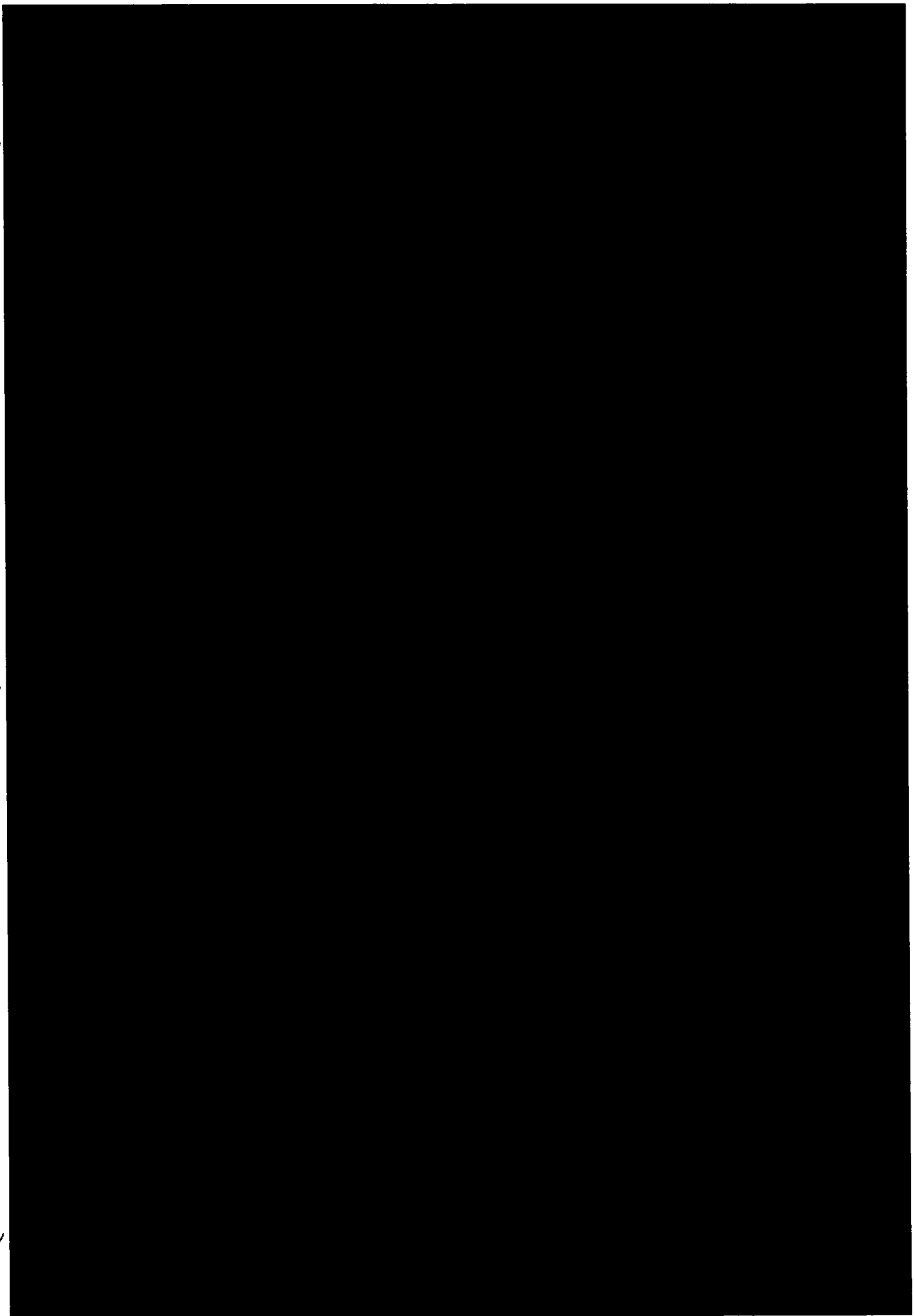




(b)(7)(D)

(b)(7)(D)

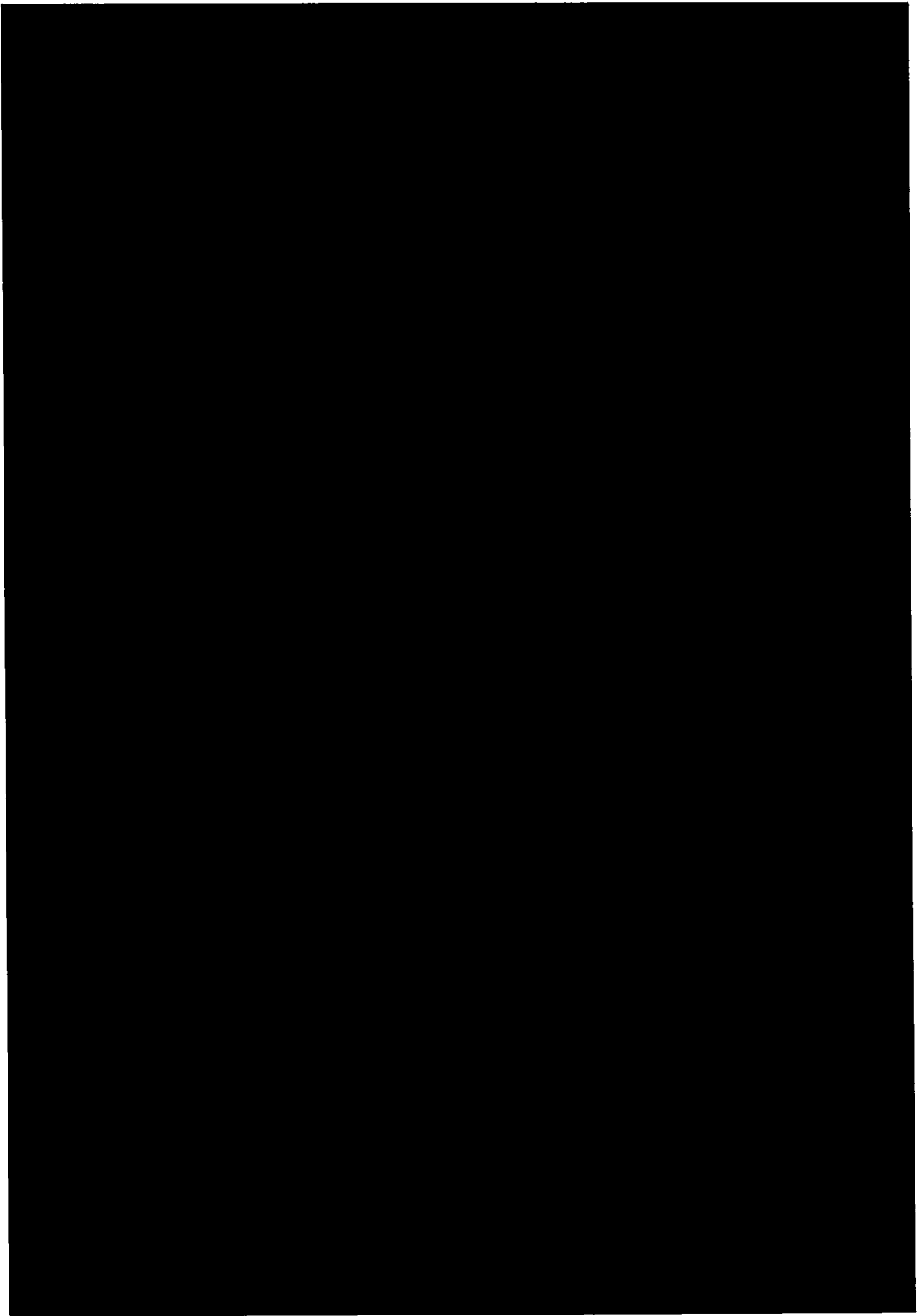
(b)(7)(D)



WLE

WLE

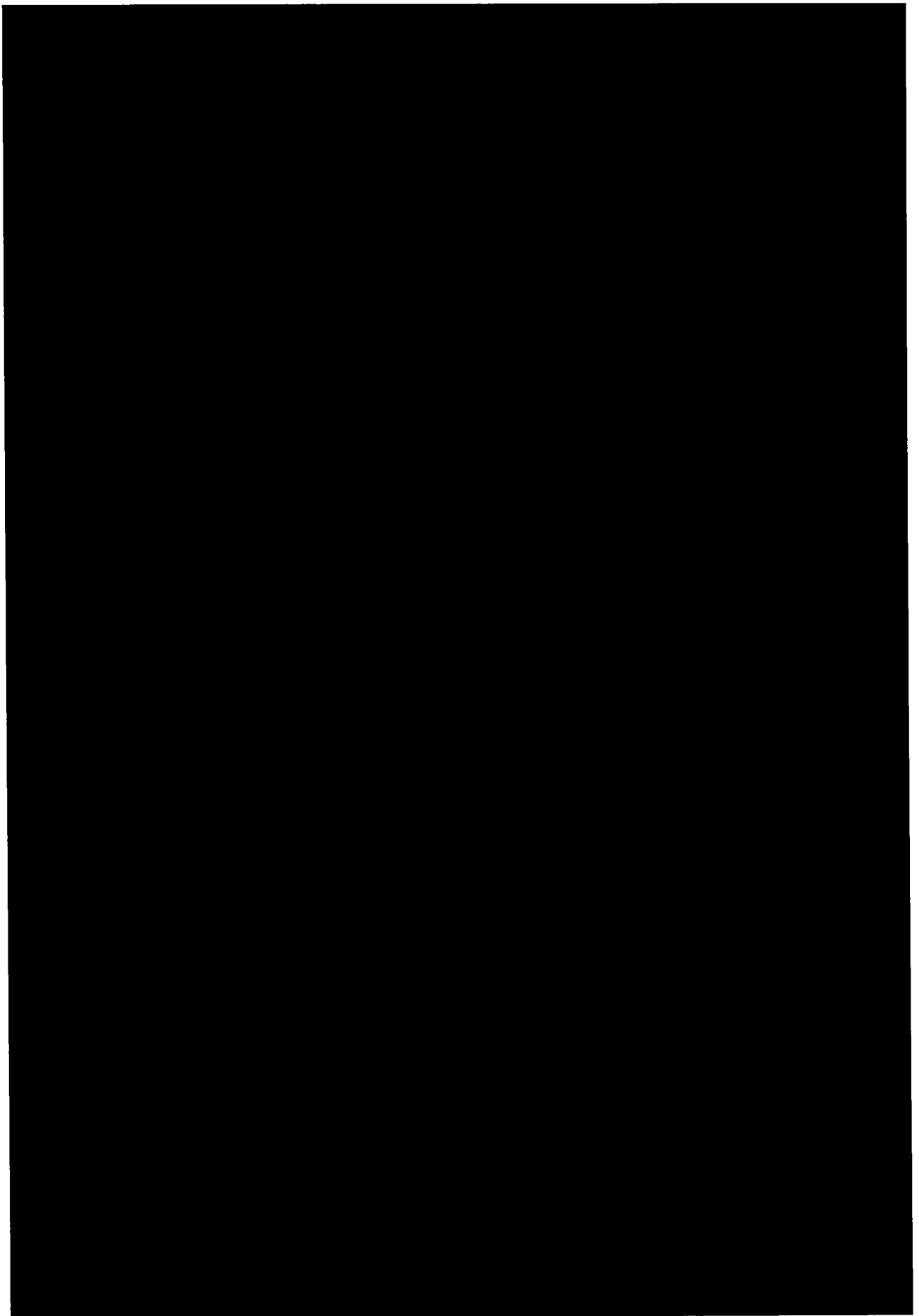
WLE



11

12

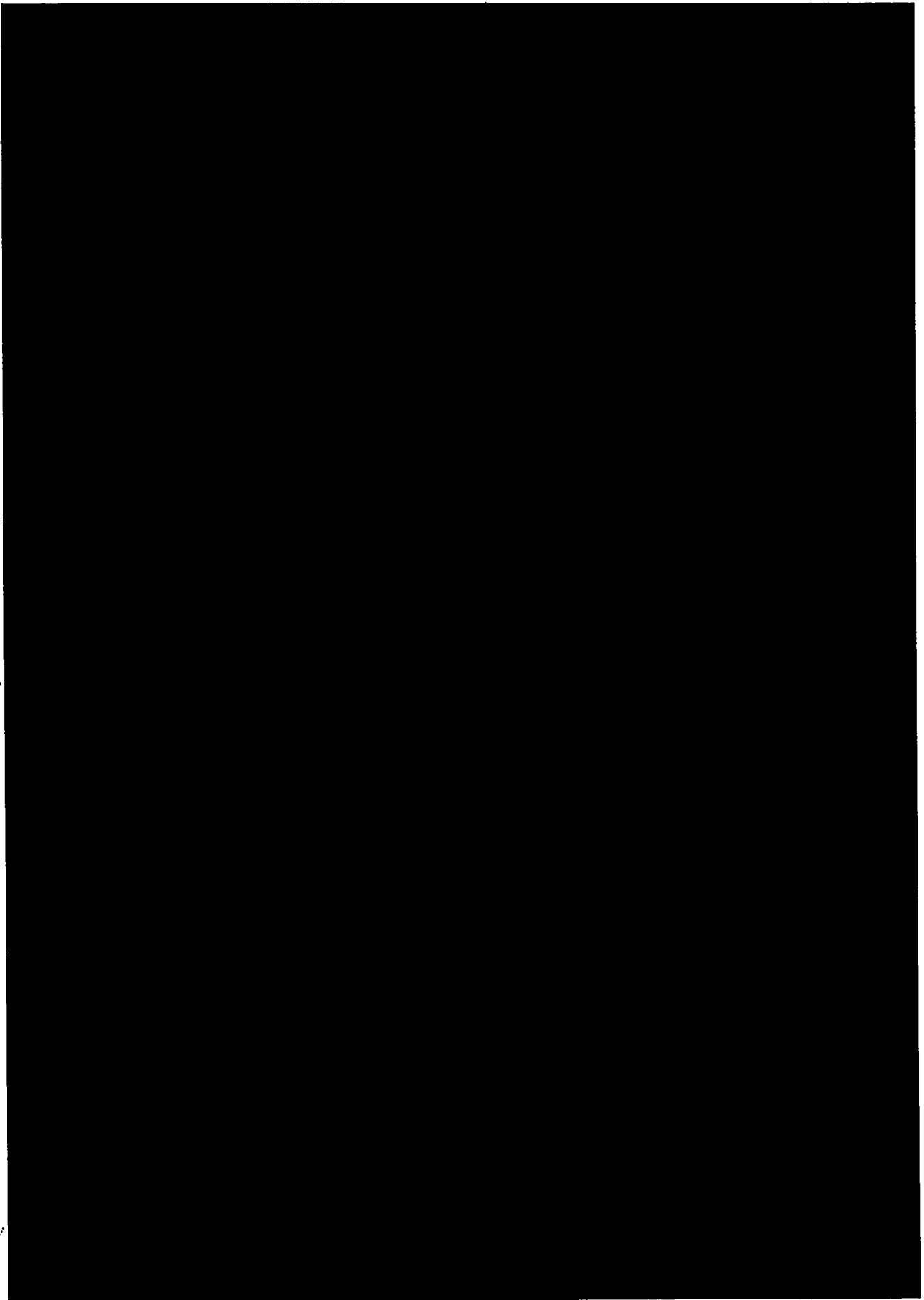
13



(S)

(S)

(S)



11

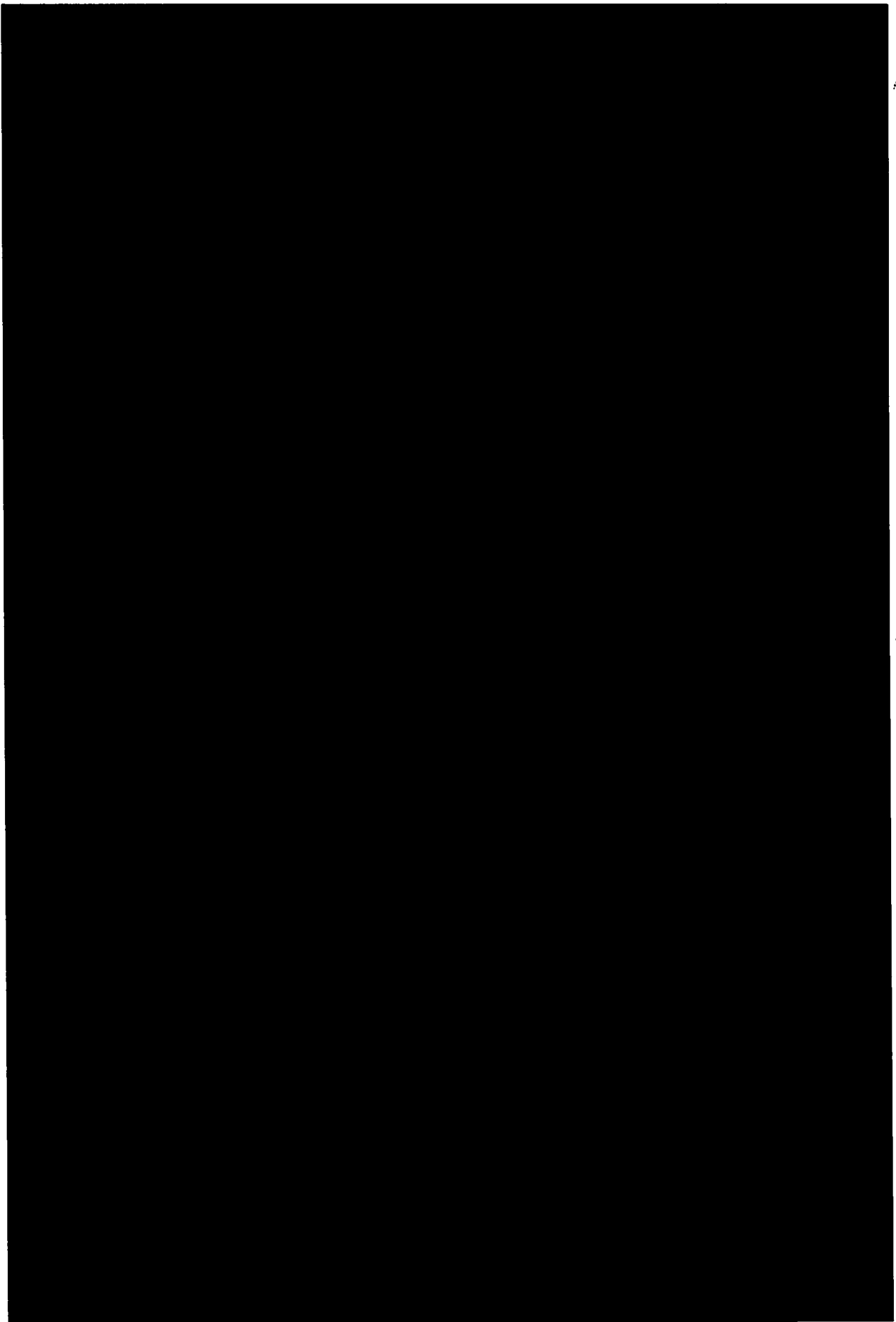
12

13

171

172

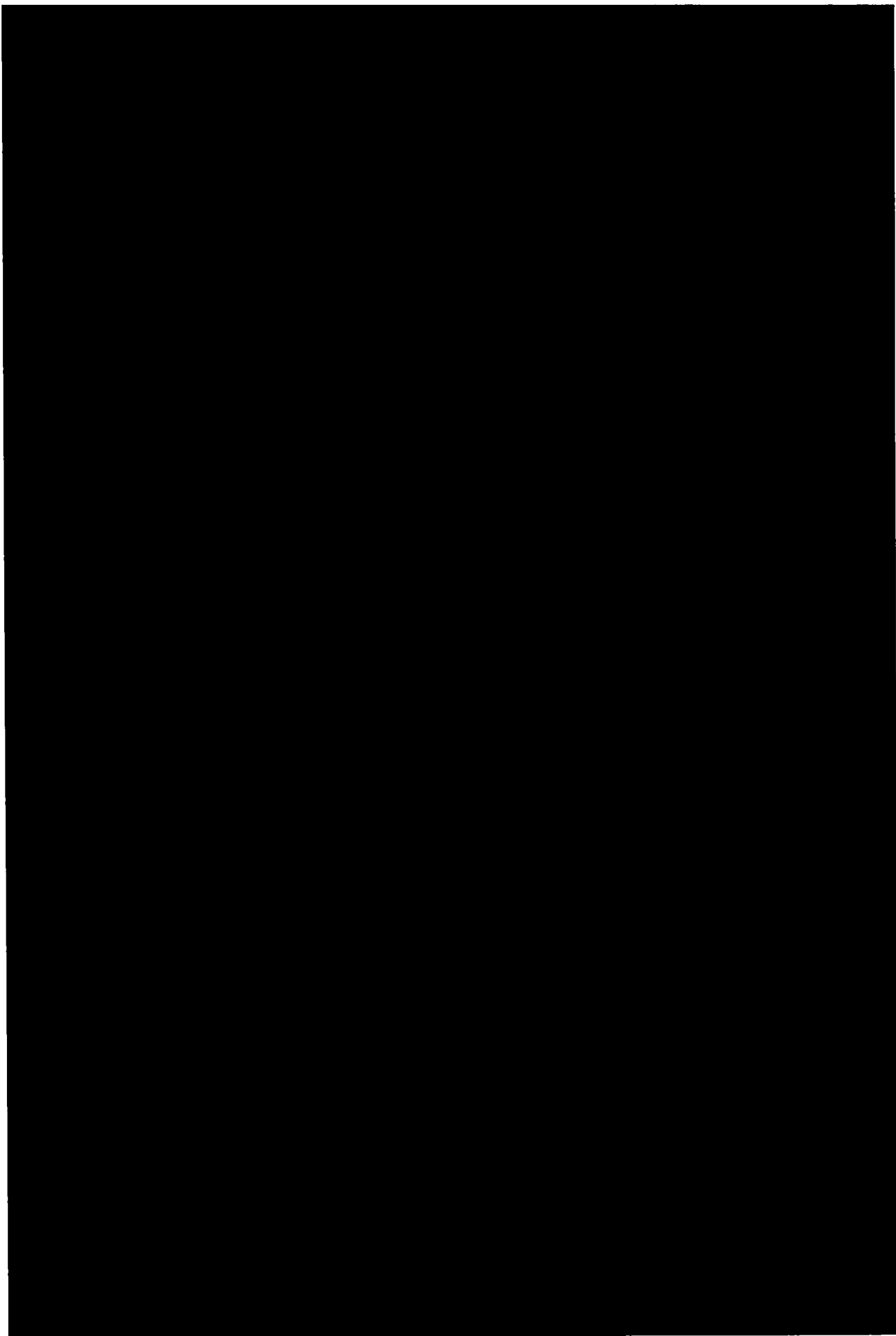
173



(b)(7)(D)

(b)(7)(D)

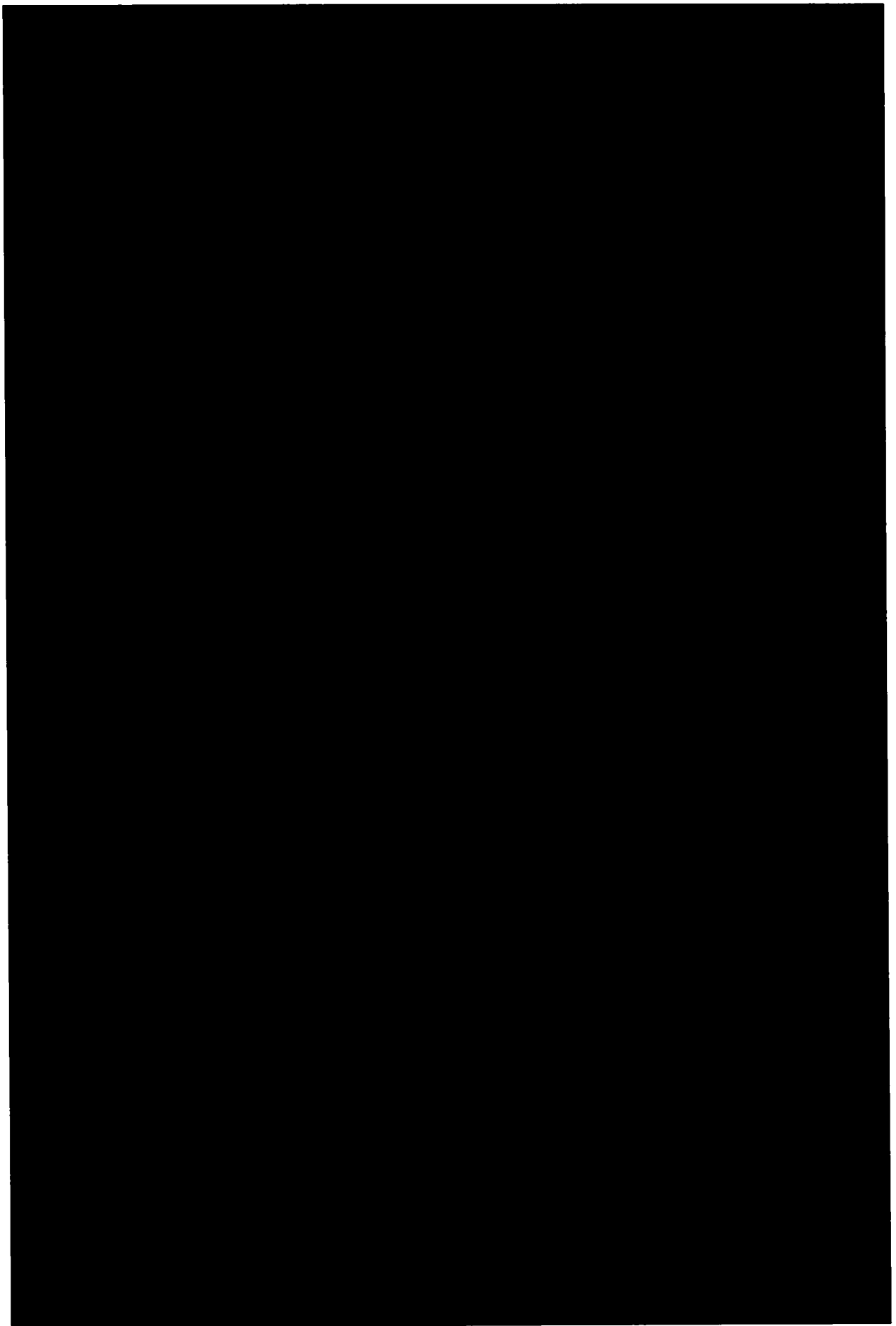
(b)(7)(D)



1

2

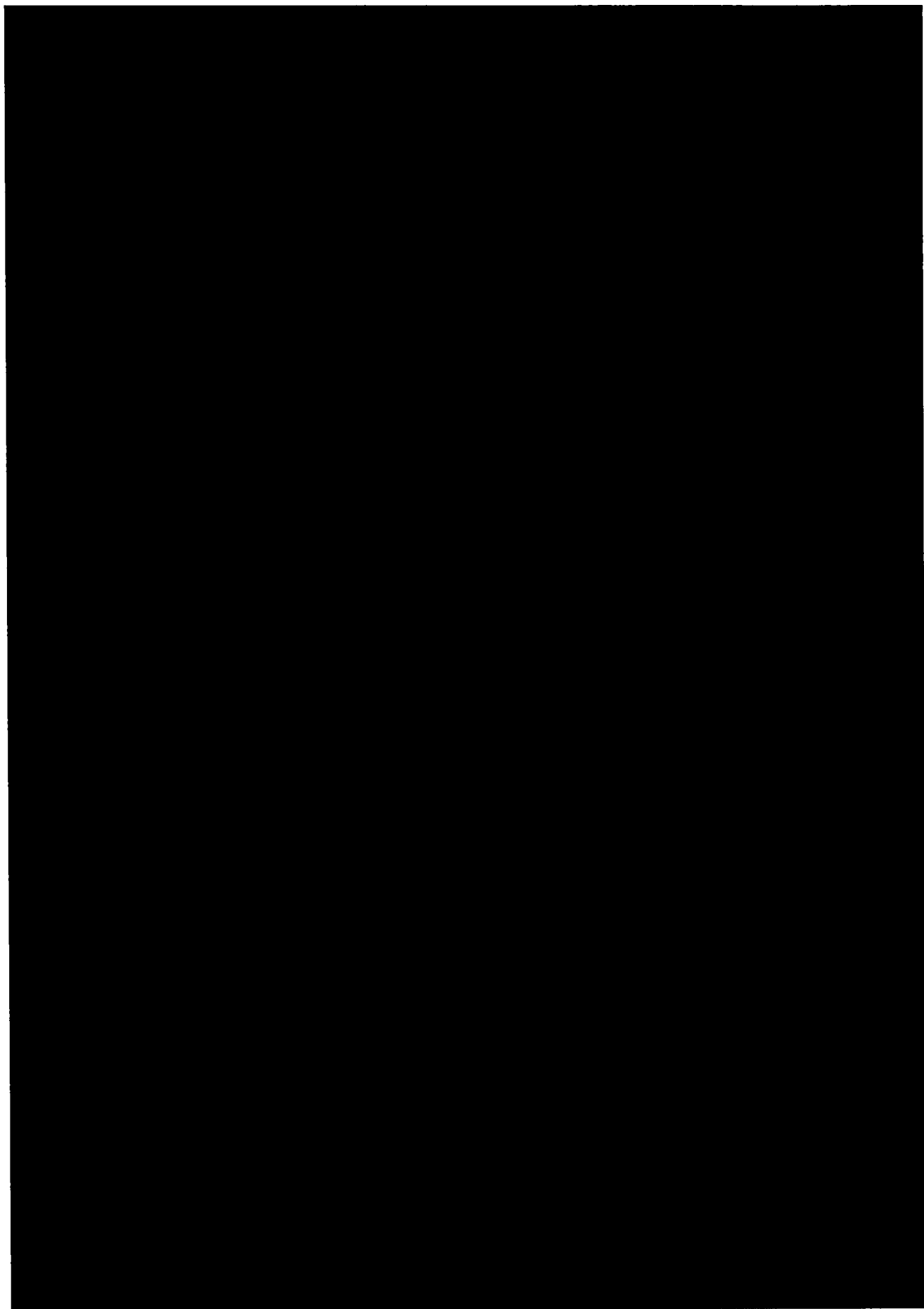
3



11/11/11

11/11/11

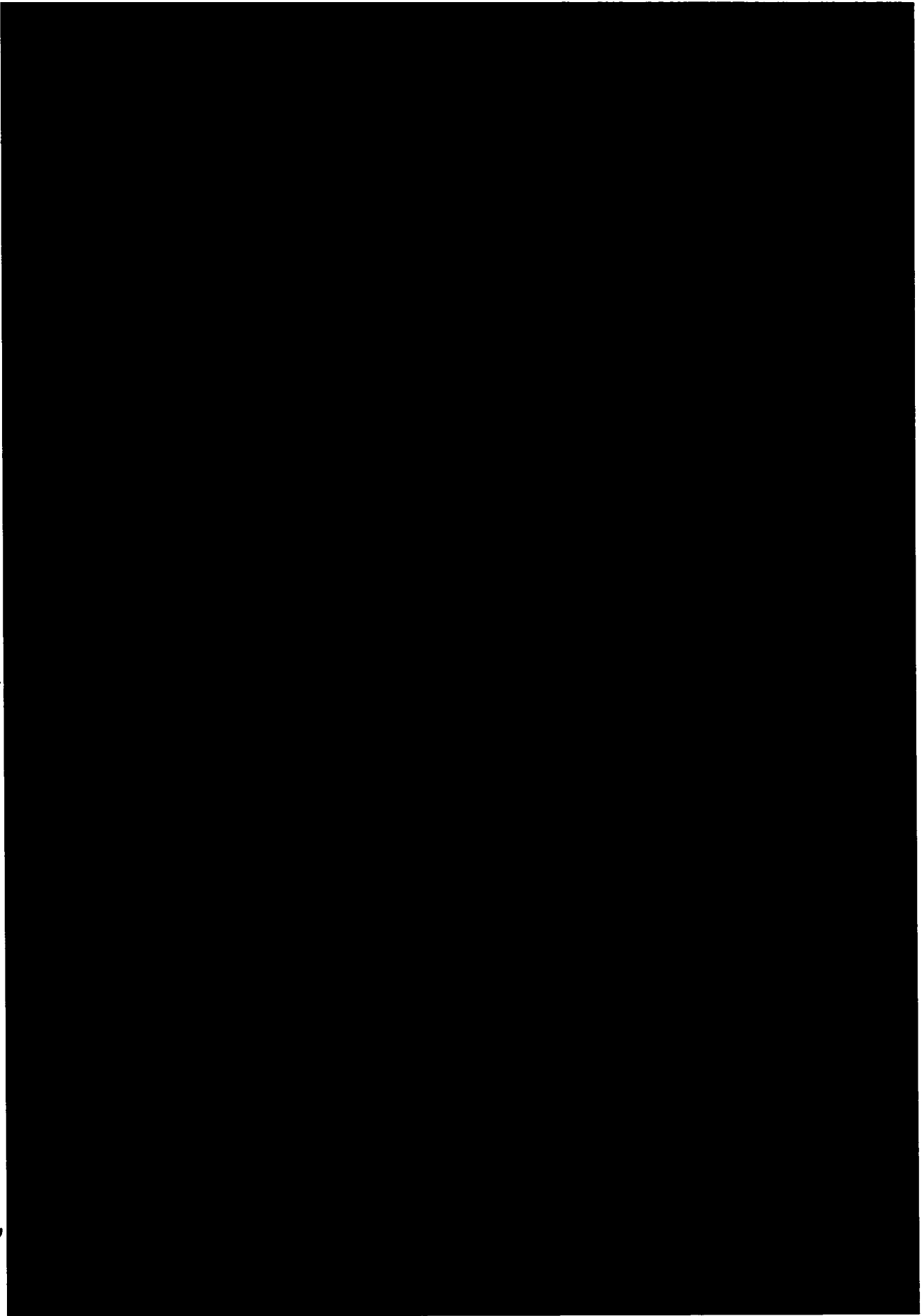
11/11/11

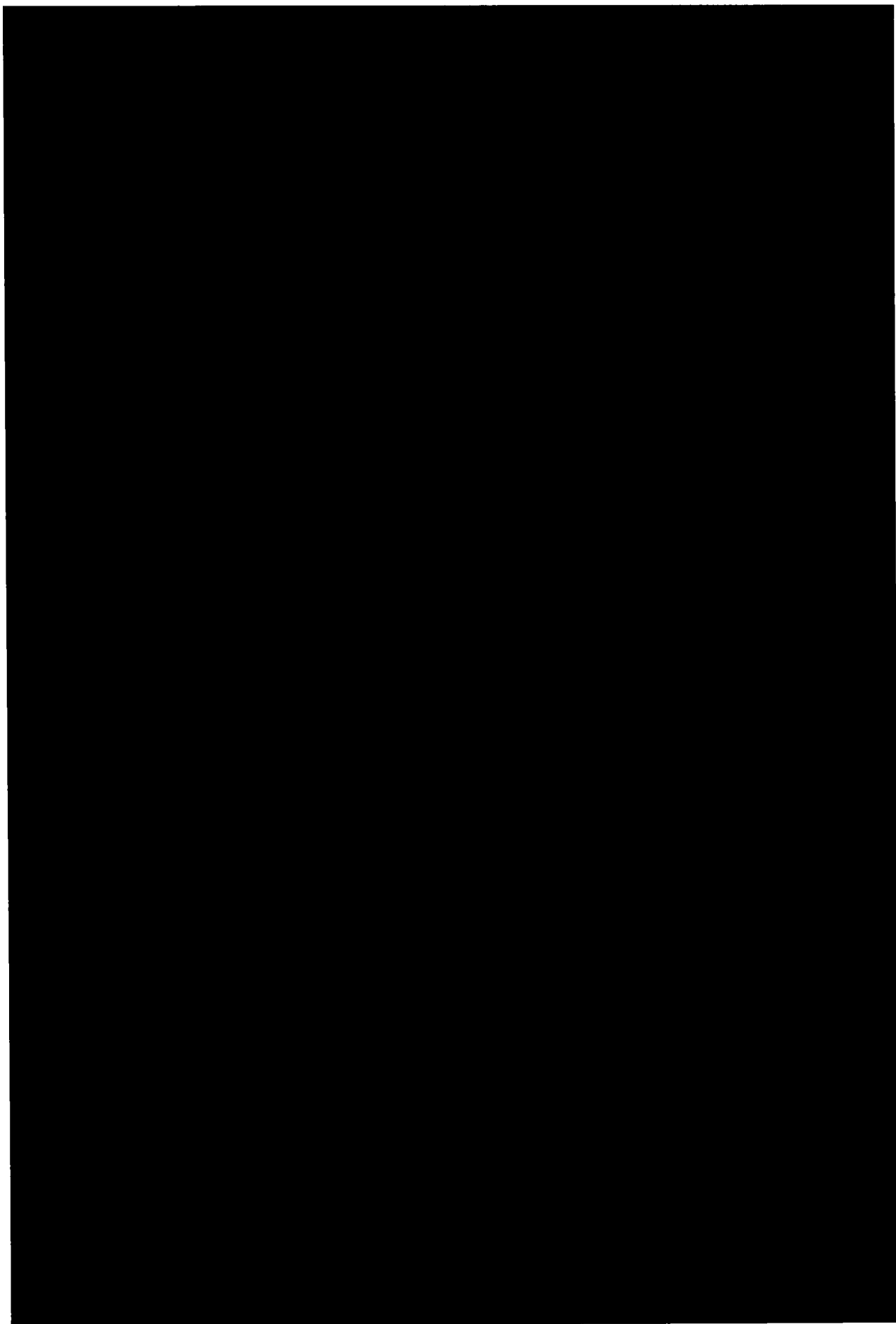


(b)(7)(C)

(b)(7)(C)

(b)(7)(C)

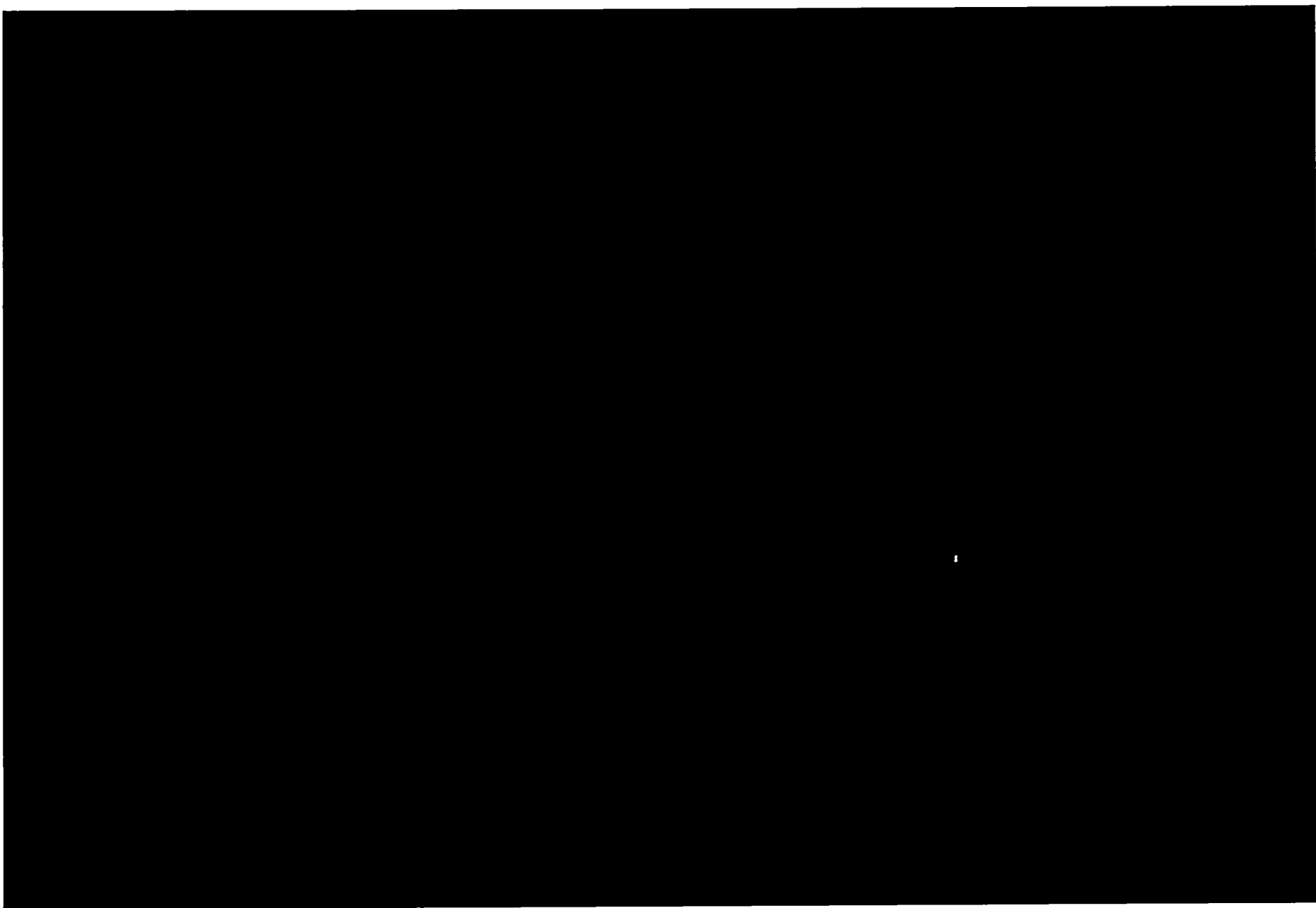


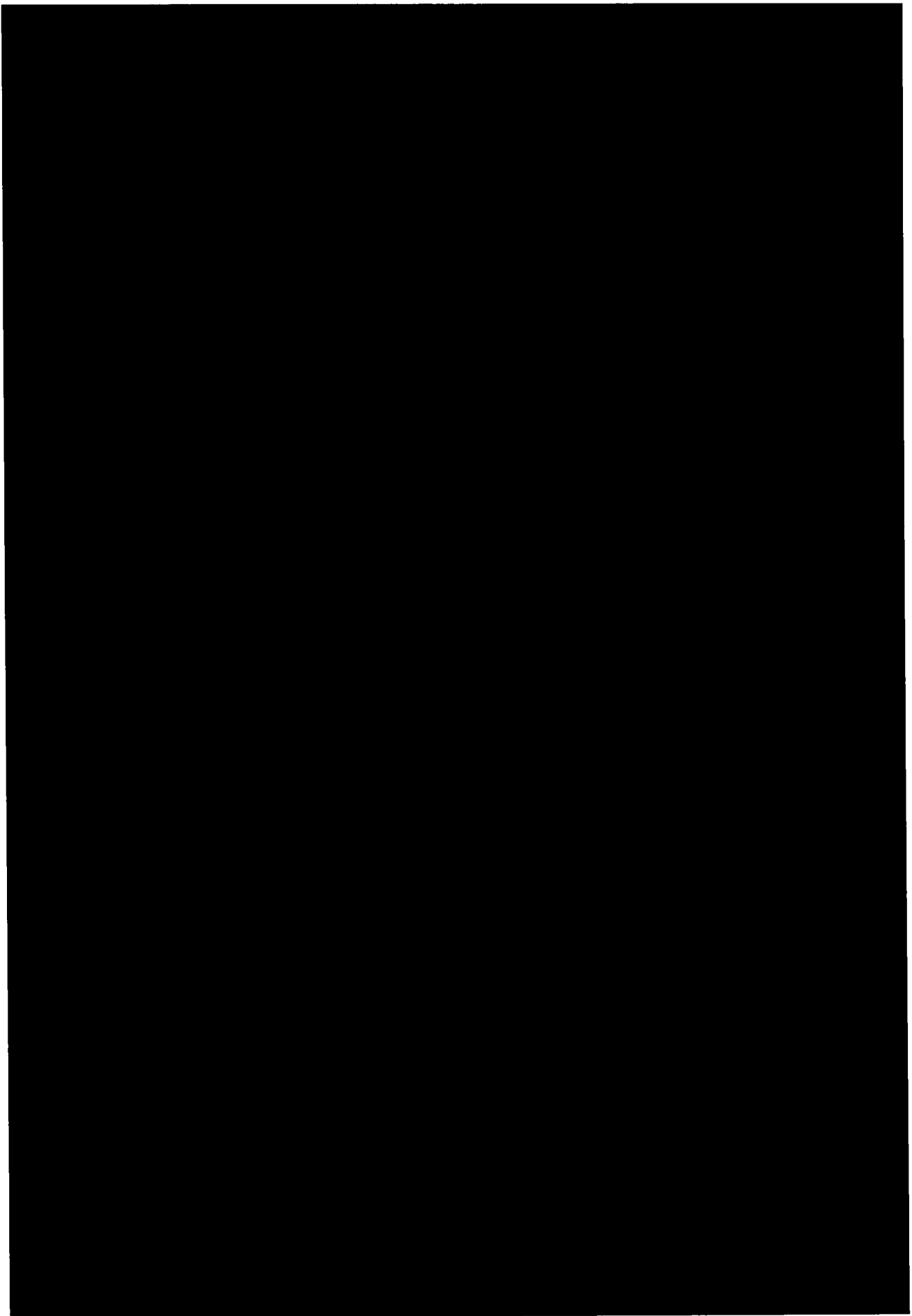


17A

17A

17A

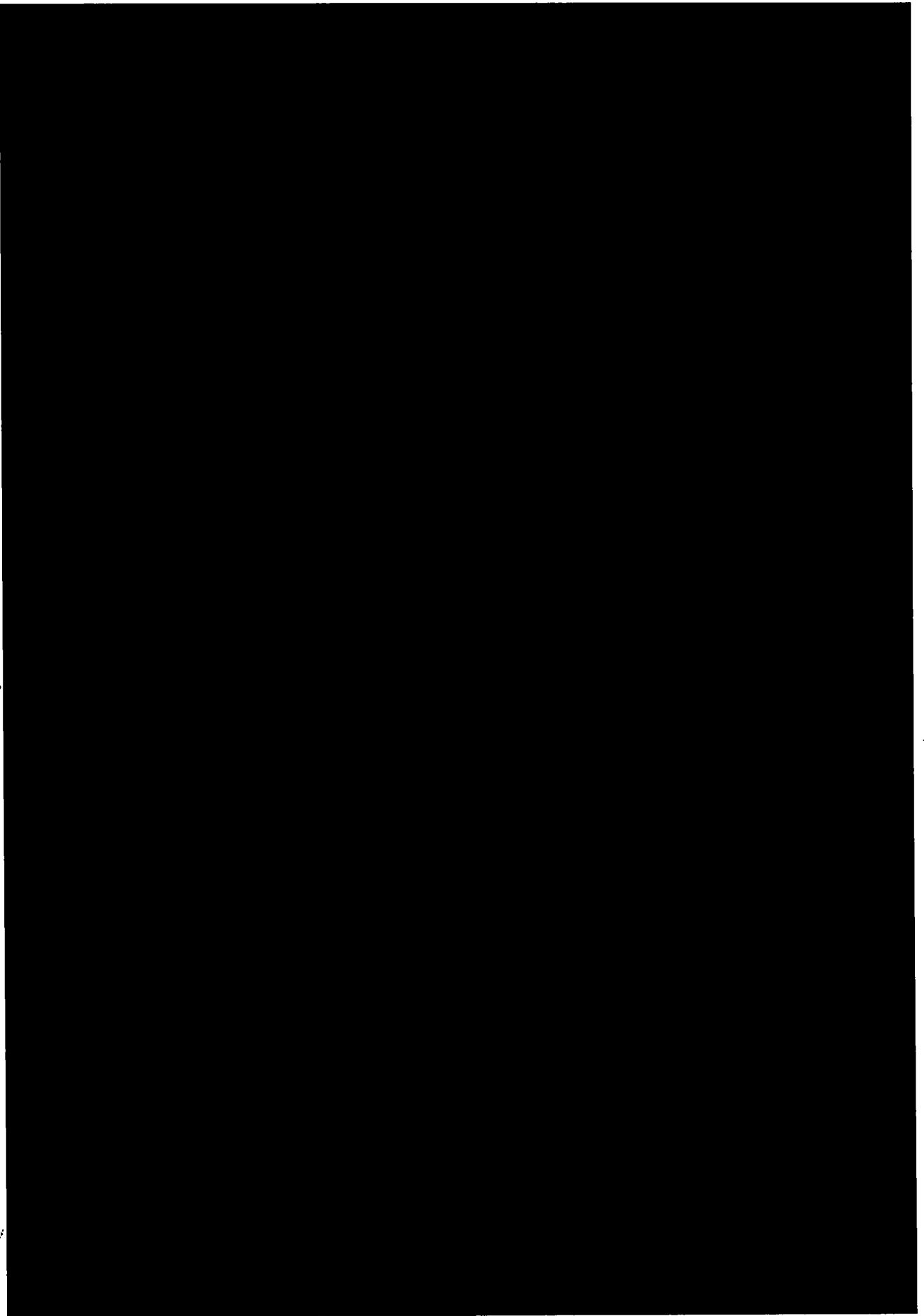


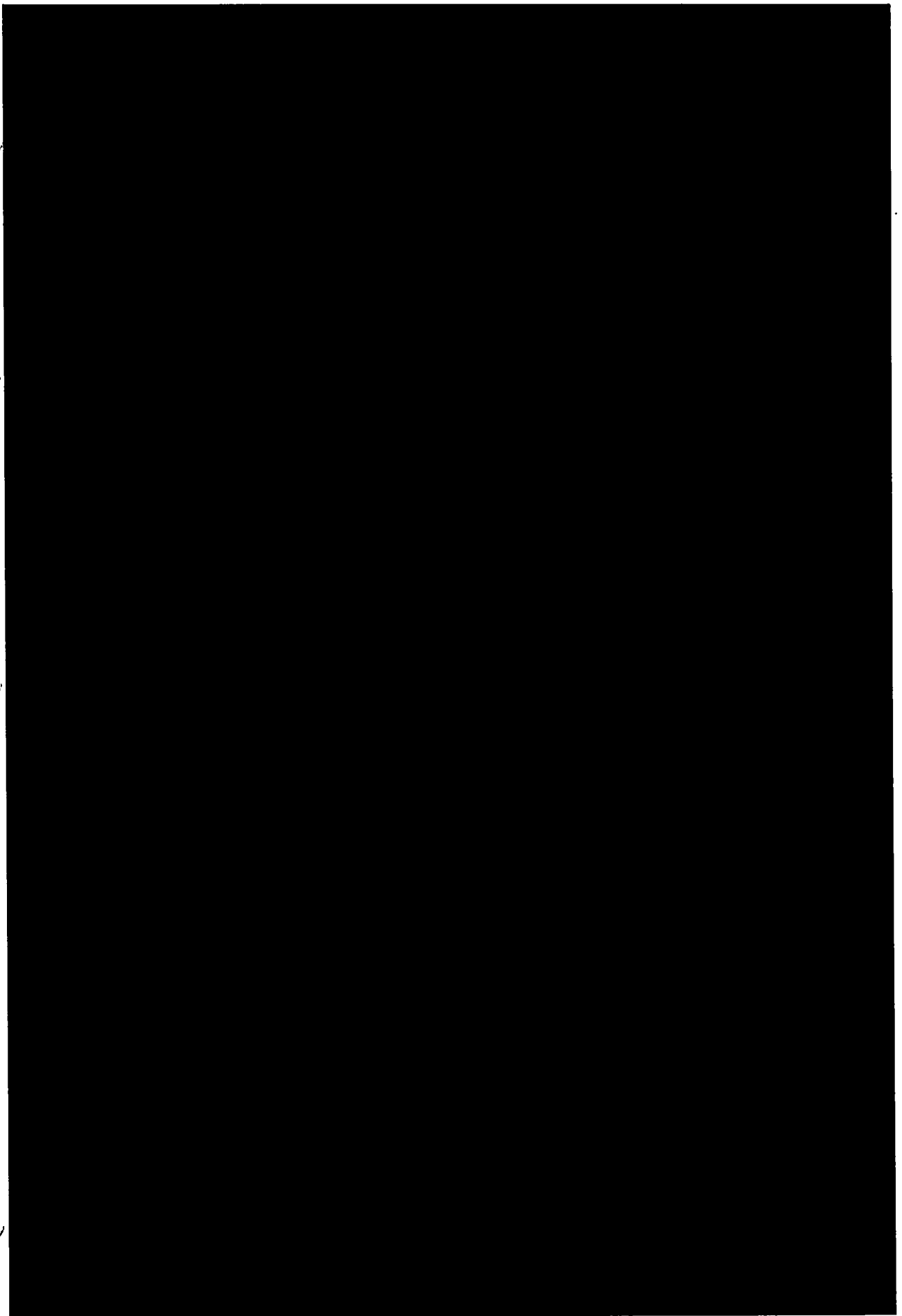


(b)(7)(C)

(b)(7)(C)

(b)(7)(C)

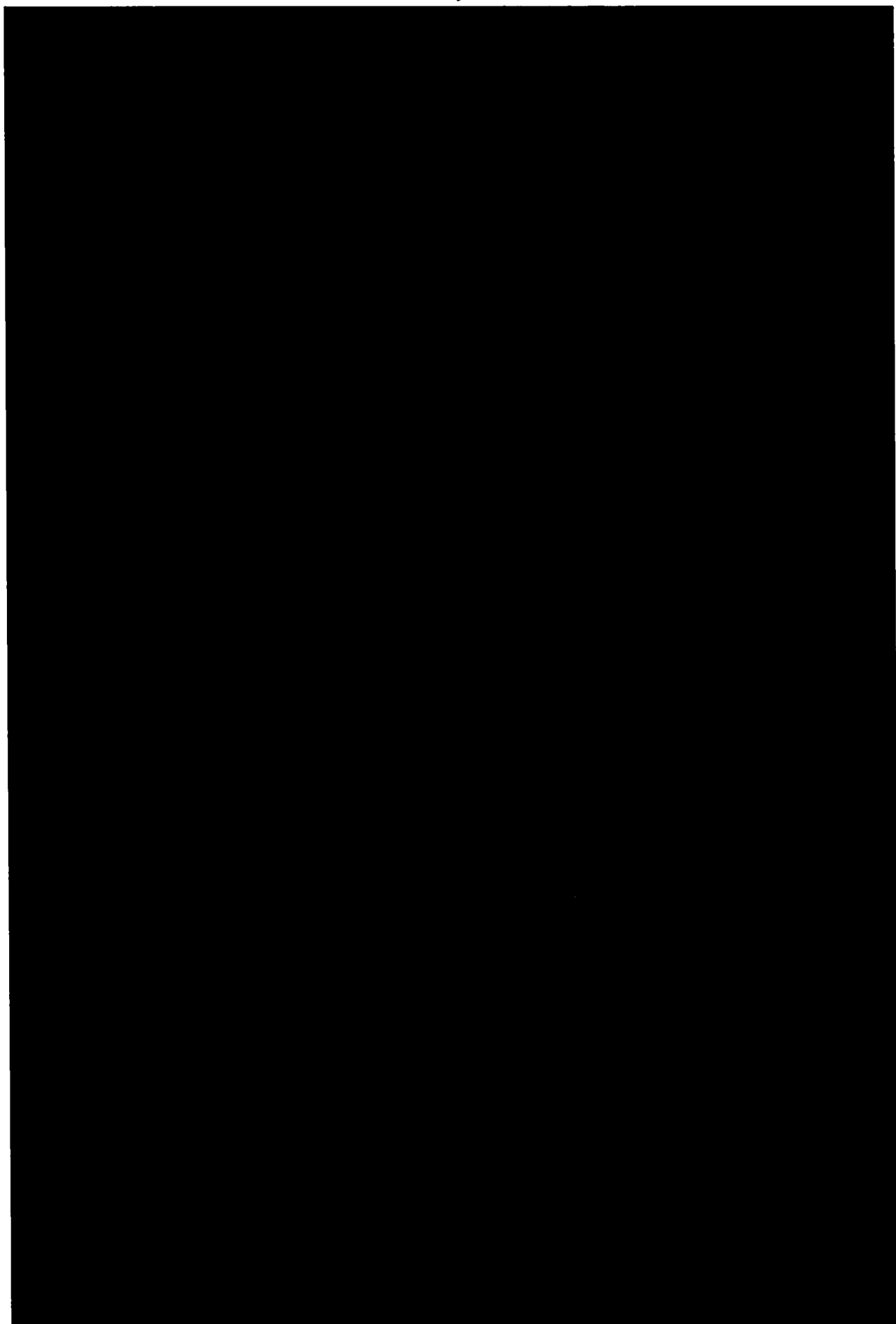




(b)(7)(C)

(b)(7)(C)

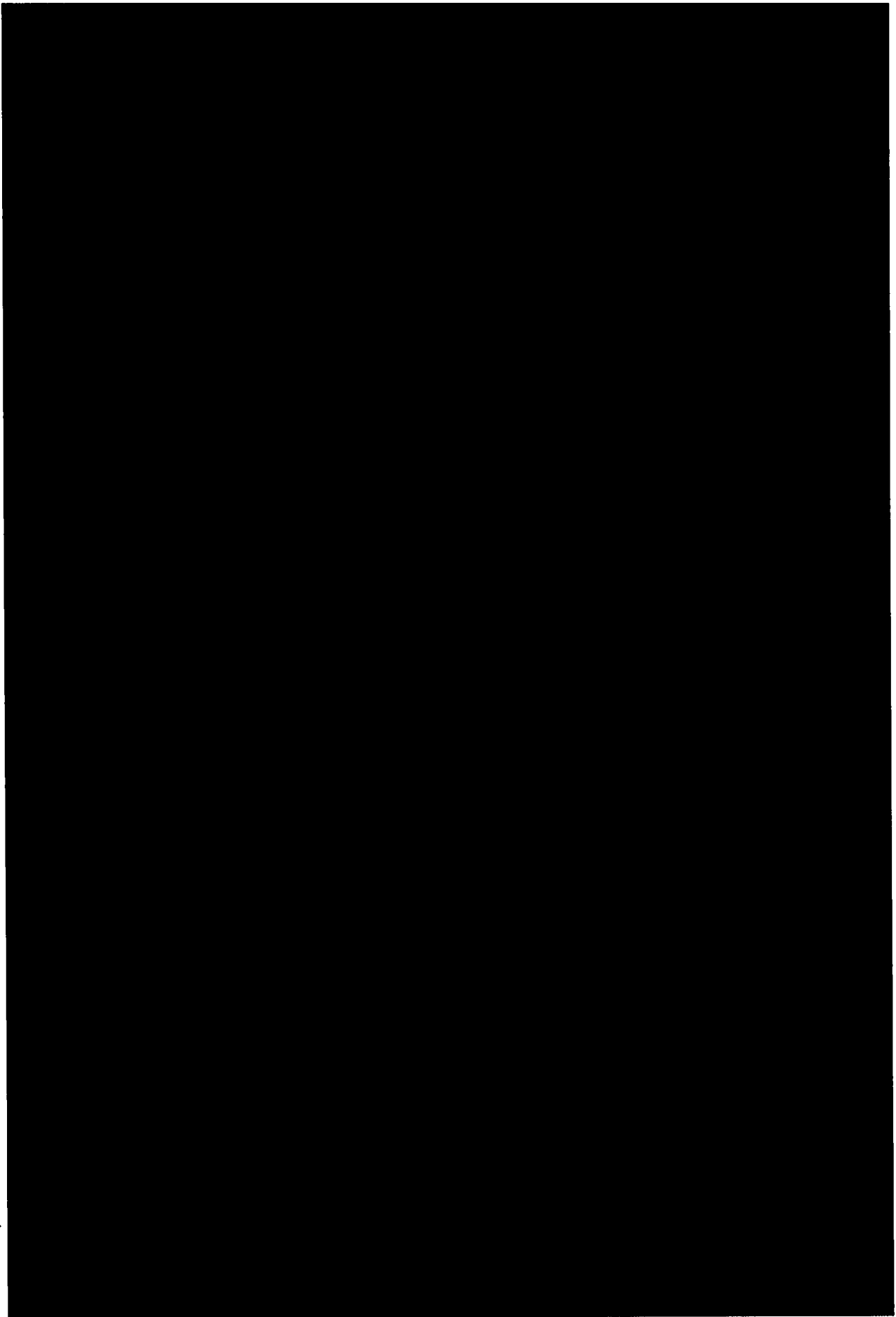
(b)(7)(C)



(b)(7)(D)

(b)(7)(D)

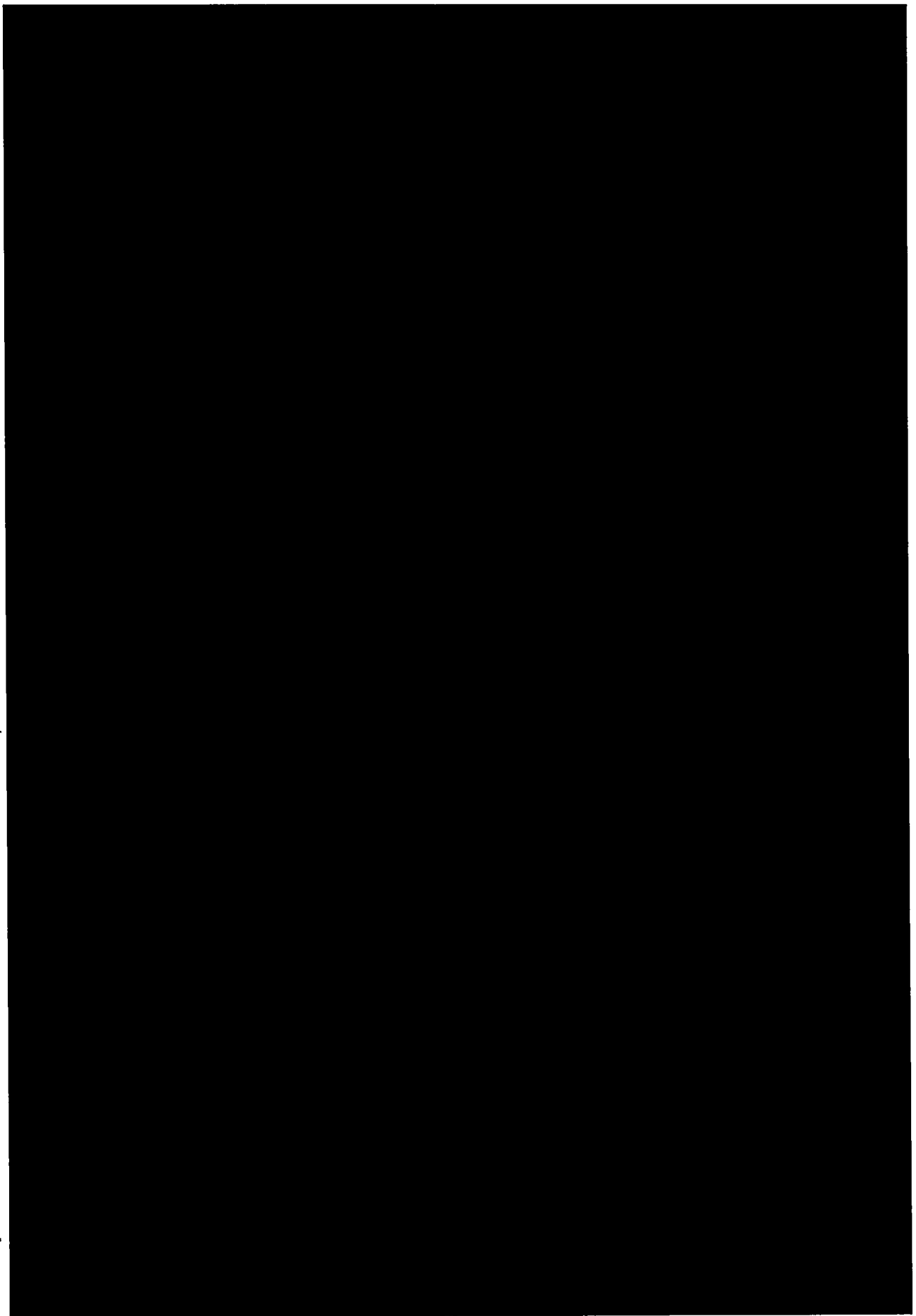
(b)(7)(D)



10/1/10

10/1/10

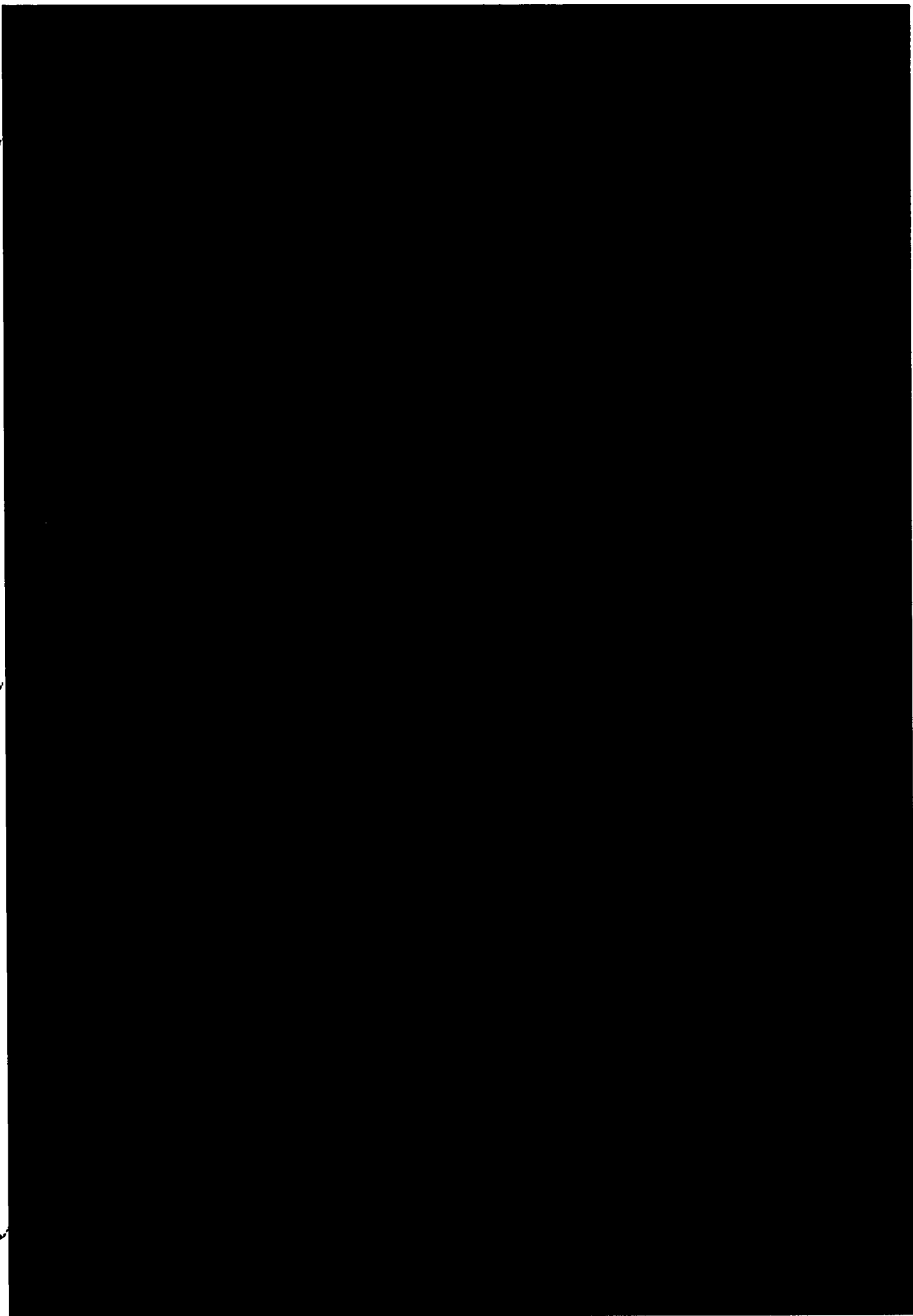
10/1/10

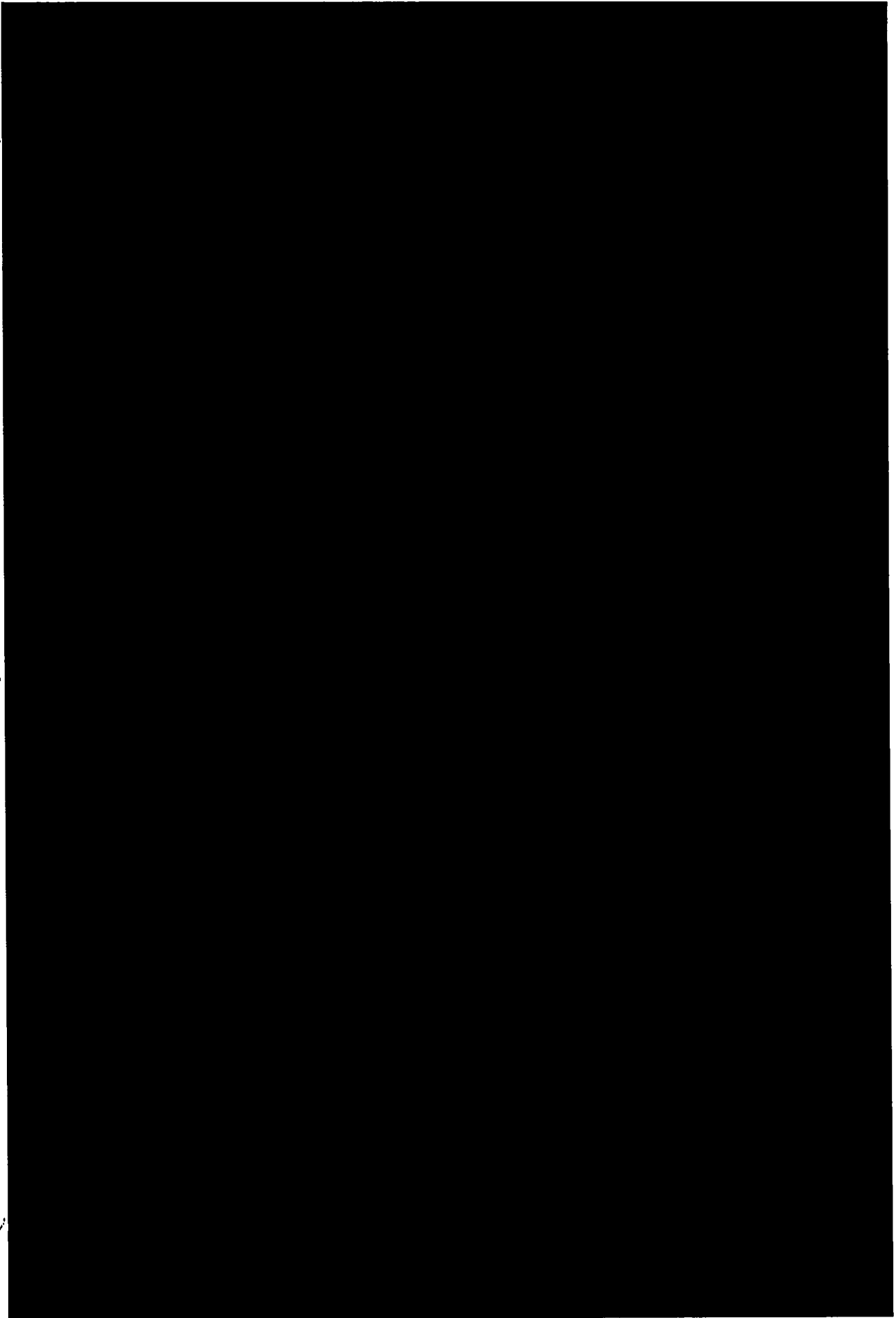


1

2

3

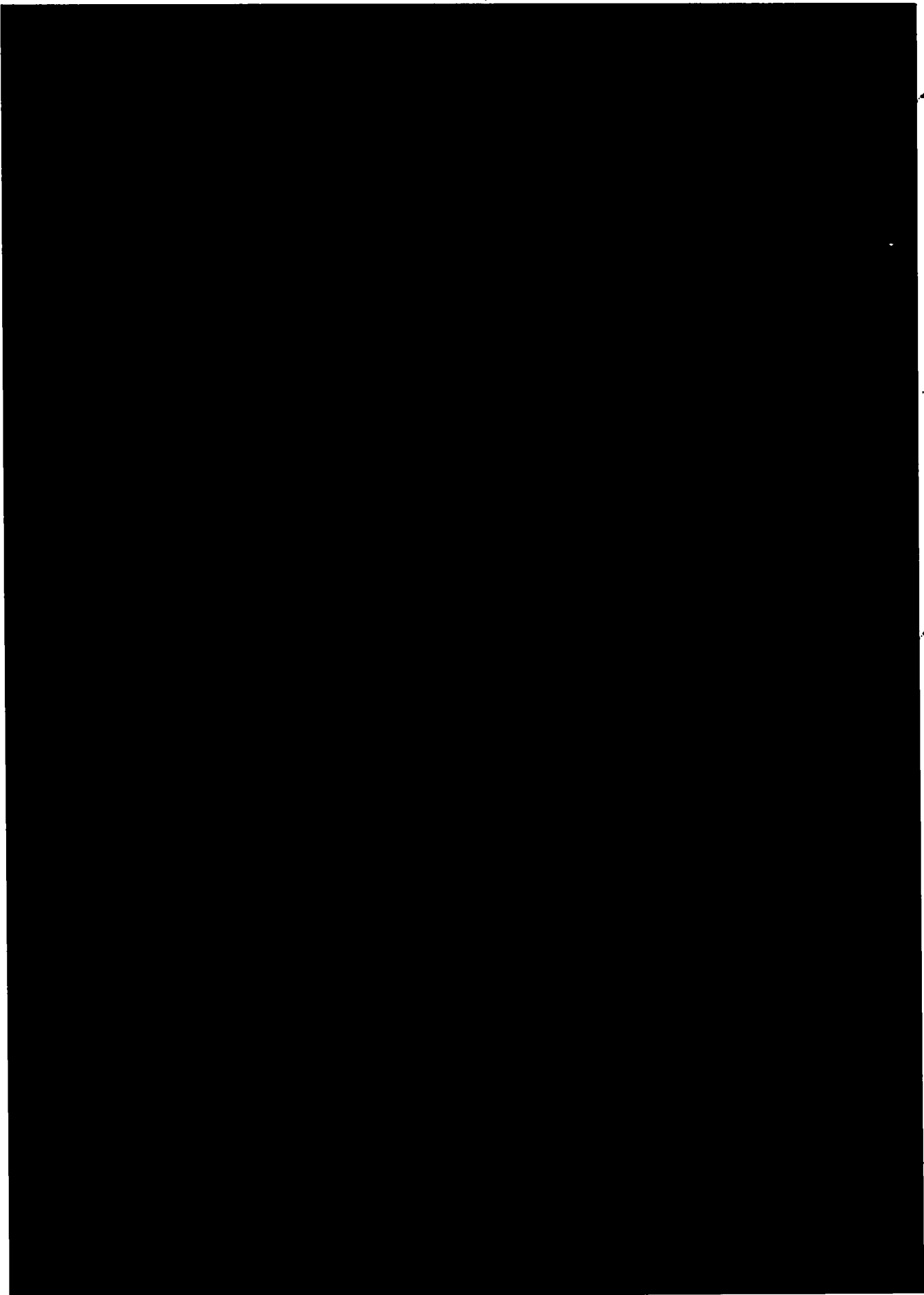


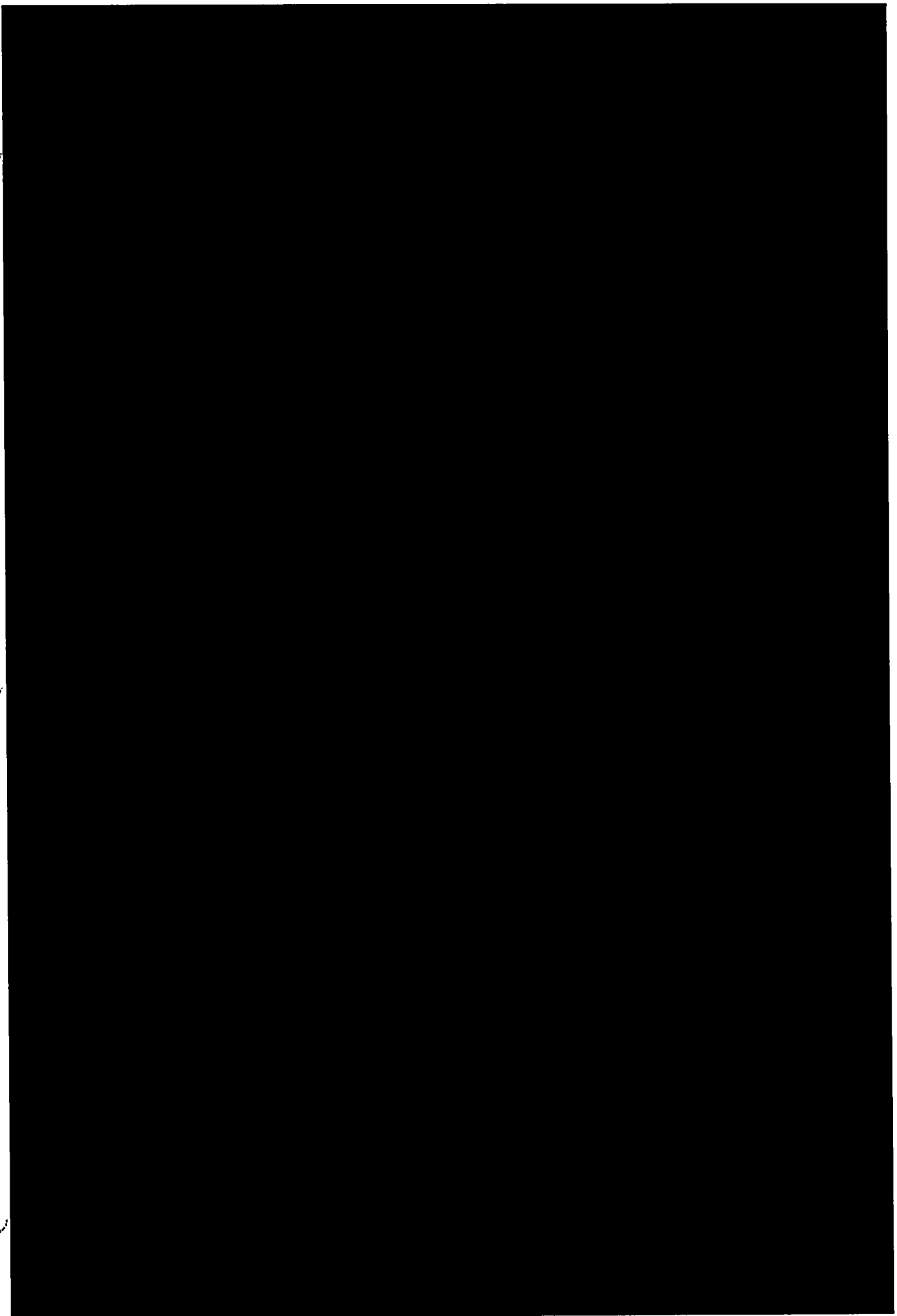


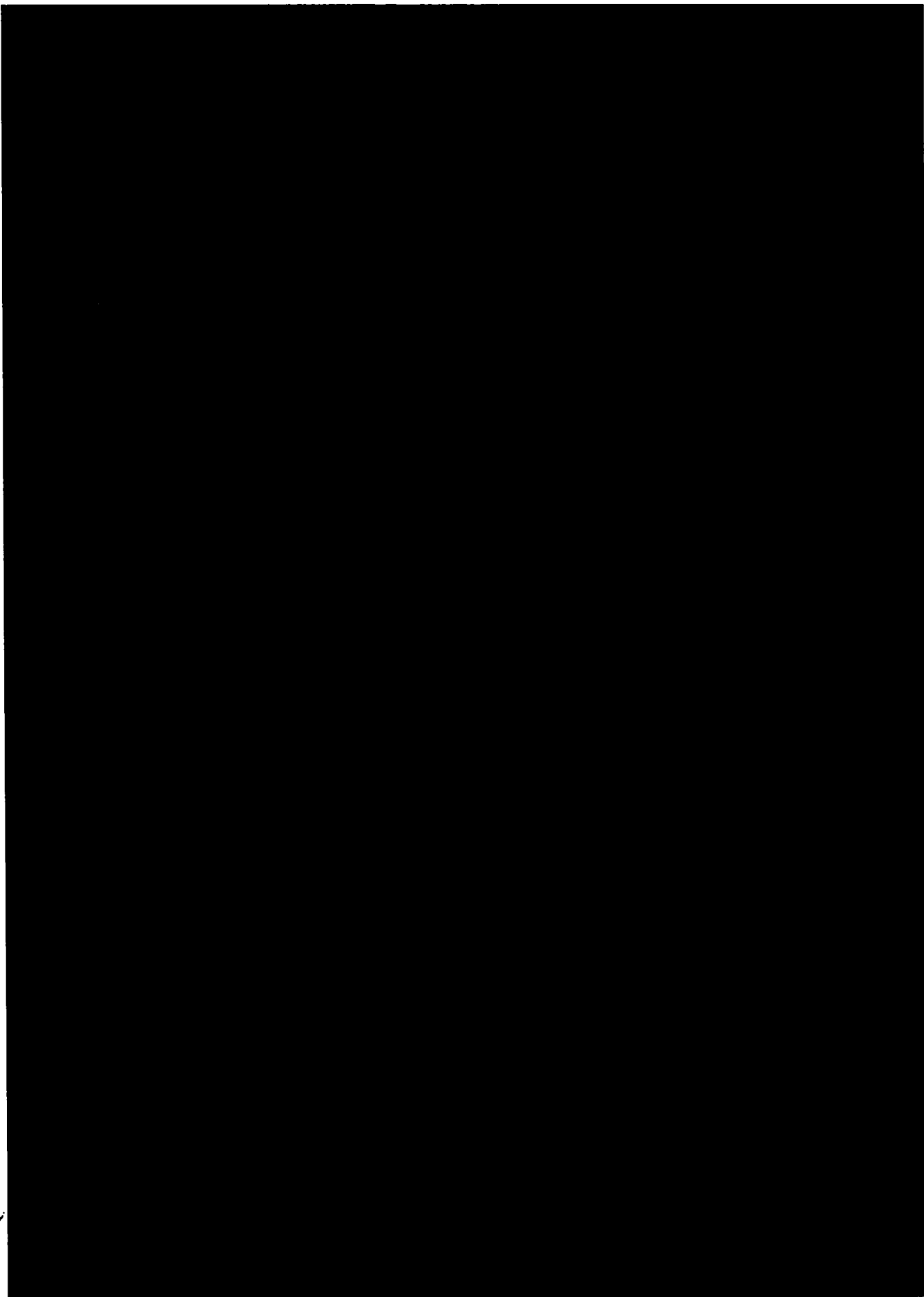
11/11/11

11/11/11

11/11/11



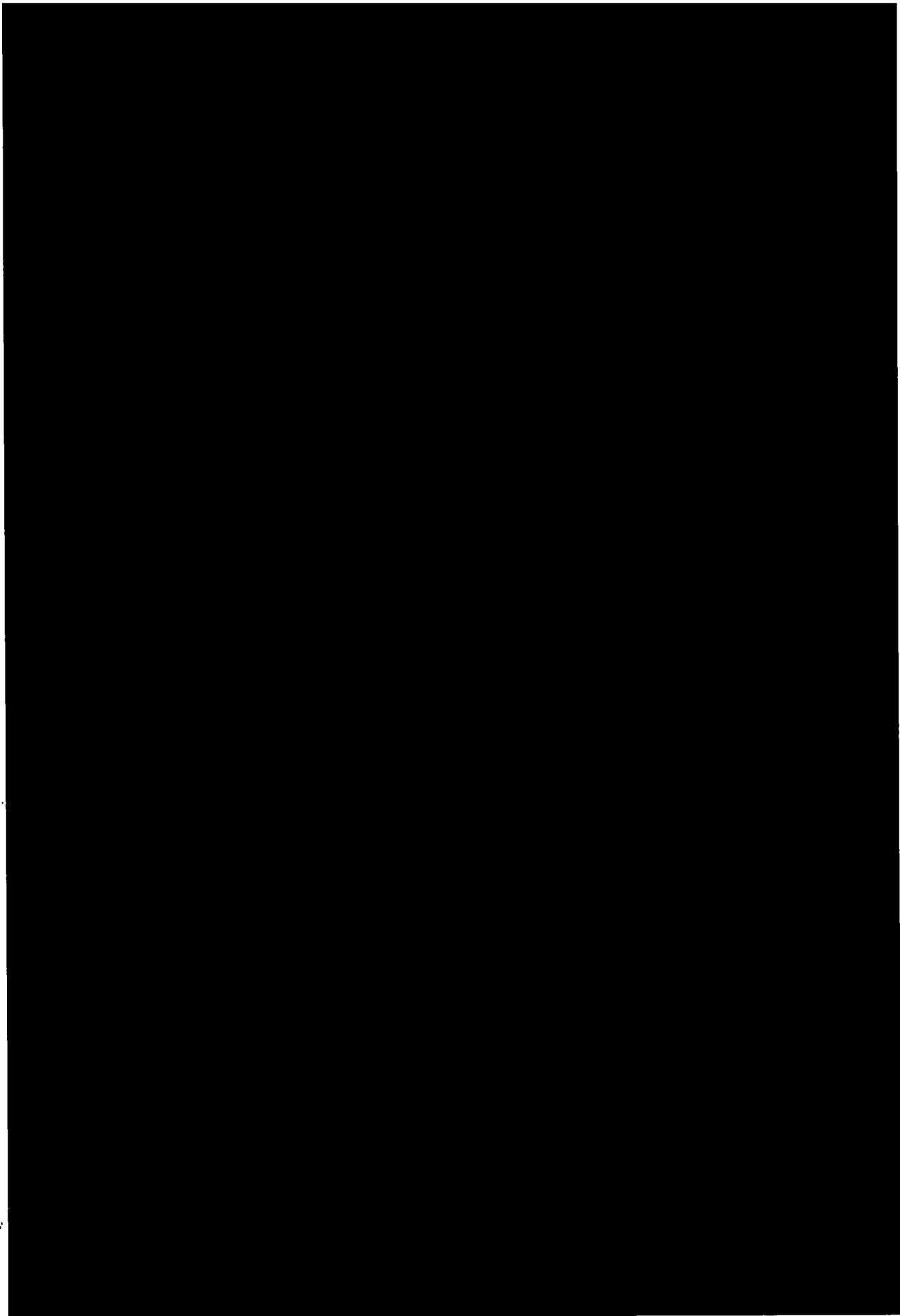


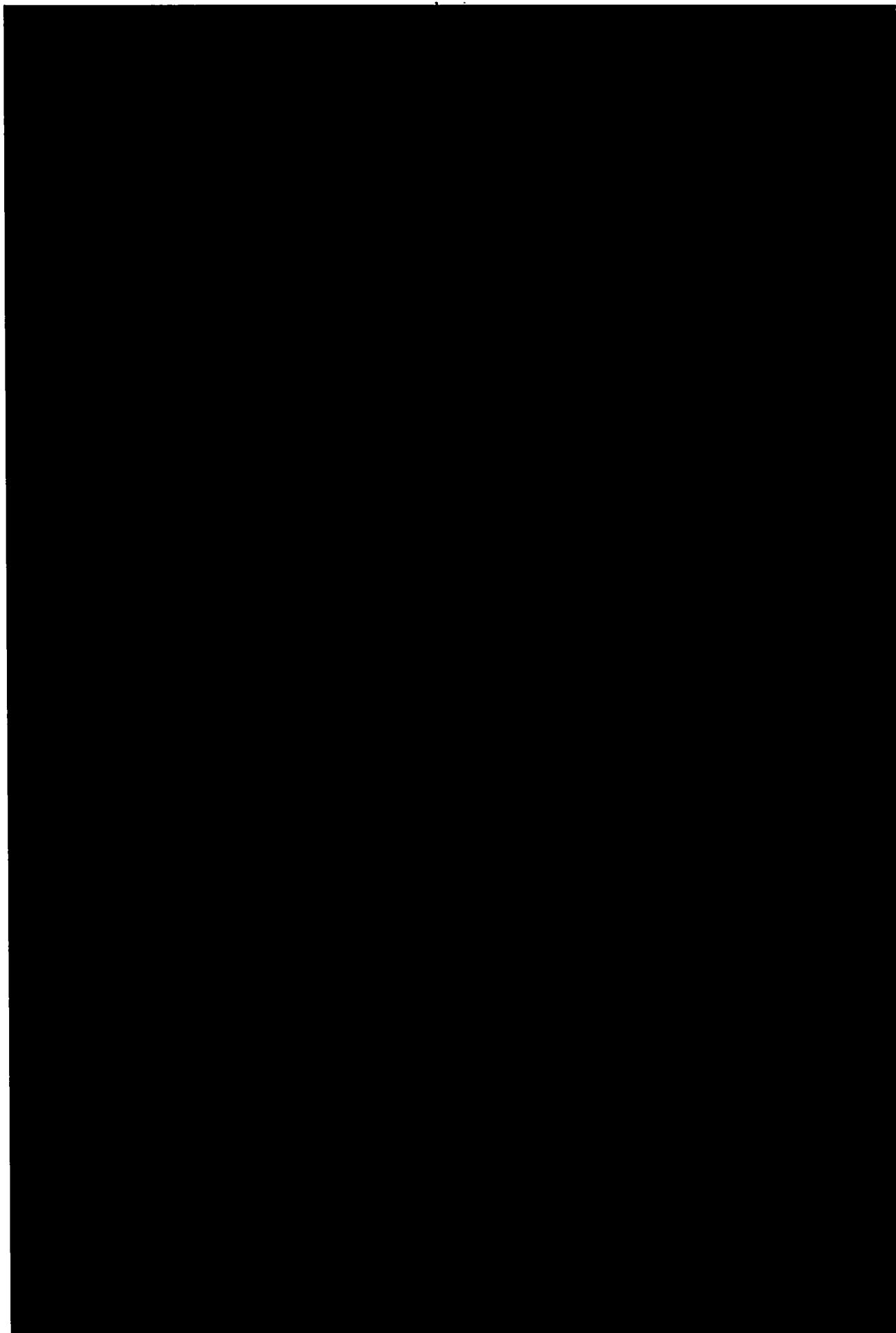


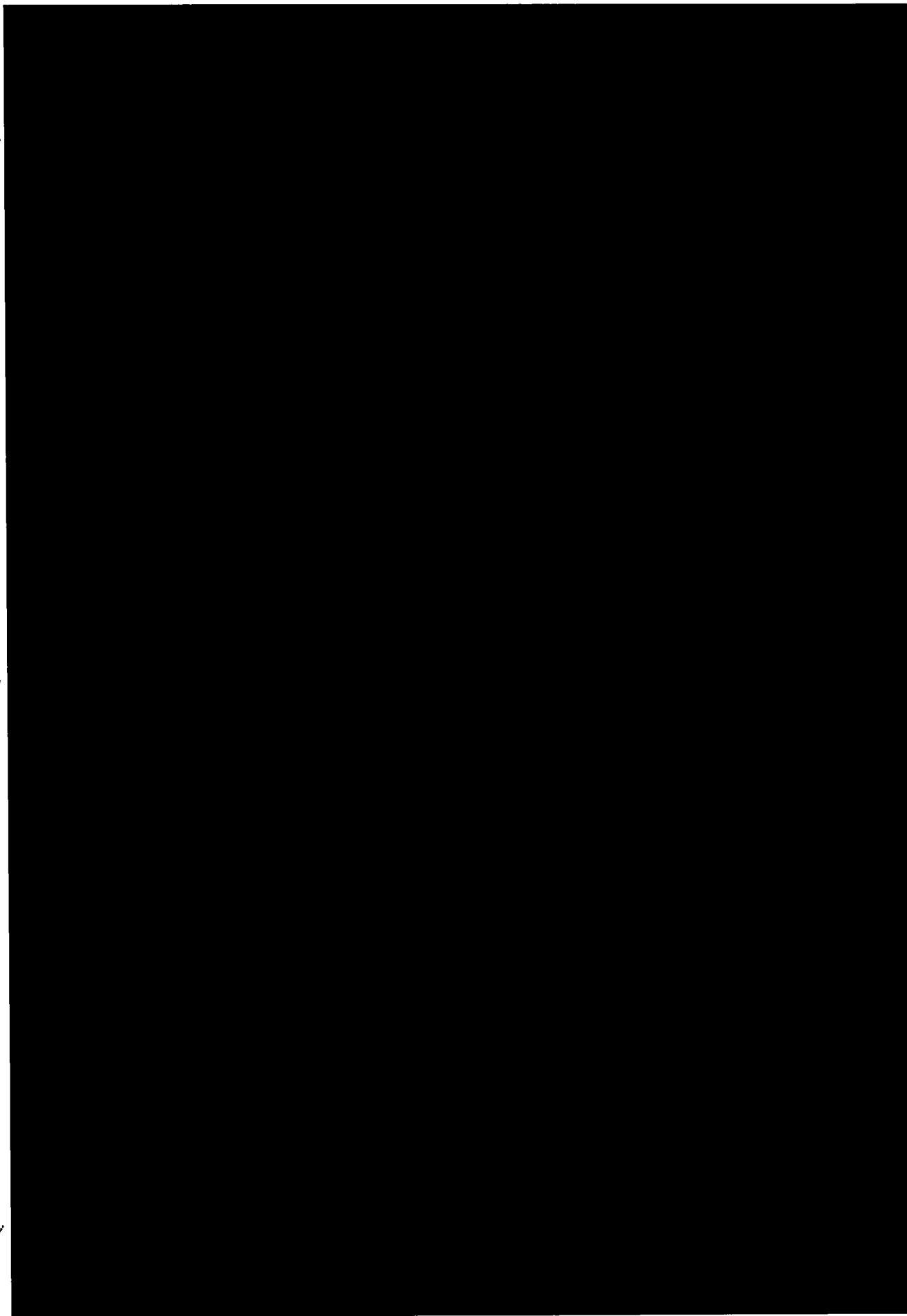
100

100

100



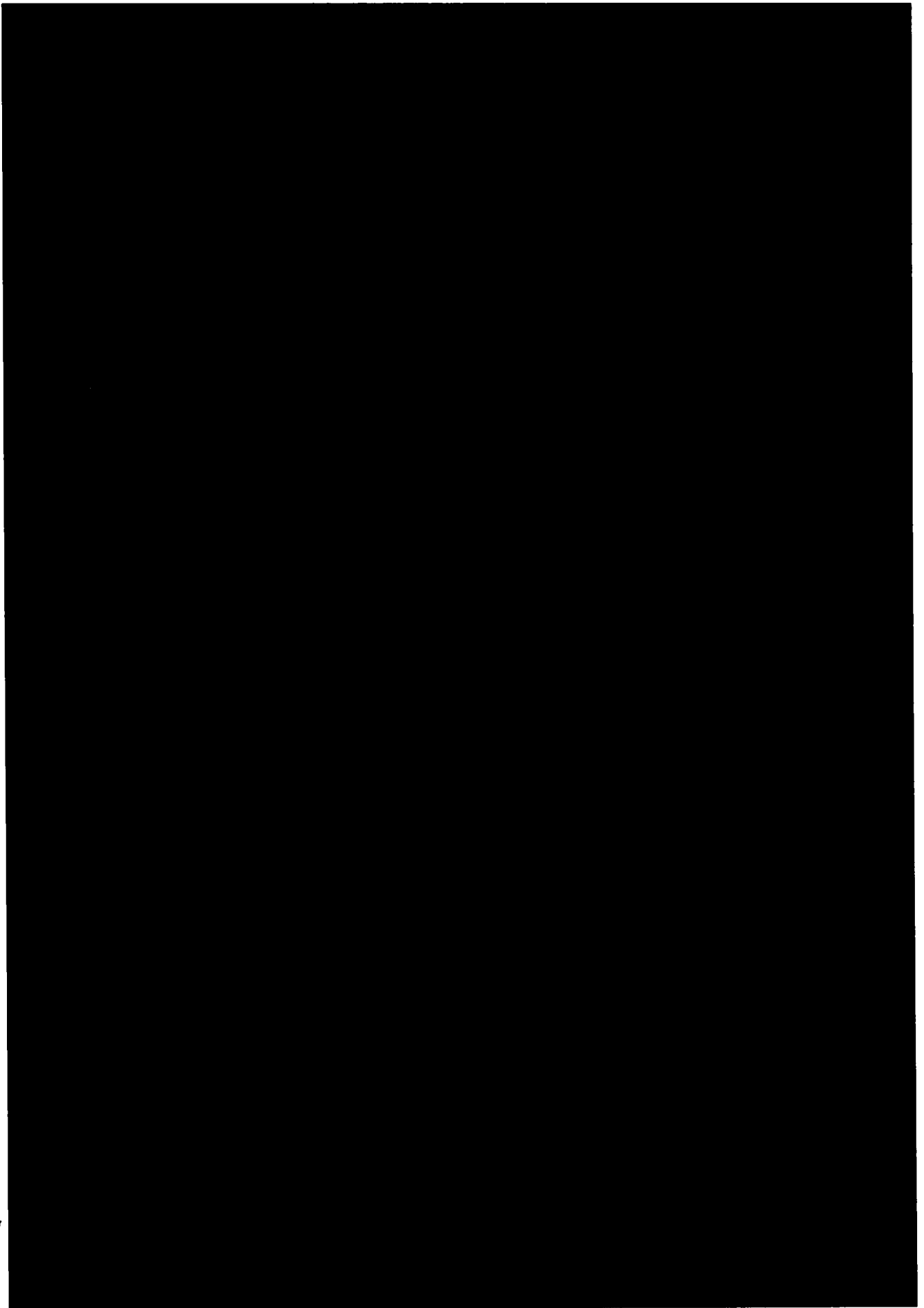




11

12

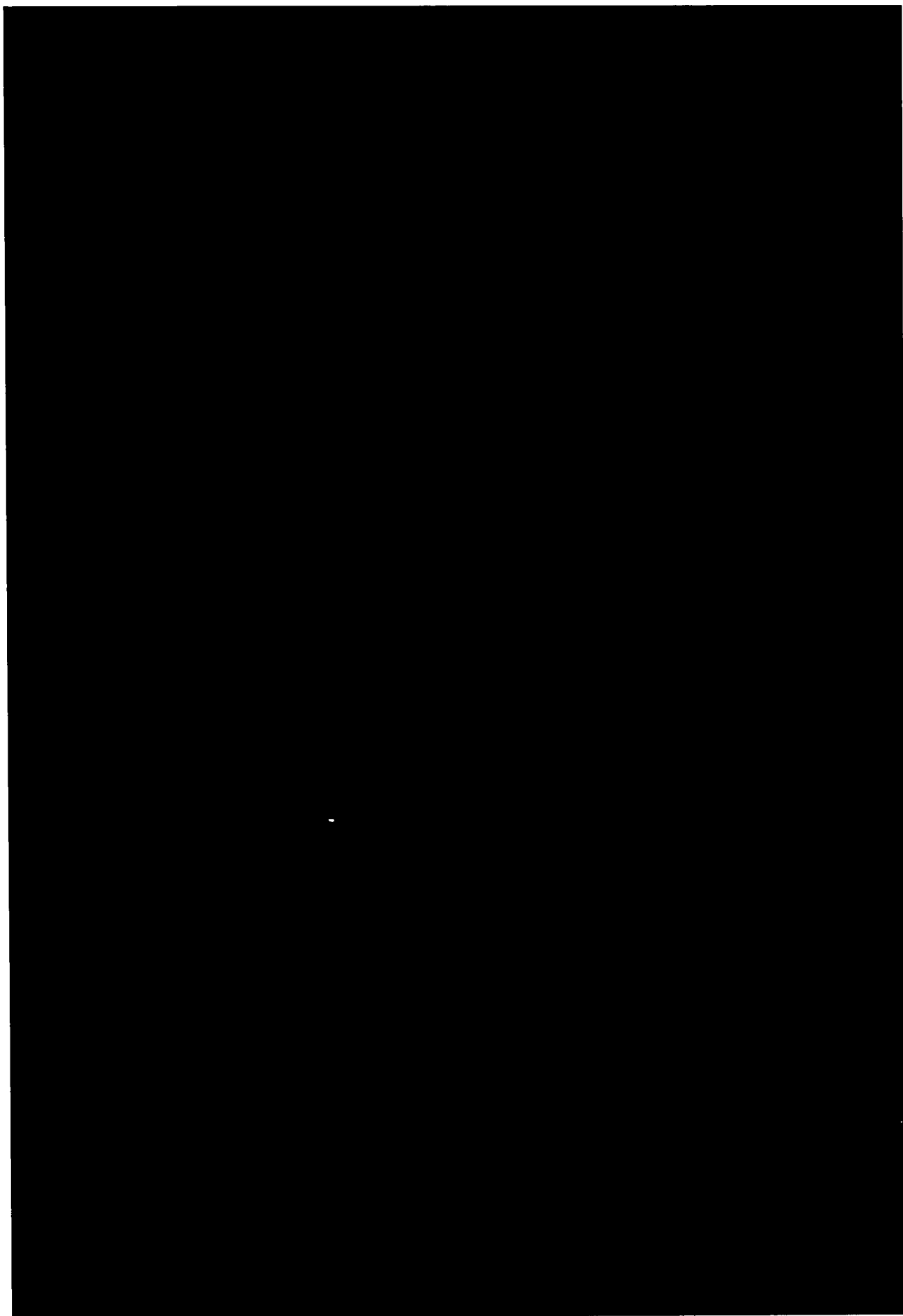
13



1

2

3



11/1/11

11/1/11

11/1/11

TABLE OF CONTENTS

	Page
3.6 PROCESS HAZARDS	3.6-1

(This page Intentionally left blank)

3.6 PROCESS HAZARDS

The separation of uranium isotopes is a physical rather than chemical process. Natural uranium hexafluoride (UF_6) arrives at the National Enrichment Facility (NEF) in the solid phase in a 48-inch diameter cylinder. [REDACTED]

[REDACTED] No process chemical reactions are initiated.

Although the separation of isotopes is a physical rather than chemical process, chemical principles play an important role in the design of the facility. The phase behavior of UF_6 is critical to the design of all aspects of the facility. [REDACTED]

[REDACTED] Other chemical reactions are controlled by utility systems that decontaminate equipment and remove contaminants from effluent streams and lubricating oil.

The process hazards associated with the NEF were identified in the Integrated Safety Analysis (ISA). These process hazards include radioactivity, toxicity of UF_6 and breakdown products, and criticality. The hazards from radioactivity were evaluated in the ISA and found to be low consequence. [REDACTED]

[REDACTED] The potential accident sequences and consequences are discussed in greater detail in Section 3.7, General Types of Accident Sequences.

*NOTE: Design process parameter values are specified with a datum of standard atmospheric pressure at sea level. These values will be finalized to reflect the site-specific National Enrichment Facility elevation during the design phase and the ISA Summary will be revised accordingly.

(This page intentionally left blank)

TABLE OF CONTENTS

	Page
3.7 GENERAL TYPES OF ACCIDENT SEQUENCES	3.7-1
3.7.1 Process Risk Assessment	3.7-4
3.7.2 Fire and External Events Risk Assessment	3.7-4
3.7.3 Selected Consequence Analysis	3.7-4
3.7.3.1 Nuclear Criticality	3.7-5
3.7.3.2 Blending Donor Station Heater Controller Failure and Heater Run Away (No IROFS Credited)	3.7-6
3.7.4 References	3.7-7

LIST OF TABLES

Table 3.7-1	Accident Sequence and Risk Index
Table 3.7-2	Accident Sequence Descriptions
Table 3.7-3	External Events And Fire Accident Sequences And Risk Index
Table 3.7-4	External Events and Fire Accident Descriptions
Table 3.7-5	Uranic Material Assumptions for Criticality Accident Sequences
Table 3.7-6	Cascade System
Table 3.7-7	Product System
Table 3.7-8	Tails System
Table 3.7-9	Product Blending System
Table 3.7-10	Product Liquid Sampling
Table 3.7-11	Contingency Dump System
Table 3.7-12	Centrifuge Test System
Table 3.7-13	Centrifuge Post Mortem
Table 3.7-14	Liquid Effluent Collection and Treatment System
Table 3.7-15	Solid Waste Collection System
Table 3.7-16	Decontamination Workshop
Table 3.7-17	Fomblin Oil Recovery System
Table 3.7-18	Ventilated Room System
Table 3.7-19	Chemical Laboratory
Table 3.7-20	Mass Spectrometry
Table 3.7-21	Cylinder Preparation System

LIST OF FIGURES

- Figure 3.7-1** **TEDE Doses from Postulated Criticality Accident**
Figure 3.7-2 **Airborne Uranium Concentrations Due to a Heater Runaway Release**
Figure 3.7-3 **Airborne Uranium Intake Due to a Heater Runaway Release**
Figure 3.7-4 **TEDE Doses Due to a Heater Runaway Release**
Figure 3.7-5 **Airborne Hydrogen Fluoride Concentrations Due to a Heater Runaway Release.**

(This page intentionally left blank)

3.7 GENERAL TYPES OF ACCIDENT SEQUENCES

Table 3.7-1, Accident Sequence and Risk Index, lists the potential accident sequences that were identified that could have consequences that exceed the performance criteria of 10 CFR 70.61 (CFR, 2003). The accident sequences identified in Table 3.7-1 include those from the classified and [REDACTED]. The likelihood, consequence, and risk ratings are also provided. The measures to reduce the risk to acceptable levels (Items Relied on for Safety (IROFS)) by either reducing the frequency of occurrence of the events or mitigating the consequences of the events are also identified. Additional details/descriptions of the accident sequences presented in Table 3.7-1 are provided in Table 3.7-2, Accident Sequence Descriptions. Again, these descriptions include the [REDACTED]

The results presented in Tables 3.7-1 and 3.7-2 are for the hazards identified for the process systems. The fire (external to the process systems) and external events (e.g., severe weather, seismic, transportation and industrial) hazards were assessed on a facility-wide basis and the results summarized in Tables 3.7-3, External Events and Fire Accident Sequences and Risk Index and 3.7-4, External Events and Fire Accident Descriptions. These are discussed in additional detail later in the text. Table 3.7-5, Uranic Material Assumptions for Criticality Accident Sequences, provides the assumed mass and enrichment values for ²³⁵U for each of the criticality accident sequences presented in Tables 3.7-1 through 3.7-4.

The accident sequence risk assessment demonstrates that credible high-consequence events are highly unlikely and credible intermediate-consequence events are unlikely. IROFS necessary to prevent or mitigate event sequences that exceed 10 CFR 70.61 (CFR, 2003) criteria have been identified.

The definitions for the contents of each column in the accident summary tabulation in Table 3.7-1 and Table 3.7-3 are provided below. The ISA methodology is described in Section 3.1, General ISA Information.

Accident Identifier

This column identifies the accident sequence being analyzed. The ISA will have all accident sequences for each uniquely identified facility process. The accident sequence identifier has the format AAB-C where AA is the system/area from the table below, B is the Hazard and Operability (HAZOP) Analysis node number and C is the accident sequence number.

Accident Sequence System Identifier	
Identifier (AA)	System/Area
CL	Chemical Laboratory
CH	Technical Services Building (TSB) Contaminated Workshop and Laboratories HVAC
CP	Cylinder Preparation Room
DC	Contingency Dump
DS	Decontamination
EC	Cascade
FR	Fomblin Oil Recovery
LR	Laundry
LT	Liquid Effluent Treatment
LW	Liquid Effluent Collection
MS	Mass Spectrometry Laboratory
PB	Product Blending and Liquid Sampling
PT	Product Take-Off
RD	Cylinder Receipt and Dispatch
SV	Separations Building Gaseous Effluent Vent
SW	Solid Waste Collection
TP	Centrifuge Test/Centrifuge Post Mortem
TT	Tails Take-Off
TV	TSB Gaseous Effluent Vent
UF	UF ₆ Feed
VR	Ventilated Room

Initiating Event Index (Column a)

This column lists initiating events or IROFS failures that are typically identified in the Process Hazard Analysis (PHA) phase of the ISA and that may lead to consequences exceeding those identified in 10 CFR 70.61 (CFR, 2003). Initiating events are of several distinct types: (1) external events, such as hurricanes and earthquakes; (2) facility events external to the node being analyzed (e.g., fires, explosions, failures of other equipment, flooding from facility water sources); (3) deviations from normal operations of the process in the node (i.e., credible abnormal events); and (4) failures of IROFS of the node. The tabulated initiating events consist of those that involve an actual or assumed failure of IROFS or that cause a demand requiring IROFS to function to prevent consequences exceeding 10 CFR 70.61 (CFR, 2003) levels. The frequency index number for initiating events is given in the table in column (a).” Table 3.1-9, Failure Frequency Index Numbers, provides criteria for assigning a value to the frequency index.

Preventive Safety Parameter 1 or IROFS 1 Failure Index (Column b)

This column addresses the failure or success of the safety parameter designated to prevent consequences exceeding 10 CFR 70.61 (CFR, 2003) criteria. Specific IROFS that are needed to maintain the safety parameter are included in the table. The failure duration of the first IROFS is assigned using Table 3.1-11, Failure Duration Index Numbers. Accident sequences

where two IROFS must simultaneously be in a failed state require assignment of the three index numbers (1) the failure frequency of the first IROFS, (2) the duration of this failure and (3) the failure frequency of the second IROFS. Except where identified on Table 3.7-3, External Events And Fire Accident Sequences And Risk Index, failure duration index numbers are zero (zero corresponds to an average failure duration and test frequency of one year) and are therefore not explicitly shown on Table 3.7-1 and Table 3.7-3. Reverse sequences are not identified in Table 3.7-1 since the failure frequencies and the duration of outages of the first and second IROFS of accident sequences with multiple IROFS are the same. Accident sequences may be more easily described as an occurrence of an initiating event followed by a failure of the IROFS on demand. In these cases, the failure probability index number is assigned using Table 3.1-10, Failure Probability Index Numbers and the failure duration is assigned using Table 3.1-11.

Preventive Safety Parameter 2 or IROFS 2 Failure Index (Column c)

This column is provided in case a second preventive Safety Parameter or IROFS is designated. The failure probability on demand is assigned in the same manner as for preventive IROFS 1.

Mitigation IROFS Failure Index (Column d)

This column is provided in case IROFS are available to mitigate the consequences of the accident sequence. That is, they reduce, but do not eliminate, the consequences of an accident sequence. An IROFS that eliminates all adverse consequences is considered preventive.

Likelihood Index T Uncontrolled (U)/Controlled (C) (Column e) and Likelihood Category (Column f)

Column (f) lists the likelihood category number for the risk matrix, which is based on the total likelihood index for an accident sequence. Column (e) is the total likelihood index, T, is the sum of the indices for those events that comprise an accident sequence, which normally consists of the initiating event and failure of one or more IROFS, including any failure duration indices. Based on the sum of these indices, the likelihood category number for the risk matrix is assigned using Table 3.1-8, Determination of Likelihood Category.

Consequence Category (Type of Accident) (Column g)

This column is provided to assign the consequence category numbers based on estimating the consequences of all types (i.e., radiological, criticality, chemical, and environmental) of accident sequences that may occur. Accident sequences having IROFS to mitigate consequences are divided into two cases, one where the mitigation succeeds, and one where it fails, each with different consequences. The type of accident is also listed in parenthesis where T indicates chemical and CR indicates criticality.

Risk Index ($h = f \times g$) Uncontrolled(U)/Controlled (C) (Column h)

This column is provided to list the risk index, which is calculated as the product of the likelihood category and consequence category numbers. This is shown in the column heading by the formula " $h = f \times g$." Sequences with values of "h" less than or equal to 4 are acceptable. (See Table 3.1-6, Risk Matrix with Risk Index Values).

Comments and Recommendations

This column records ISA team conclusions.

3.7.1 Process Risk Assessment

The results of the risk assessment performed for each accident sequence are summarized in Table 3.7-1, Accident Sequence and Risk Index. The following information is provided for each accident sequence, including the inclusion of any events which were screened as not credible:

- Consequences for each general type of uncontrolled accident sequence
- Comparison of the accident consequences to the performance requirements of 10 CFR 70.61 (CFR, 2003) and designation of each as a 'high consequence event' (10 CFR 70.61(b)) (i.e., Consequence Category 3), an 'intermediate consequence event' (10 CFR 70.61(c)) (i.e., Consequence Category 2) or neither (i.e. an event of no regulatory concern (low consequence event)) (i.e., Consequence Category 1)
- Likelihood of occurrence of each accident sequence, expressed in terms of the likelihood category (3=not unlikely, 2=unlikely, 1=highly unlikely)
- Classification of the risk of each uncontrolled accident sequence
- Classification of the likelihood of occurrence of each accident sequence (following application of IROFS)
- Classification of the risk of each controlled accident sequence

The detailed descriptions for the accident sequences are provided in Table 3.7-2, Accident Sequence Descriptions.

3.7.2 Fire and External Events Risk Assessment

As discussed previously, facility fires (FF) and external events (EE) were assessed on a facility-wide basis. The results of this assessment are presented in Tables 3.7-3, External Events and Fire Accident Sequences and Risk Index, and 3.7-4, External Events and Fire Accident Descriptions. The ISA methodology utilized for external events and facility fires is described in Section 3.1, General Integrated Safety Analysis (ISA) Information. The information contained in the columns in Table 3.7-3, External Events and Fire Accident Sequences and Risk Index is defined in Section 3.7.1, Process Risk Assessment.

3.7.3 Selected Consequence Analysis

To support the classification of ISA events and sequences by the National Enrichment Facility Emergency Plan, consequence analyses have been performed for the postulated events identified in the ISA Summary for which [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]:

[REDACTED]

[REDACTED] Submersion, inhalation, [REDACTED]
[REDACTED]

For the atmospheric releases, 100 % of the noble gases produced by the criticality events and 25 % of the halogens (iodines) produced by the criticality events, and 0.05 % of the particulates and uranium isotopes in the evaporated solution (i.e., 0.0125 % of the totals) were assumed to be released from the vessel where the criticality takes place and released to the atmosphere without mixing or decay within the building. The atmospheric releases were assumed to be at uniform rates representative of the actual airborne releases from the criticality events during the 0 to 2 hr interval and the 2 to 8 hr interval. Credit for deposition within the building and ductwork was conservatively ignored.

3.7.4 References

CFR, 2003. Title 10, Code of Federal Regulations, Section 70.61, Performance Requirements, 2003.

- NRC, 1982. Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, Regulatory Guide 1.145, Revision 1, U.S. Nuclear Regulatory Commission, 1982.

NRC, 1998. Nuclear Fuel Cycle Accident Analysis Handbook, NUREG/CR-6410, U.S. Nuclear Regulatory Commission, March 1998.

(This page intentionally left blank)

TABLES

(This page Intentionally left blank)

Table 3.7-1 Accident Sequence and Risk Index

Page 1 of 9

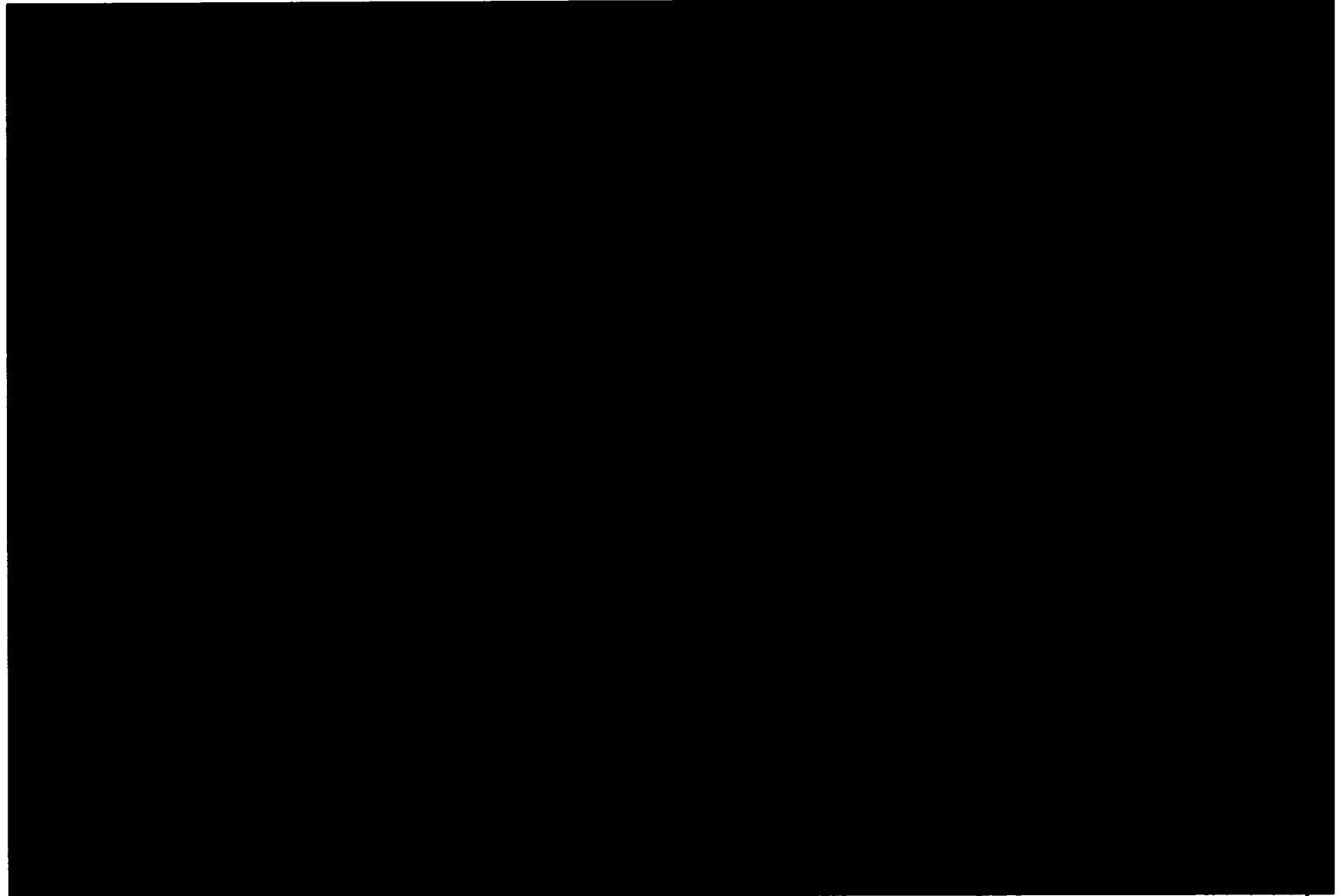


Table 3.7-1 Accident Sequence and Risk Index

Page 2 of 9

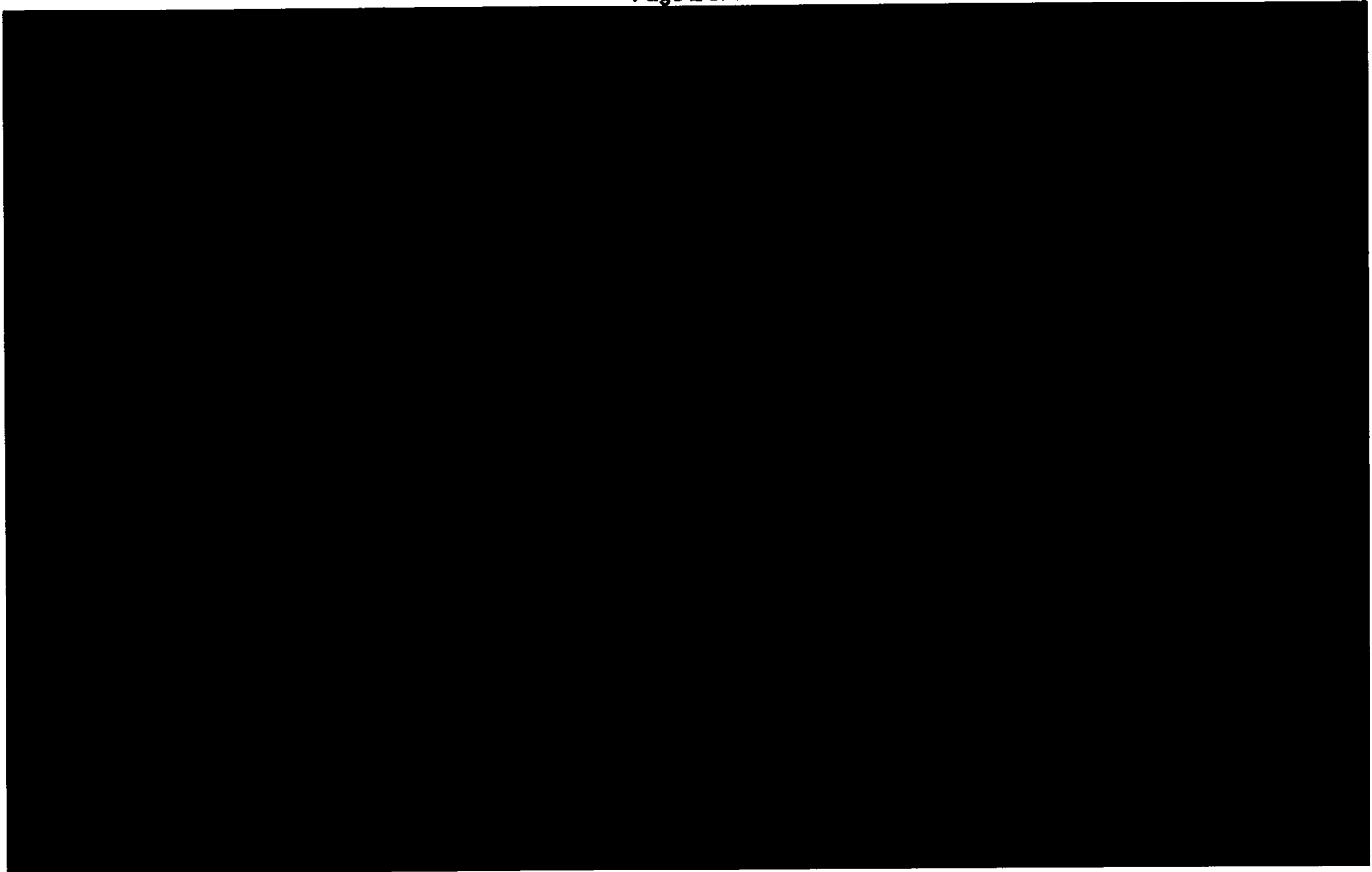


Table 3.7-1 Accident Sequence and Risk Index

Page 3 of 9

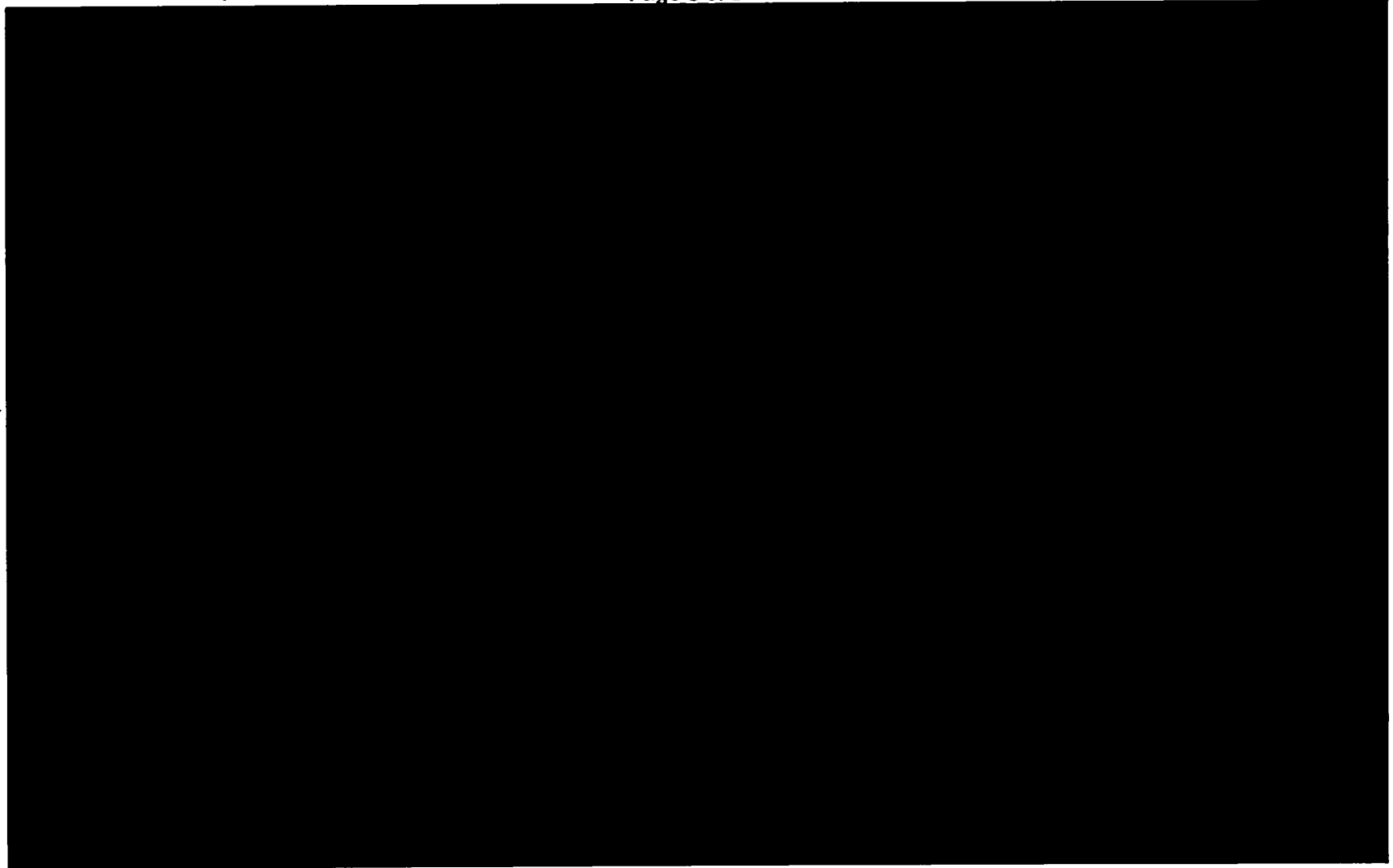


Table 3.7-1 Accident Sequence and Risk Index
Page 4 of 9

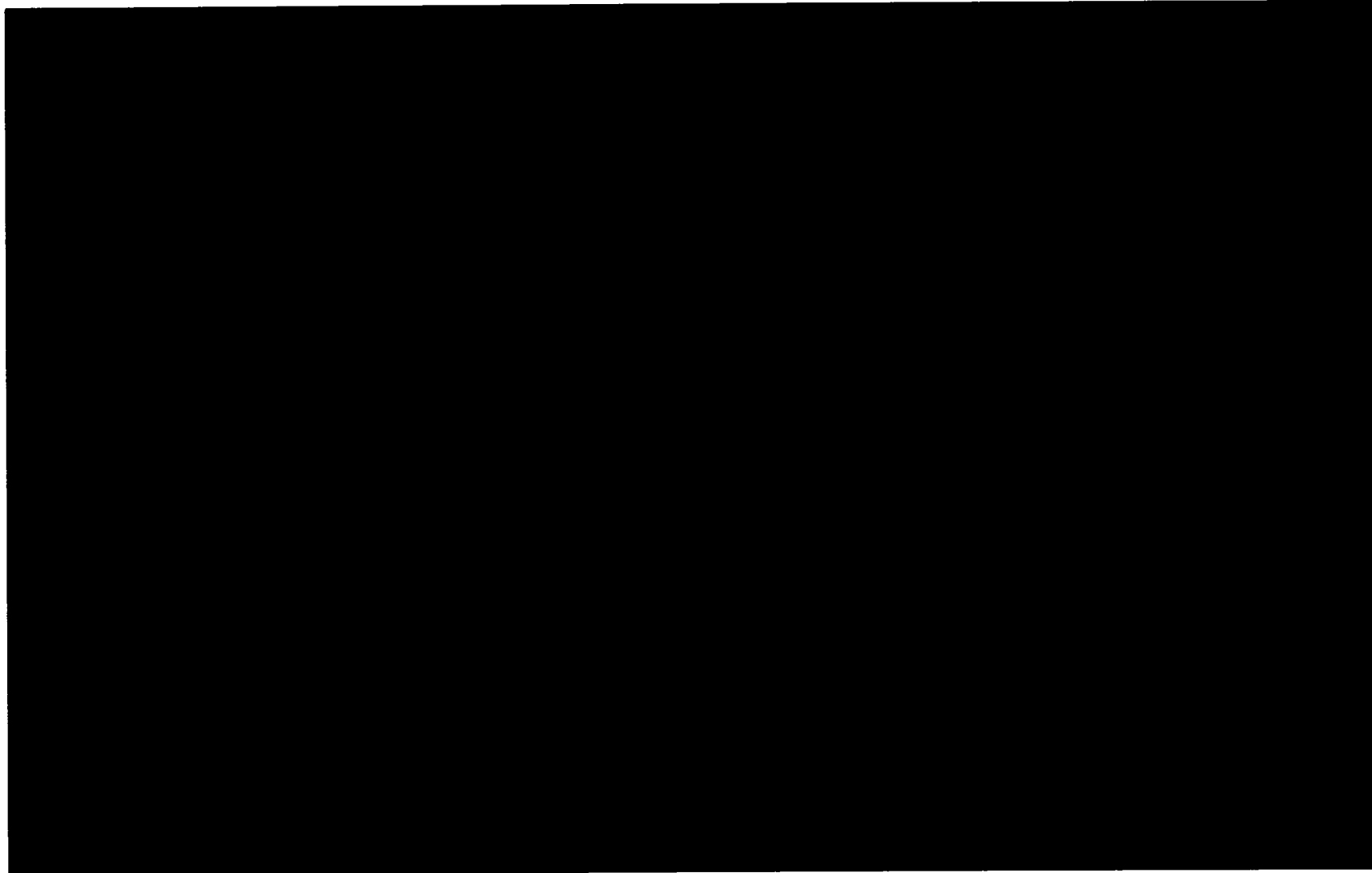


Table 3.7-1 Accident Sequence and Risk Index

Page 5 of 9

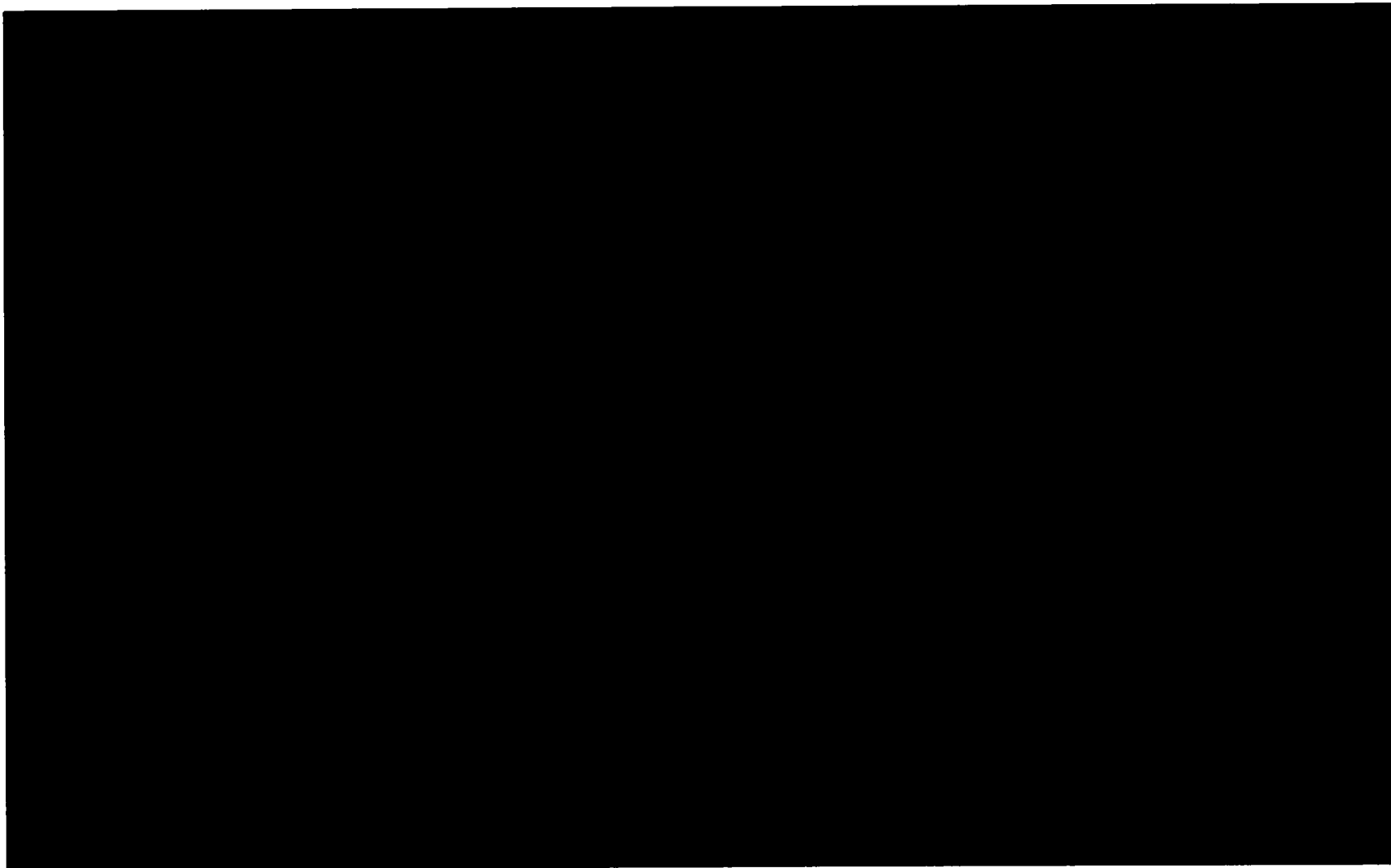


Table 3.7-1 Accident Sequence and Risk Index

Page 6 of 9

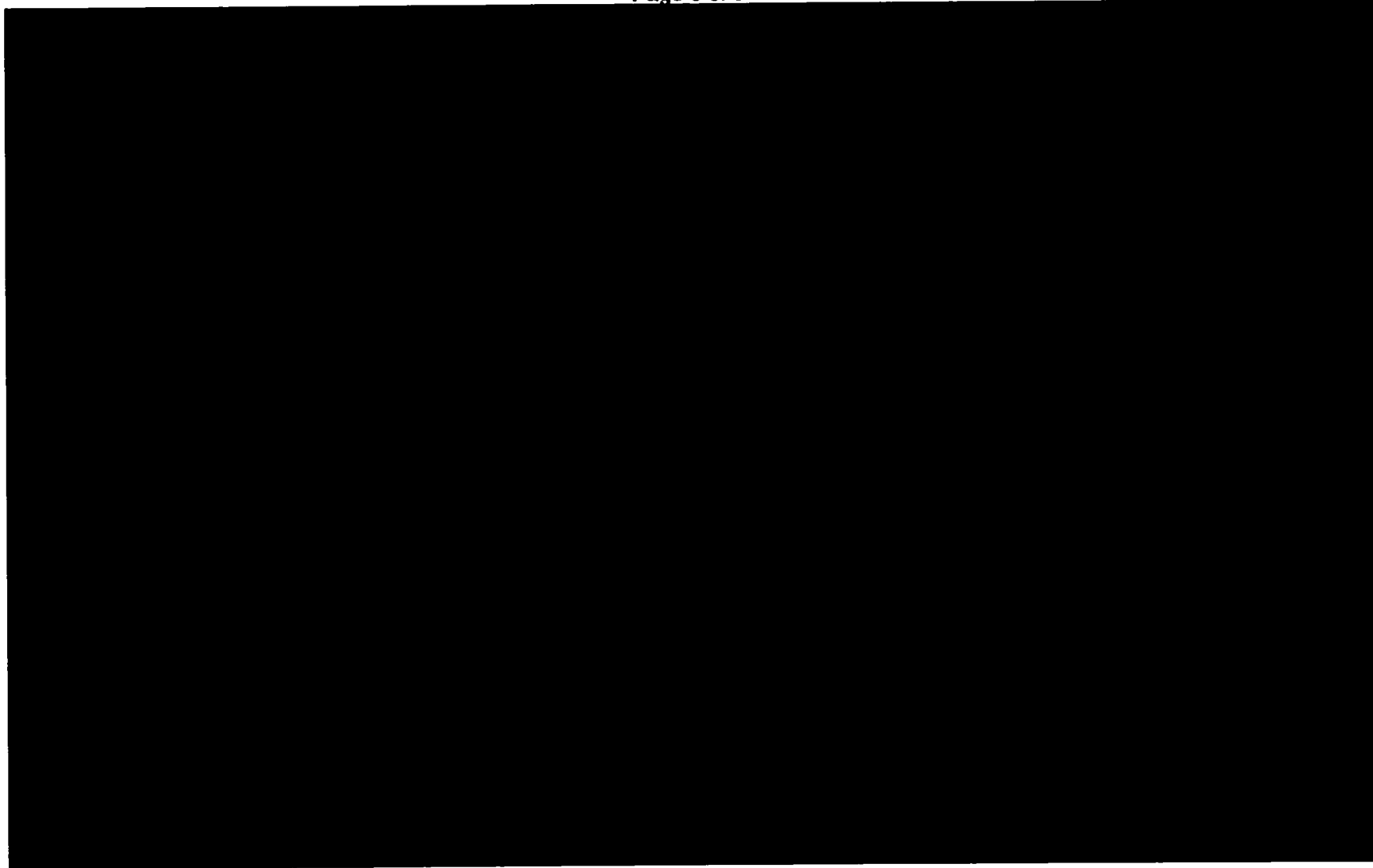


Table 3.7-1 Accident Sequence and Risk Index

Page 7 of 9

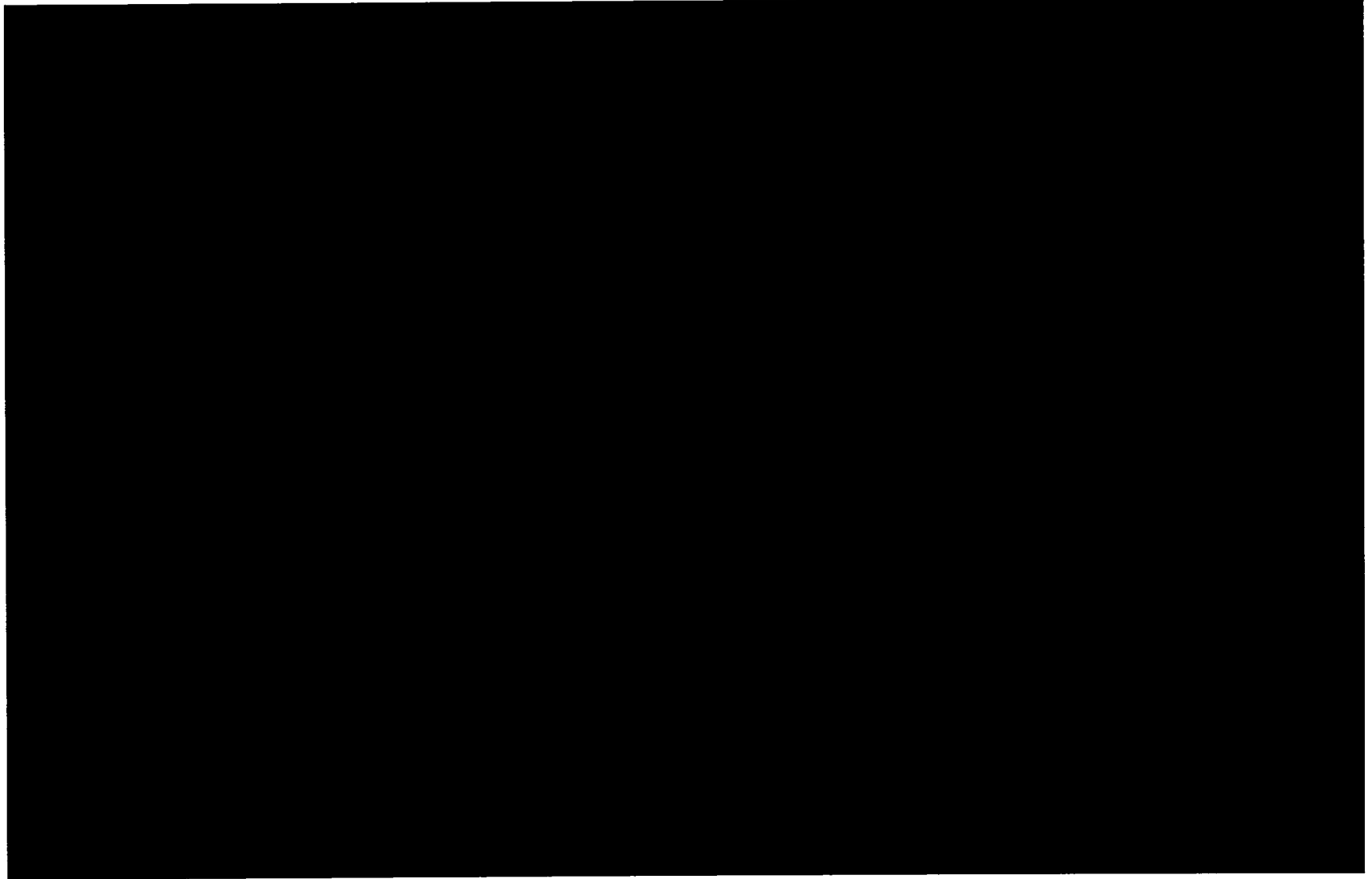


Table 3.7-1 Accident Sequence and Risk Index

Page 8 of 9

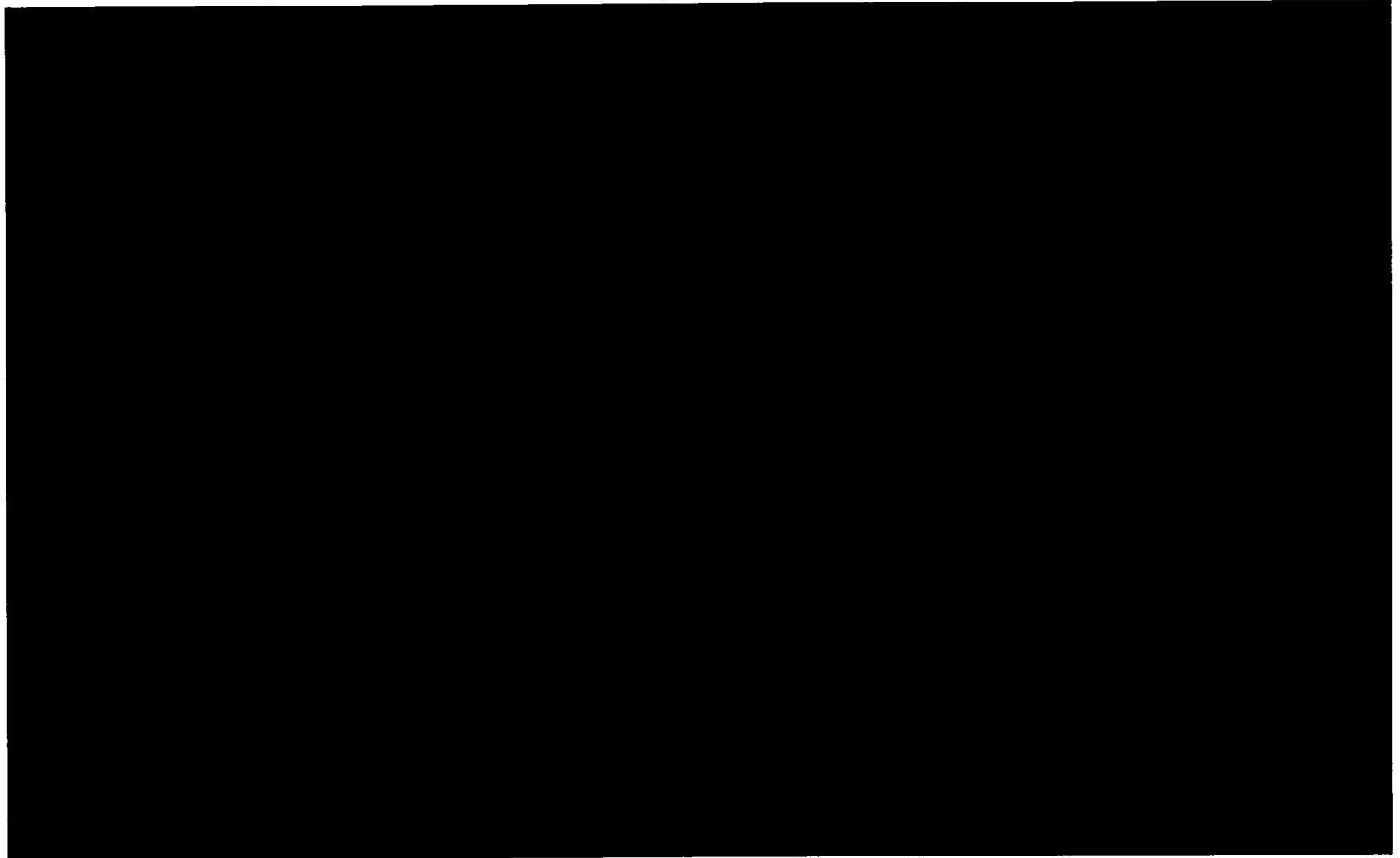
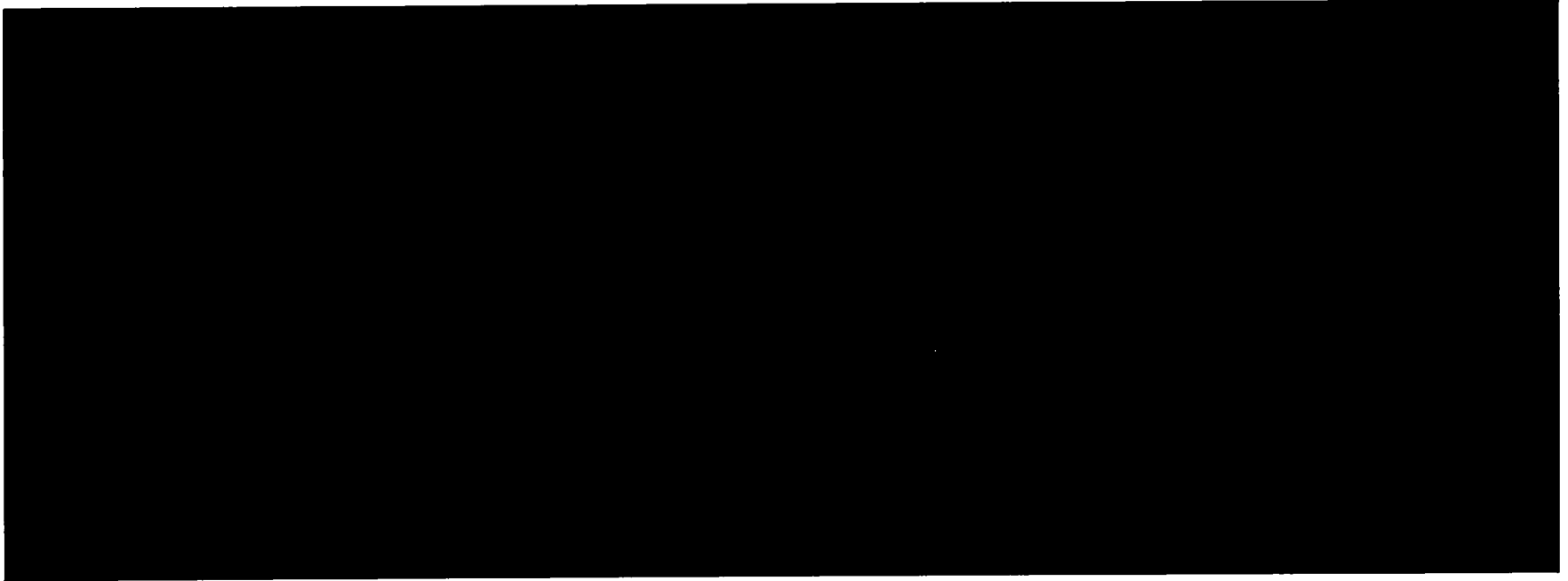


Table 3.7-1 Accident Sequence and Risk Index

Page 9 of 9



(This page intentionally left blank)

Table 3.7-2 Accident Sequence Descriptions

Page 1 of 64

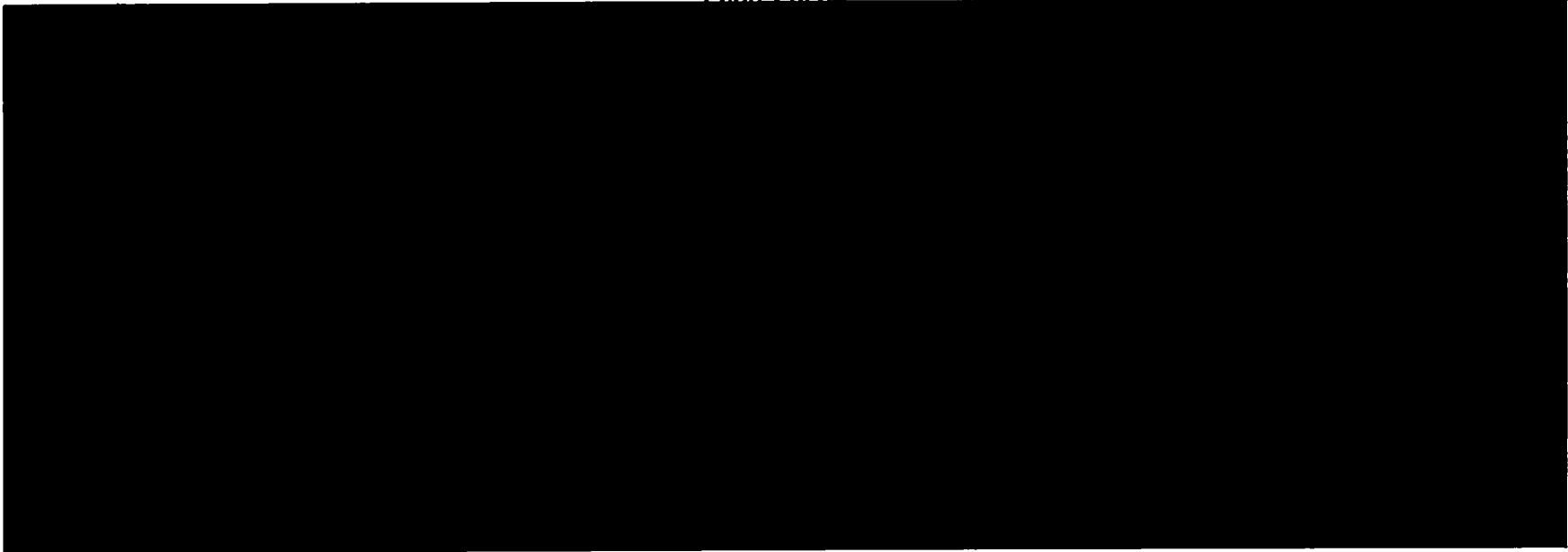


Table 3.7-2 Accident Sequence Descriptions

Page 2 of 64

[illegible]

Table 3.7-2 Accident Sequence Descriptions

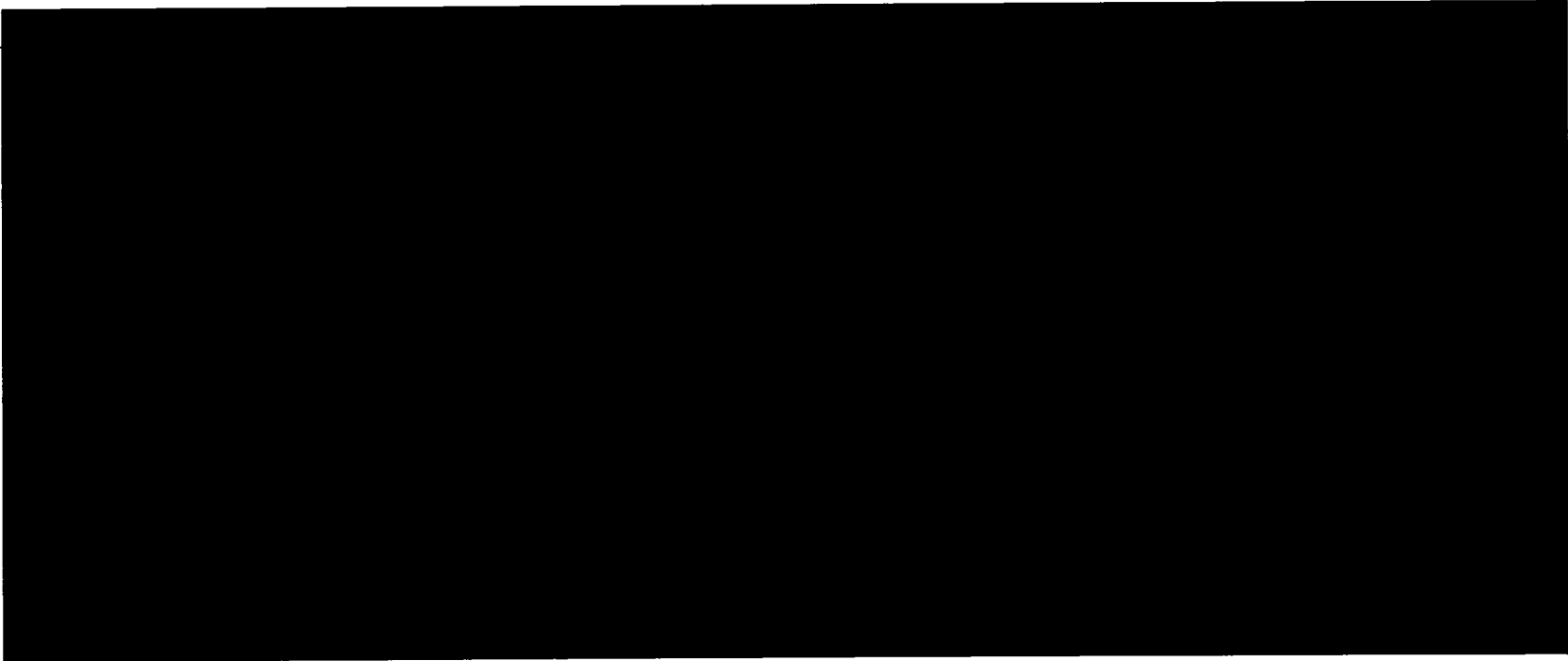


Table 3.7-2 Accident Sequence Descriptions
Page 4 of 64

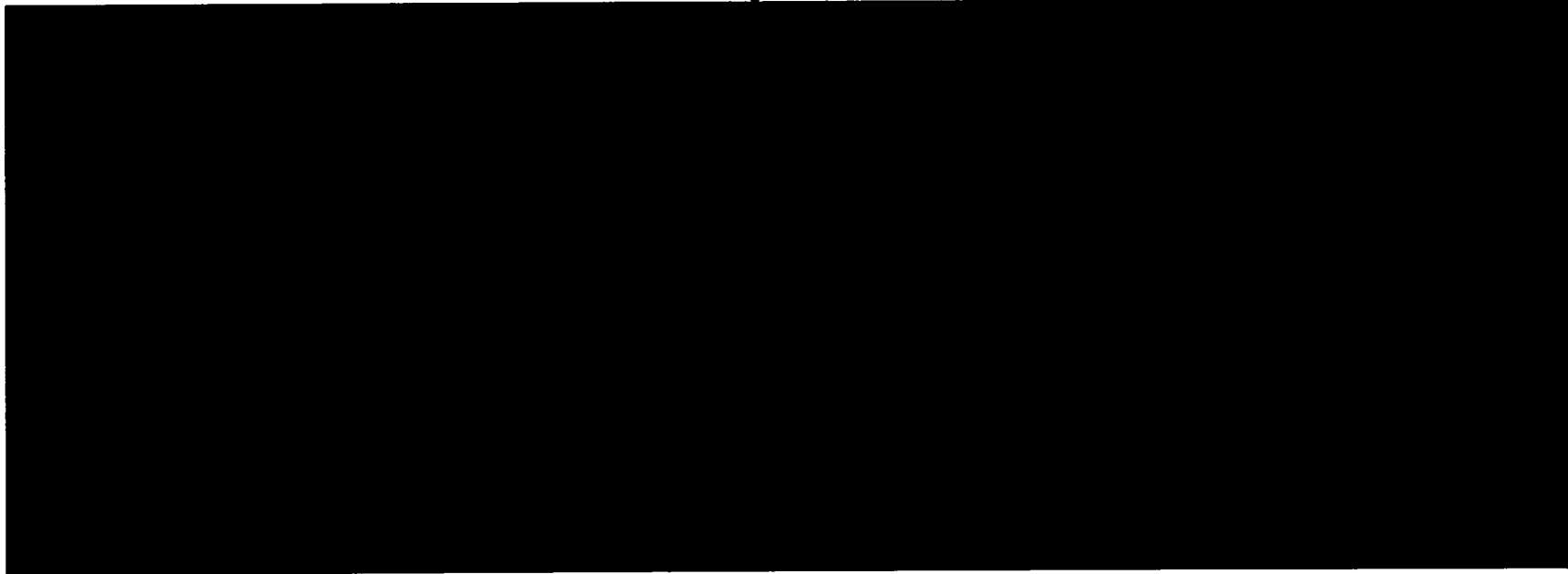


Table 3.7-2 Accident Sequence Descriptions

Page 5 of 64

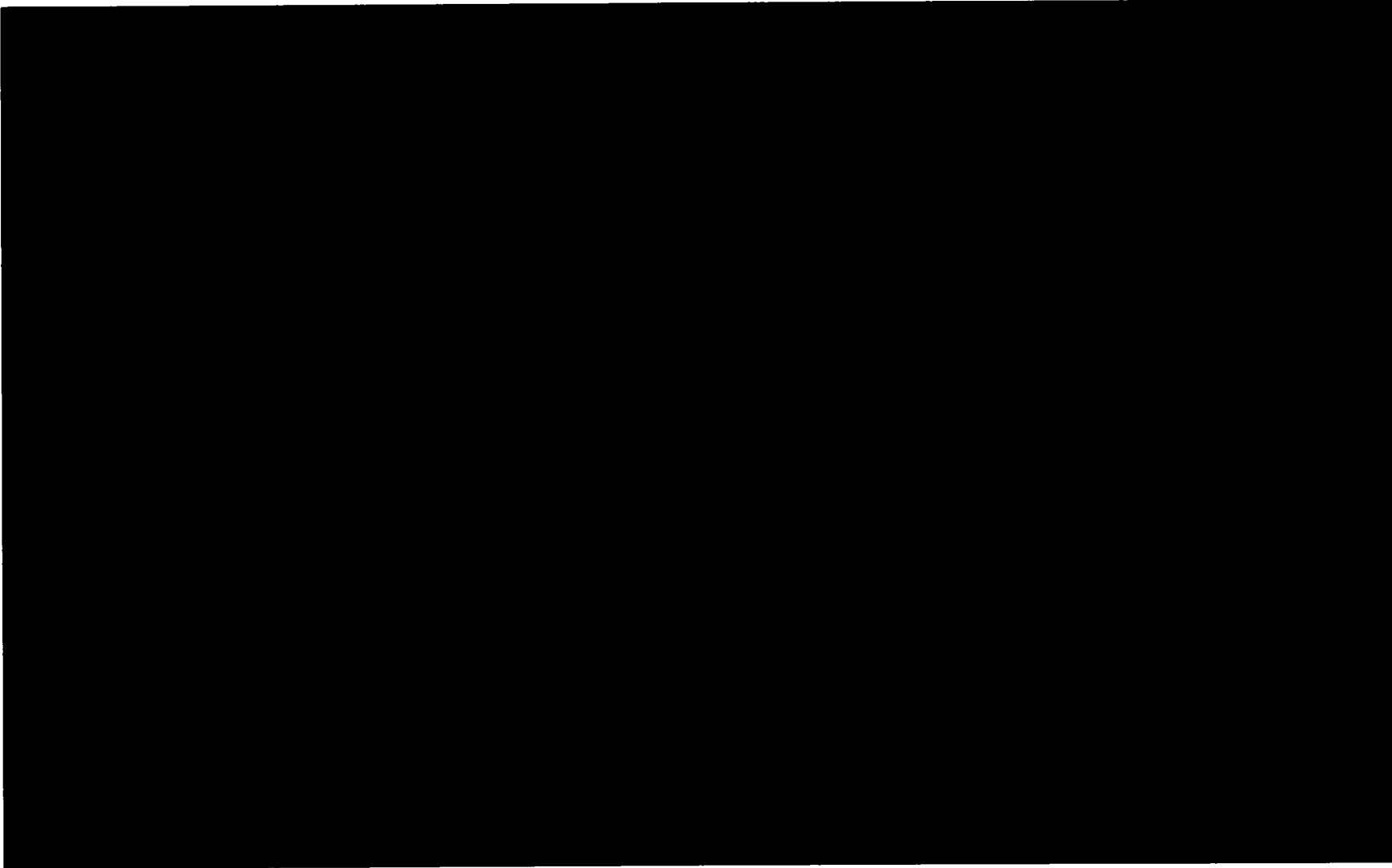


Table 3.7-2 Accident Sequence Descriptions

Page 6 of 64

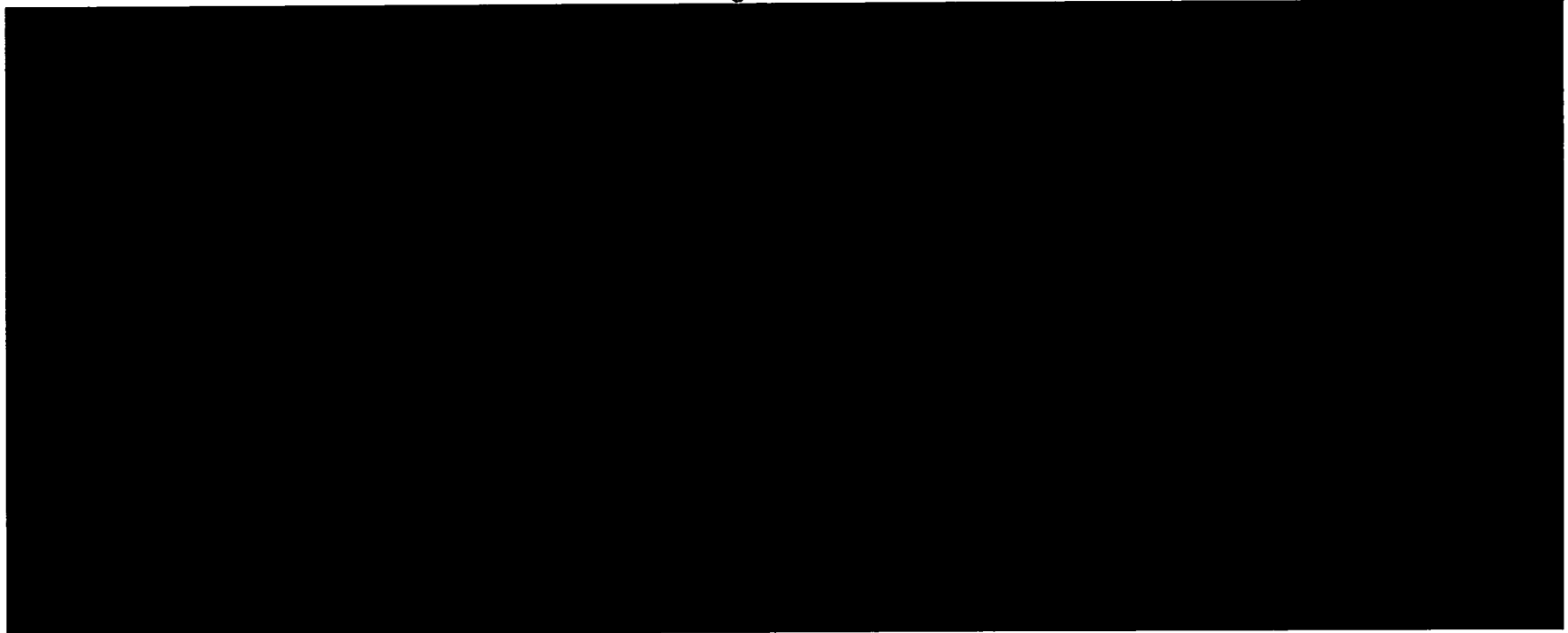


Table 3.7-2 Accident Sequence Descriptions

Page 7 of 64

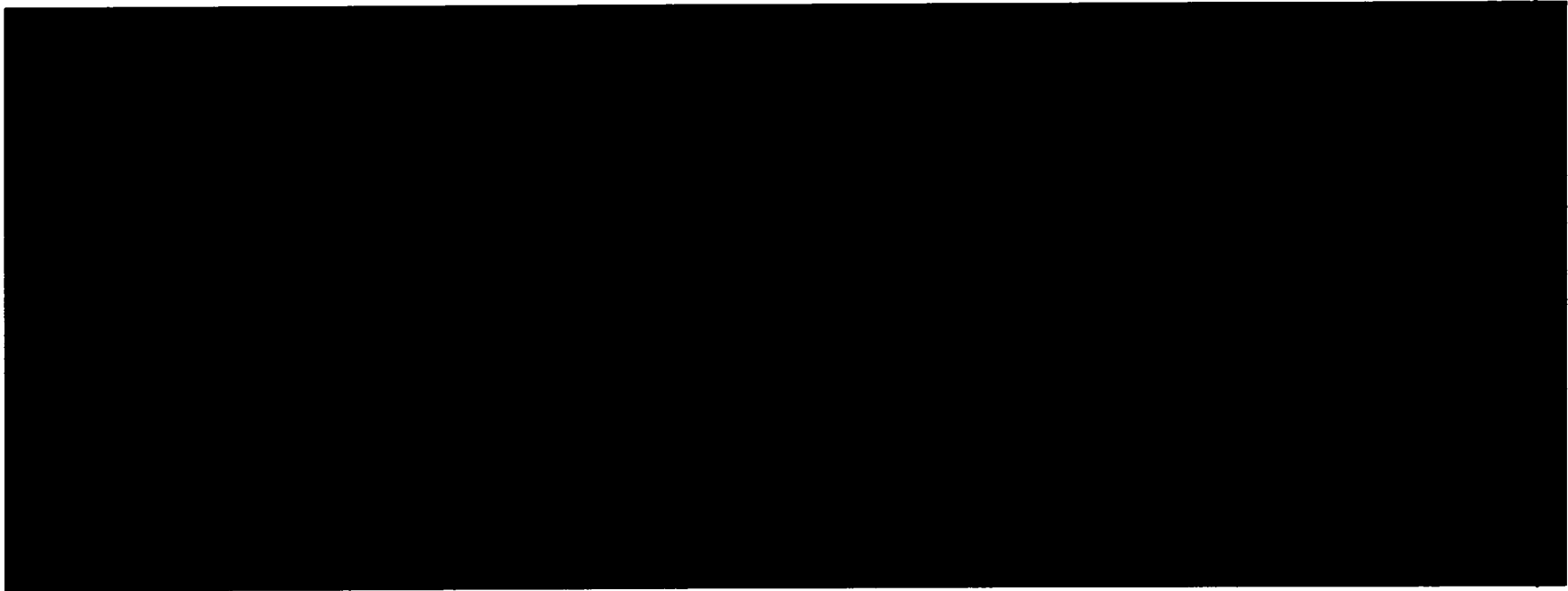


Table 3.7-2 Accident Sequence Descriptions
Page 8 of 64

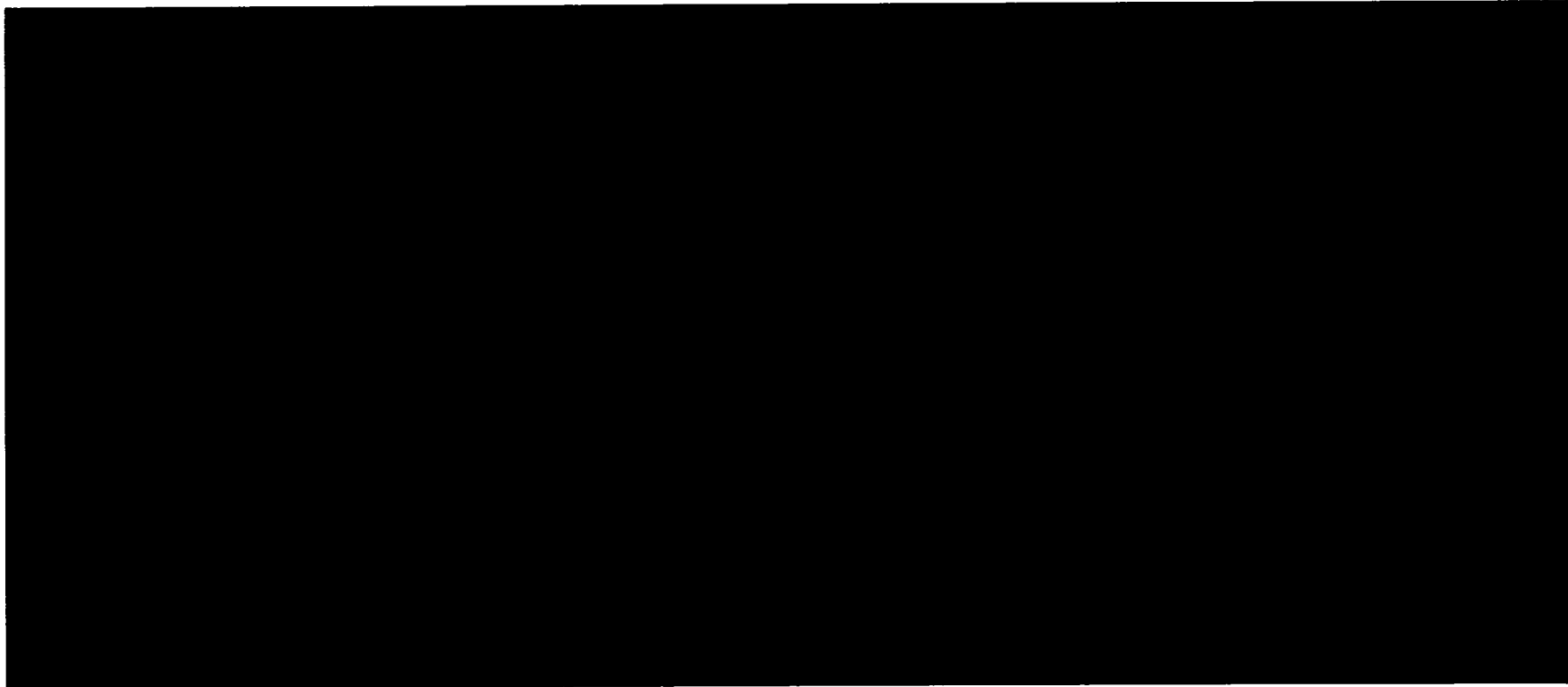


Table 3.7-2 Accident Sequence Descriptions

Page 9 of 64

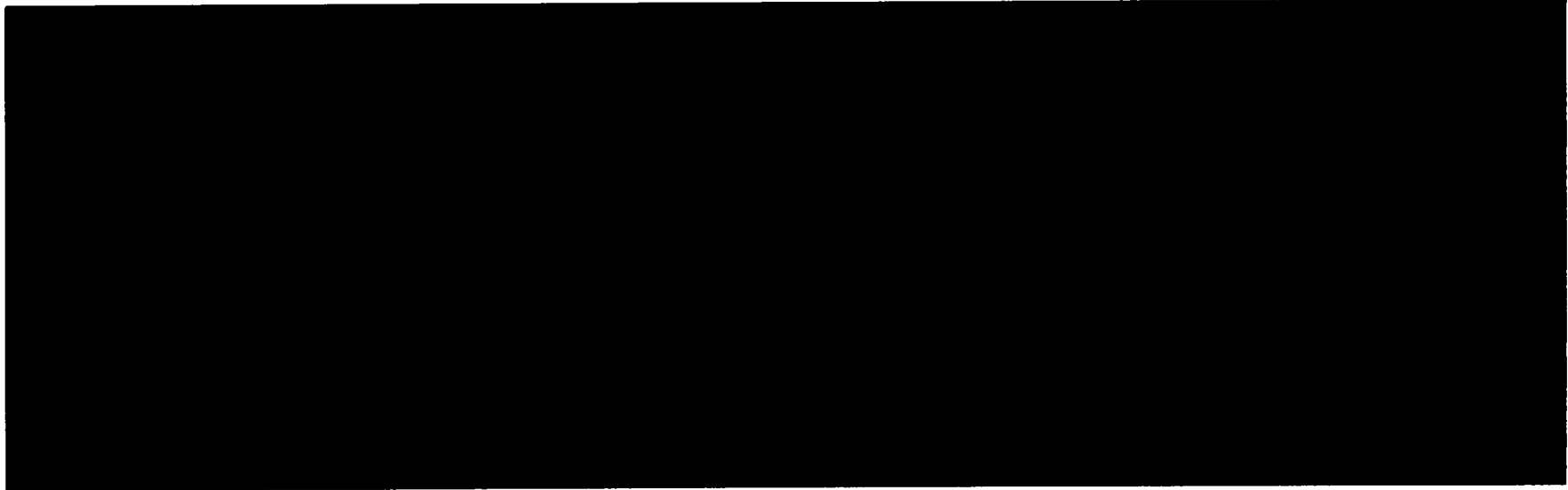


Table 3.7-2 Accident Sequence Descriptions
Page 10 of 64

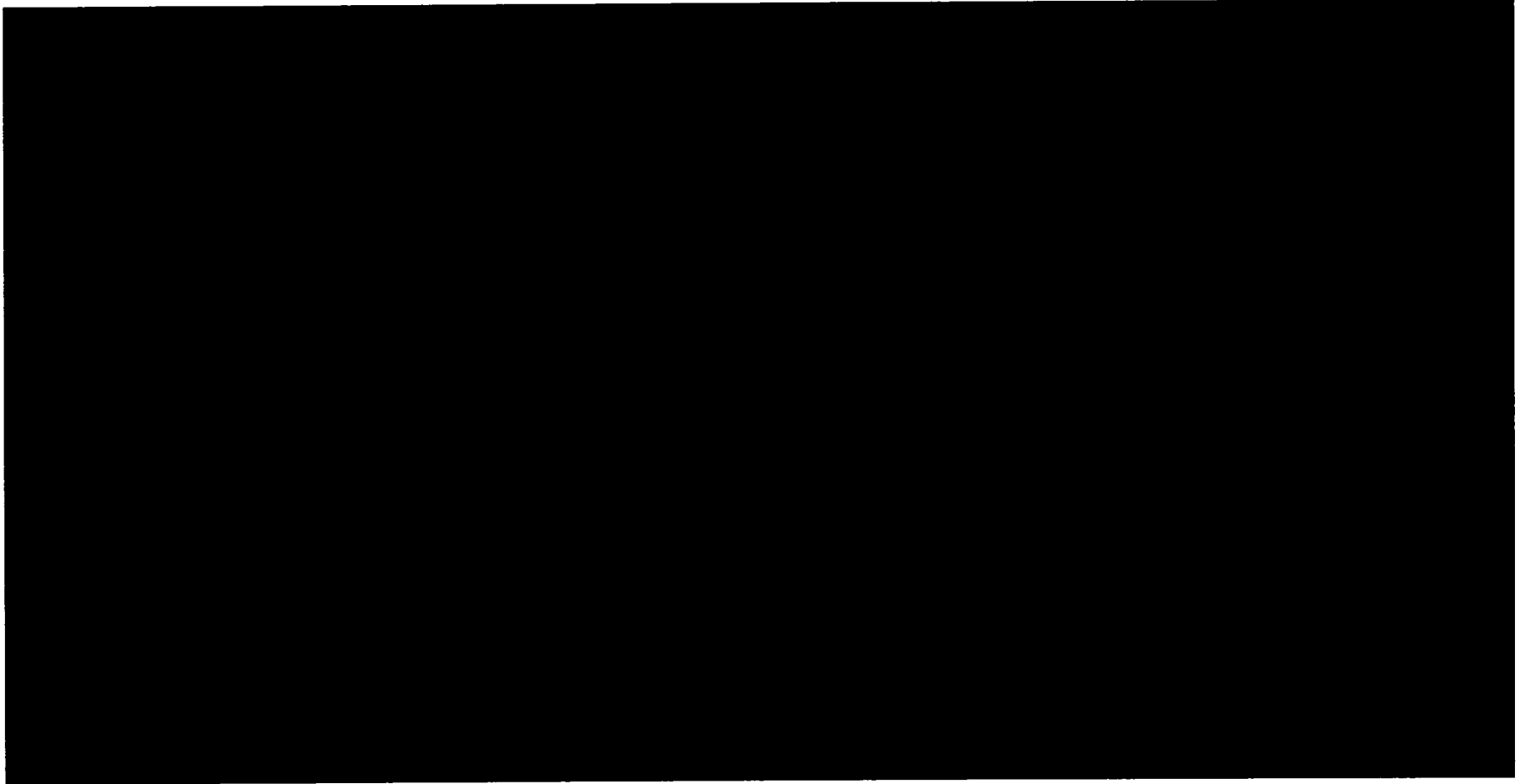


Table 3.7-2 Accident Sequence Descriptions
Page 11 of 64

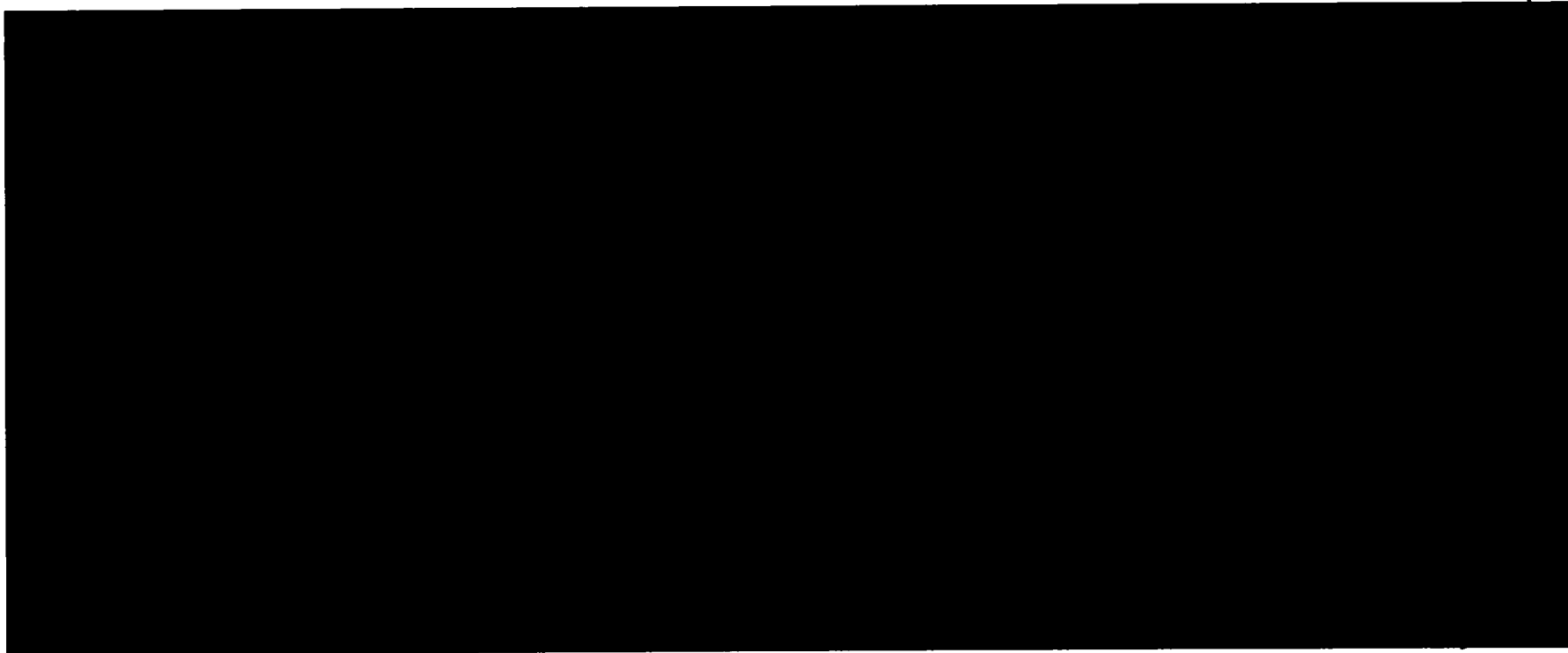


Table 3.7-2 Accident Sequence Descriptions
Page 12 of 64

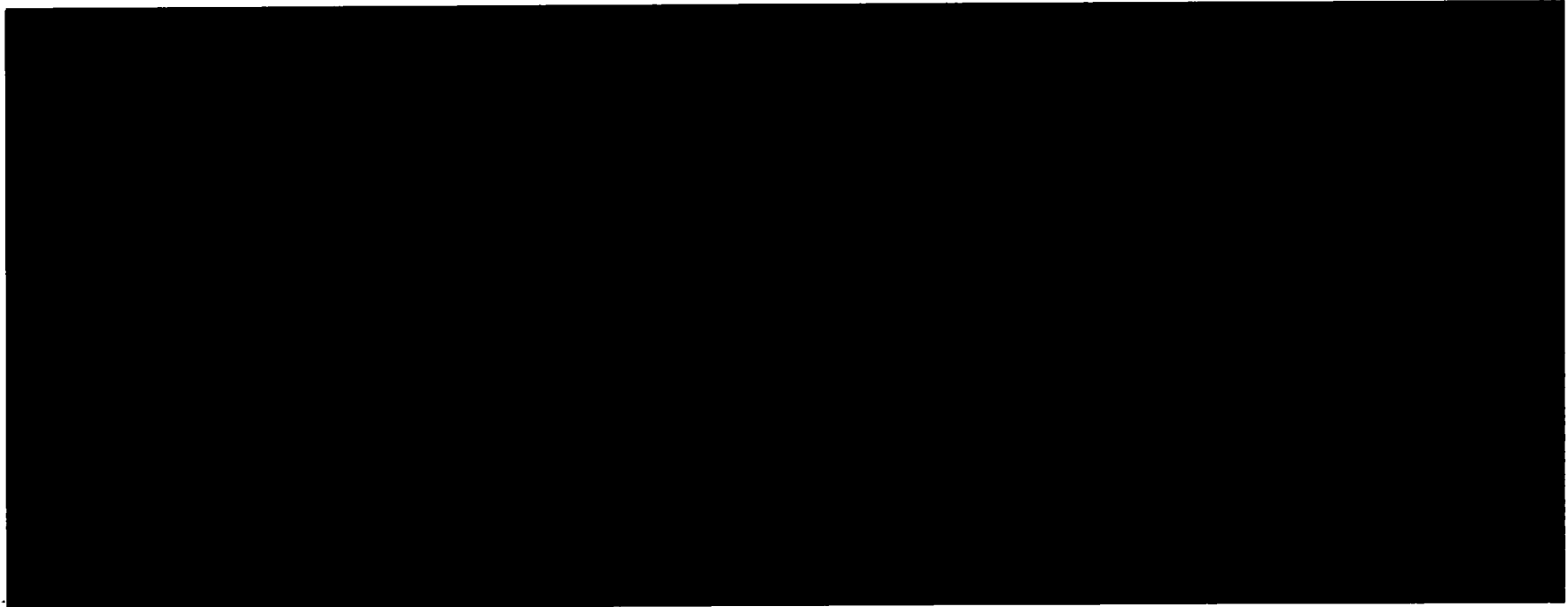


Table 3.7-2 Accident Sequence Descriptions

Page 13 of 64

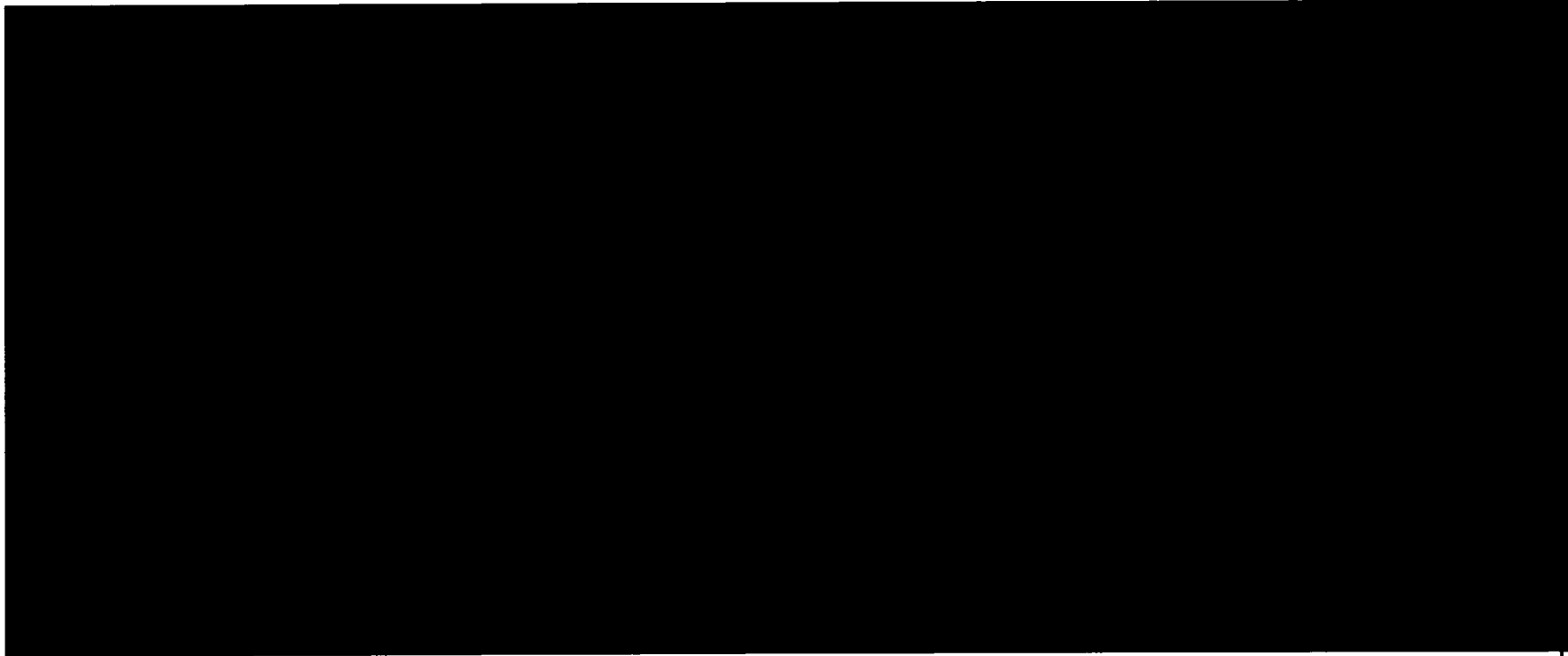


Table 3.7-2 Accident Sequence Descriptions

Page 14 of 64

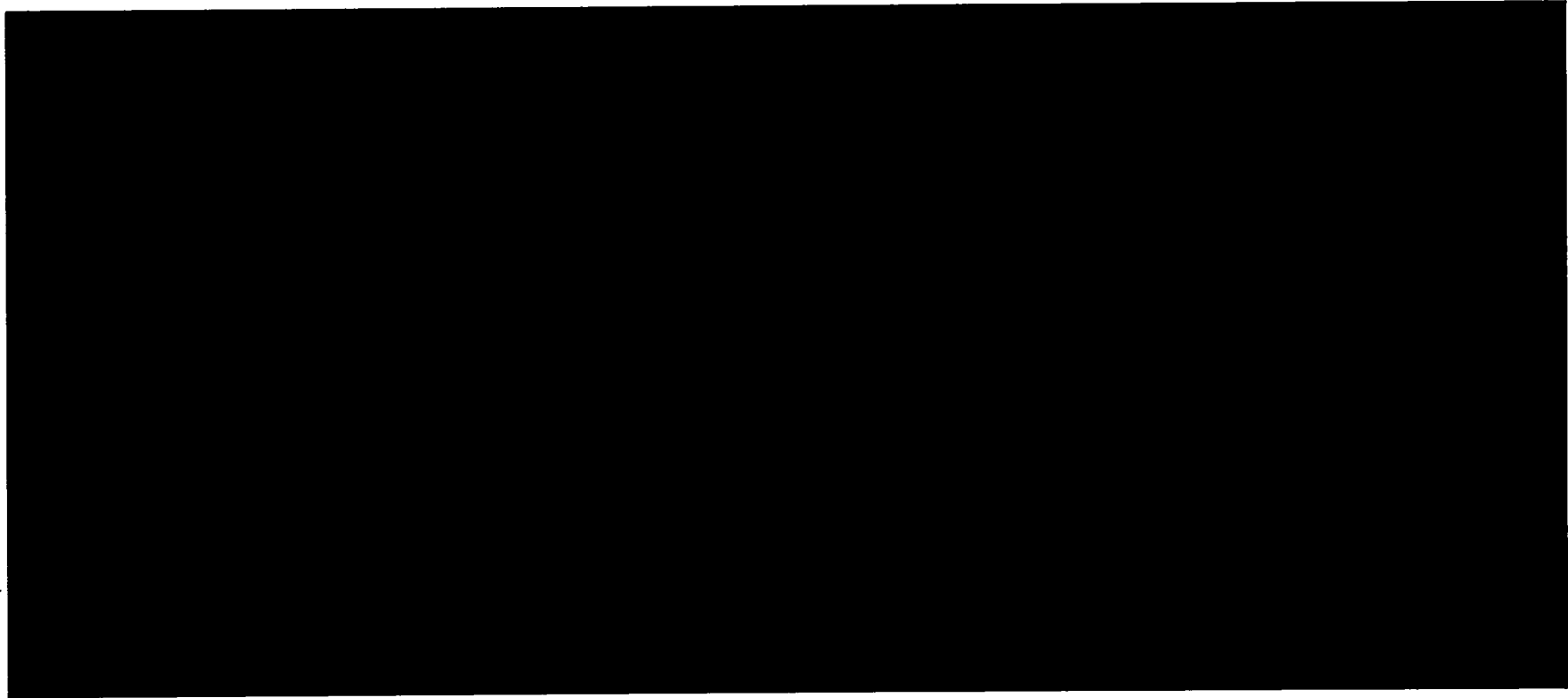


Table 3.7-2 Accident Sequence Descriptions

Page 15 of 64

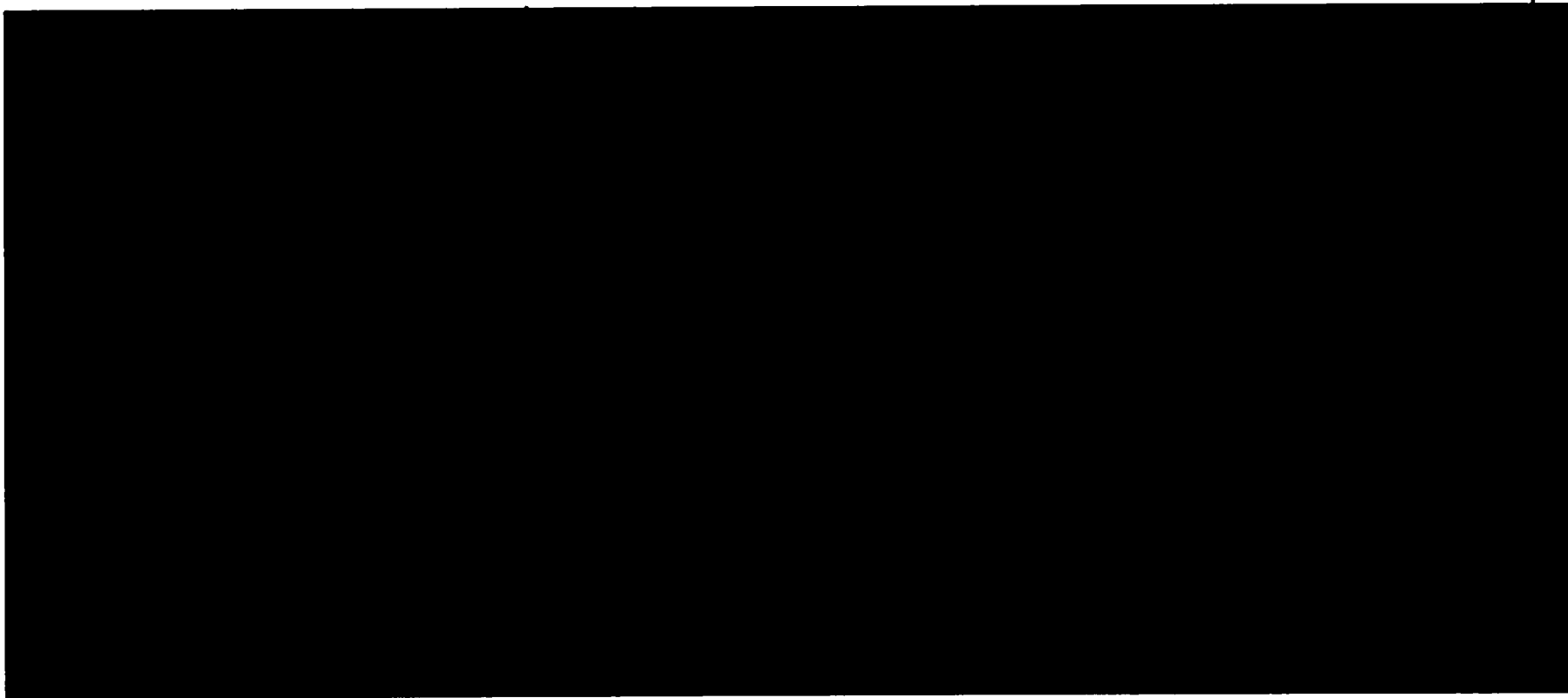


Table 3.7-2 Accident Sequence Descriptions
Page 16 of 64

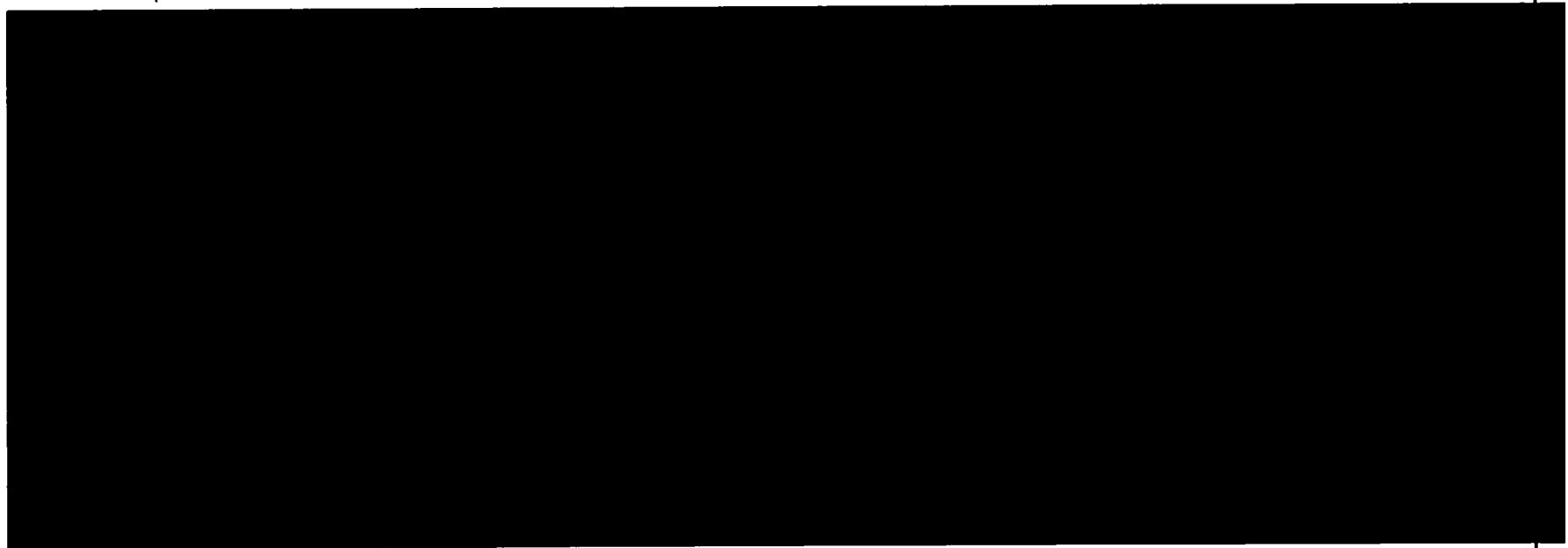


Table 3.7-2 Accident Sequence Descriptions

Page 17 of 64



Table 3.7-2 Accident Sequence Descriptions
Page 18 of 64

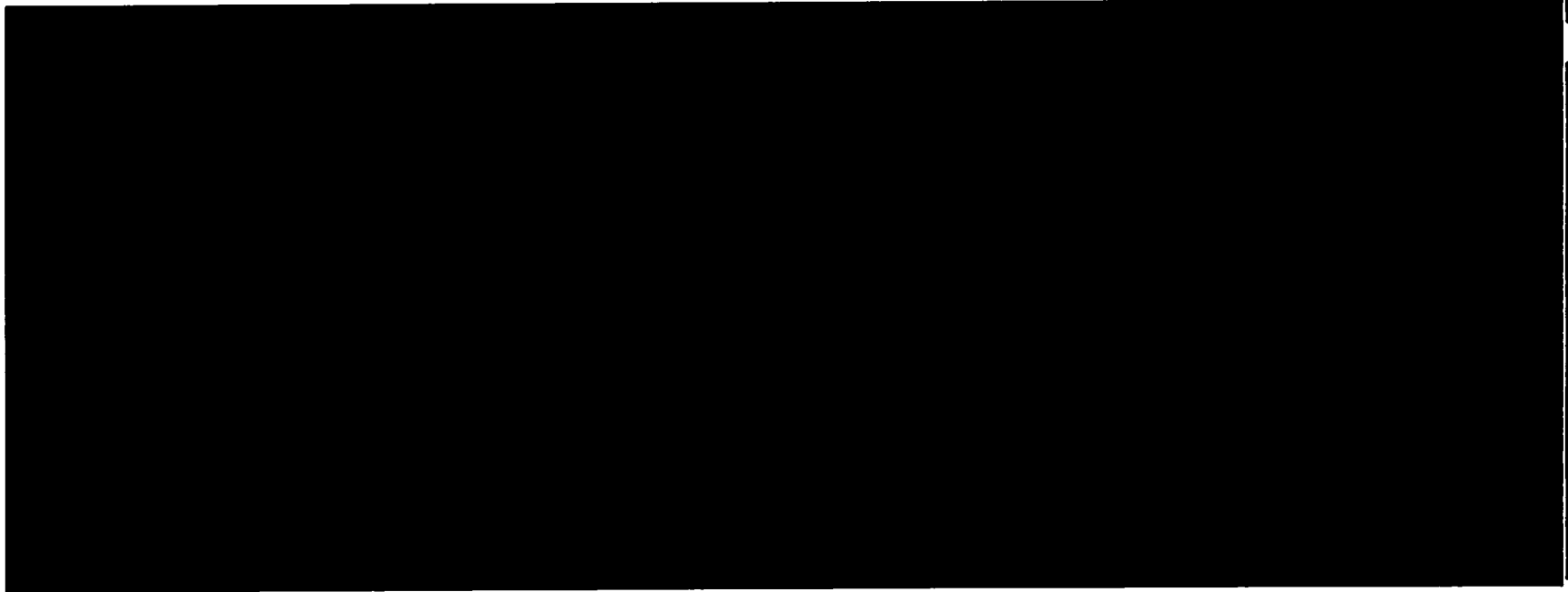


Table 3.7-2 Accident Sequence Descriptions

Page 19 of 64

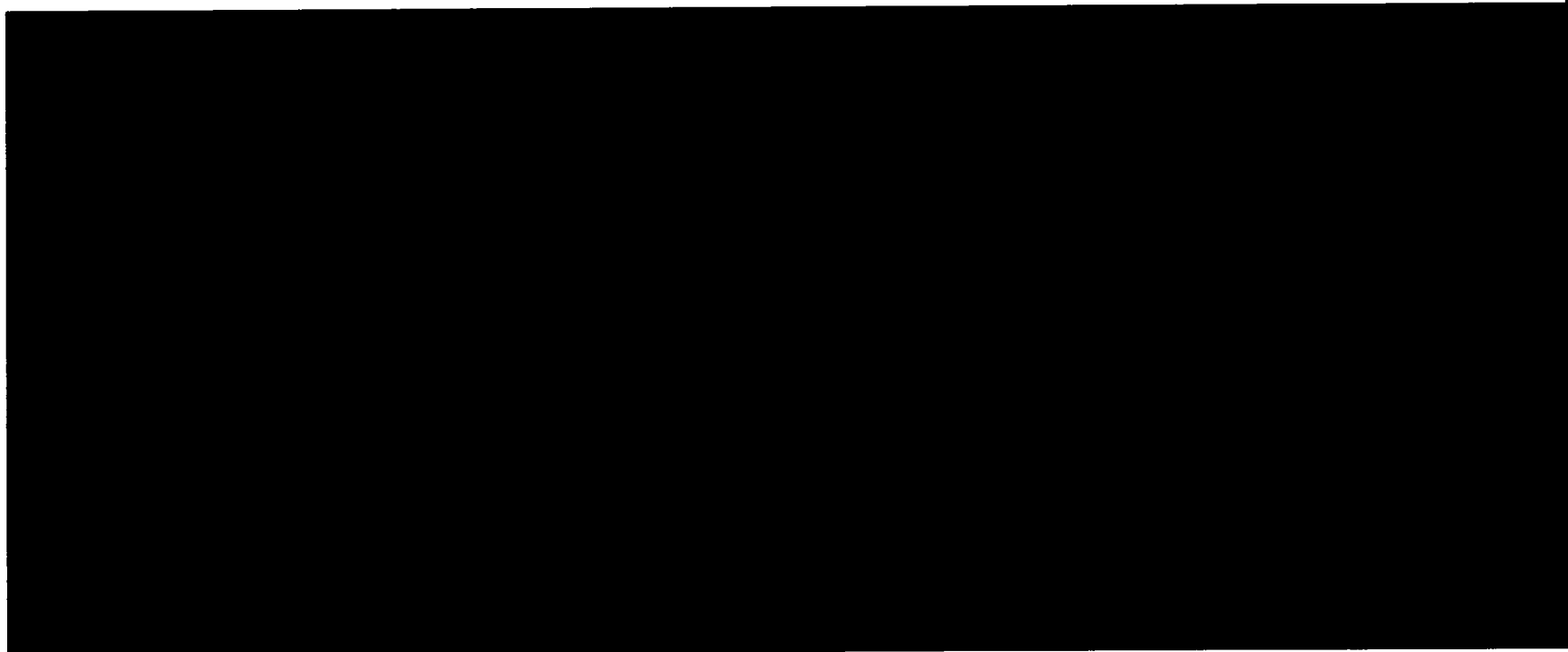


Table 3.7-2 Accident Sequence Descriptions
Page 20 of 64

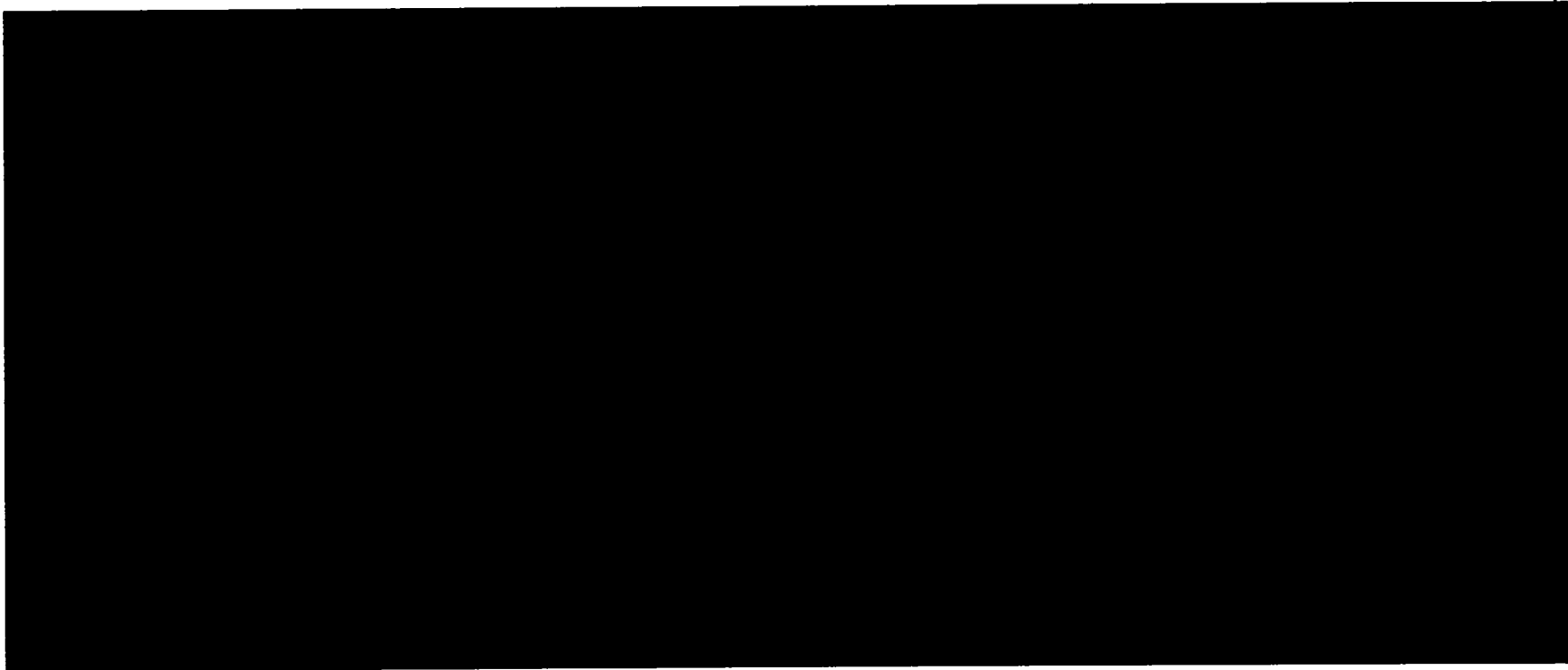


Table 3.7-2 Accident Sequence Descriptions

Page 21 of 64

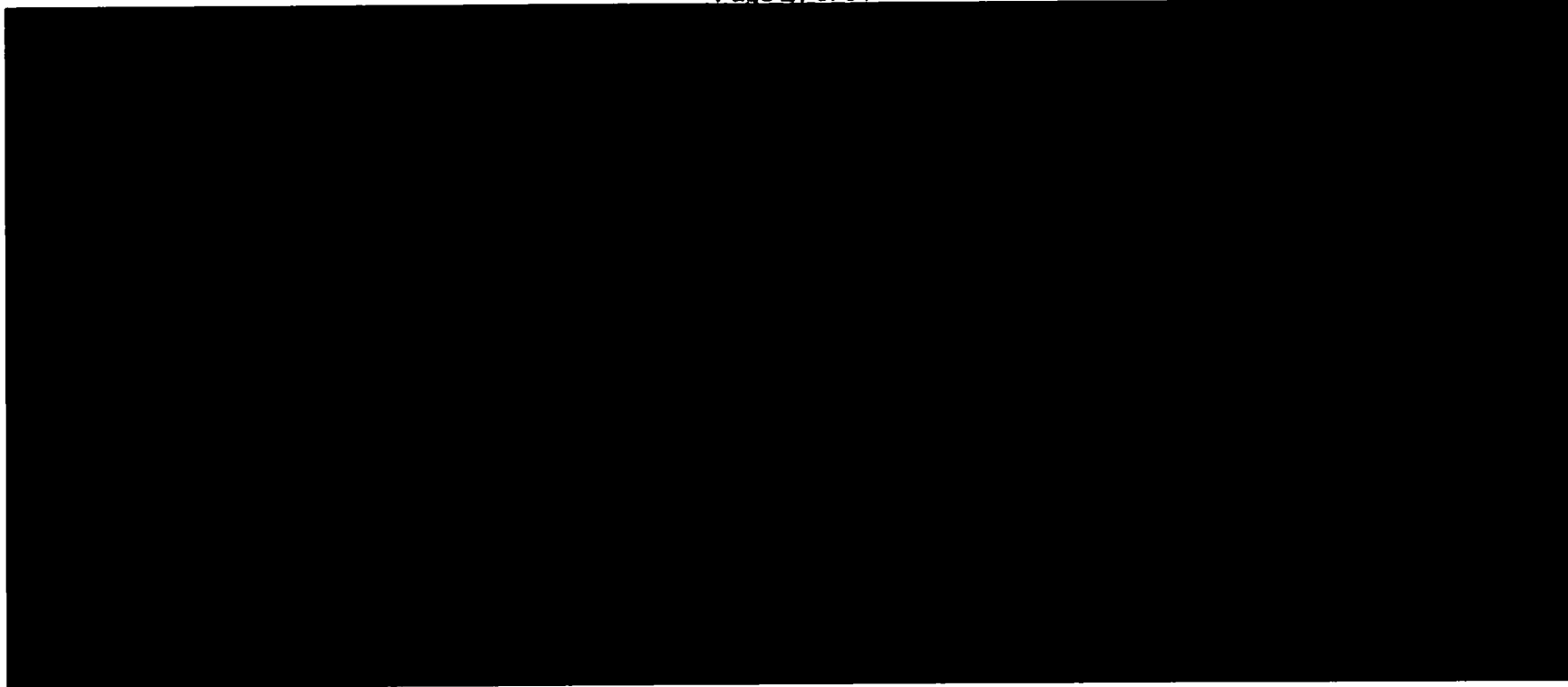


Table 3.7-2 Accident Sequence Descriptions
Page 22 of 64

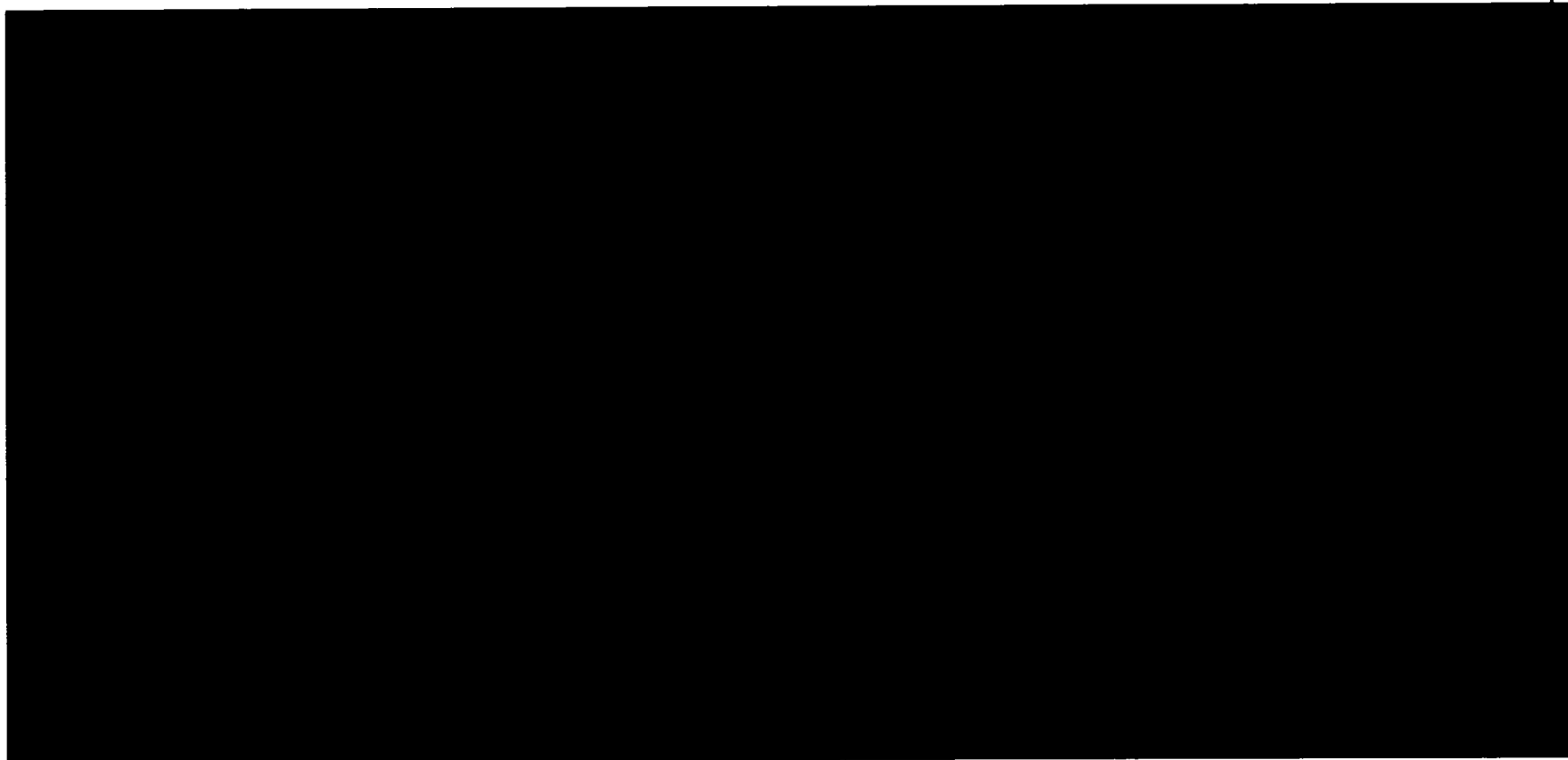


Table 3.7-2 Accident Sequence Descriptions

Page 23 of 64

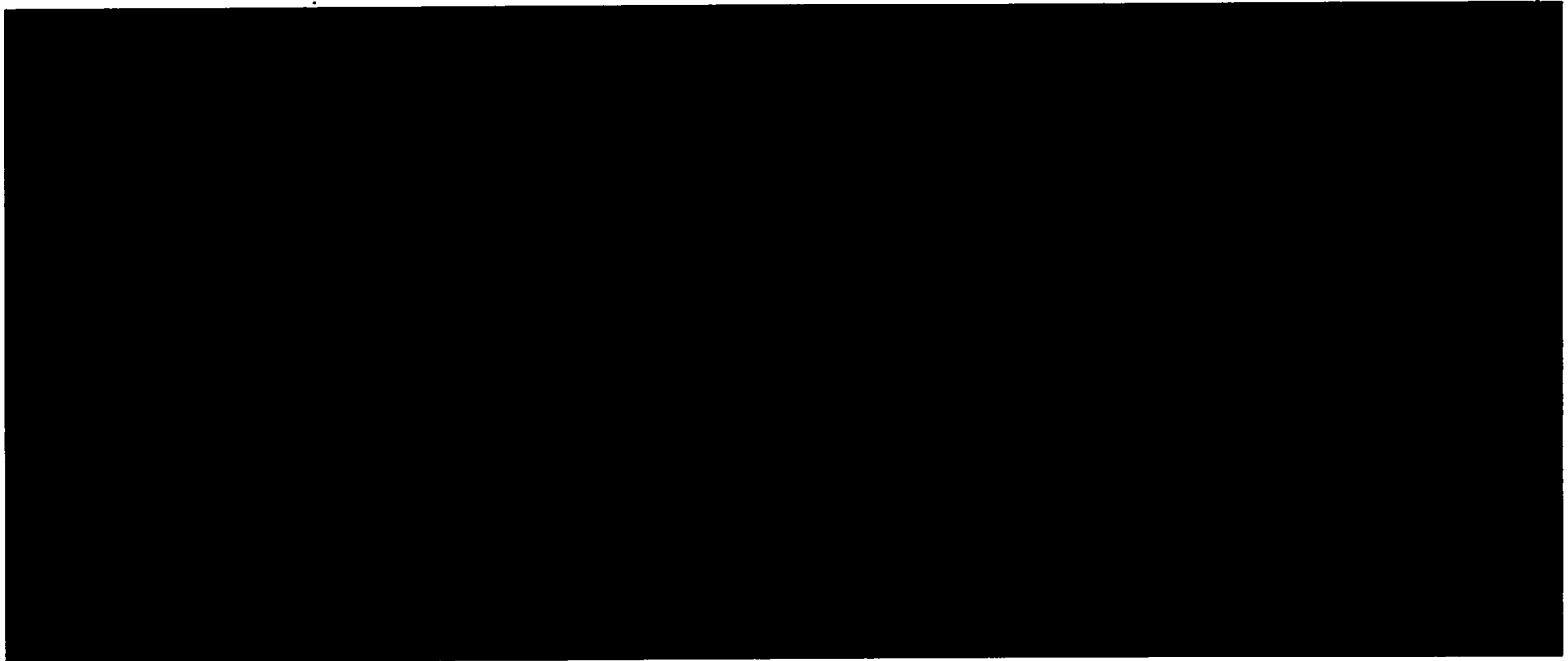


Table 3.7-2 Accident Sequence Descriptions
Page 24 of 64



Table 3.7-2 Accident Sequence Descriptions
Page 25 of 64

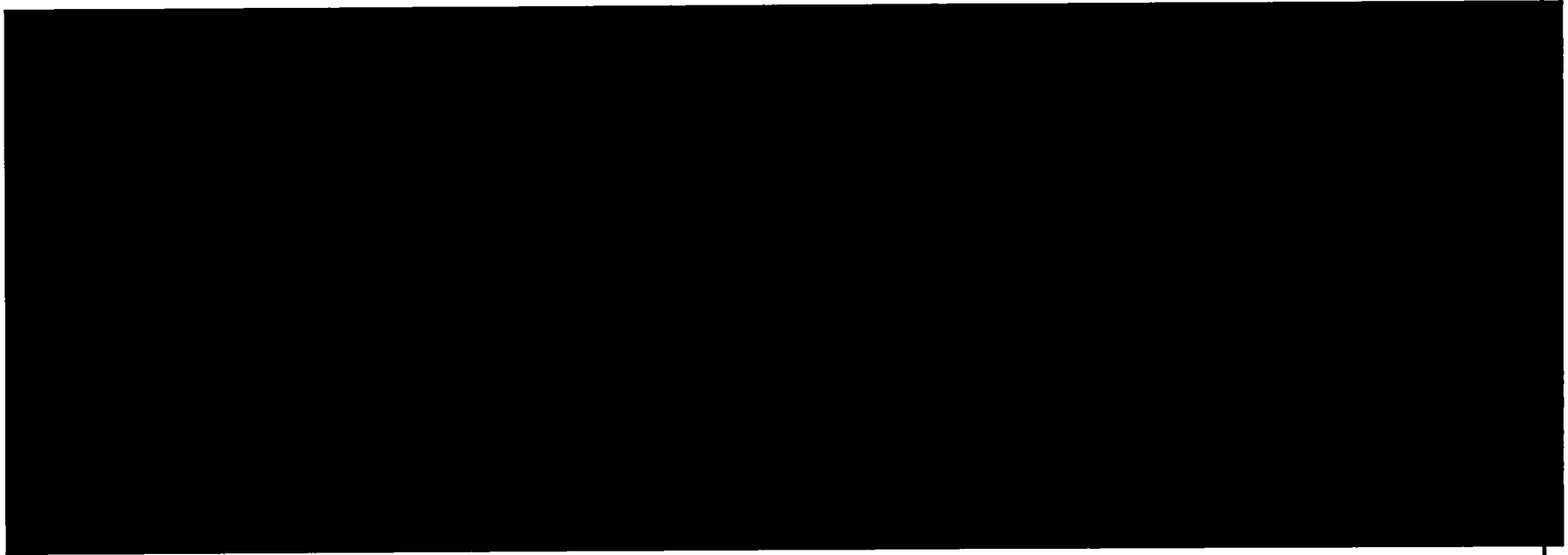


Table 3.7-2 Accident Sequence Descriptions

Page 26 of 64

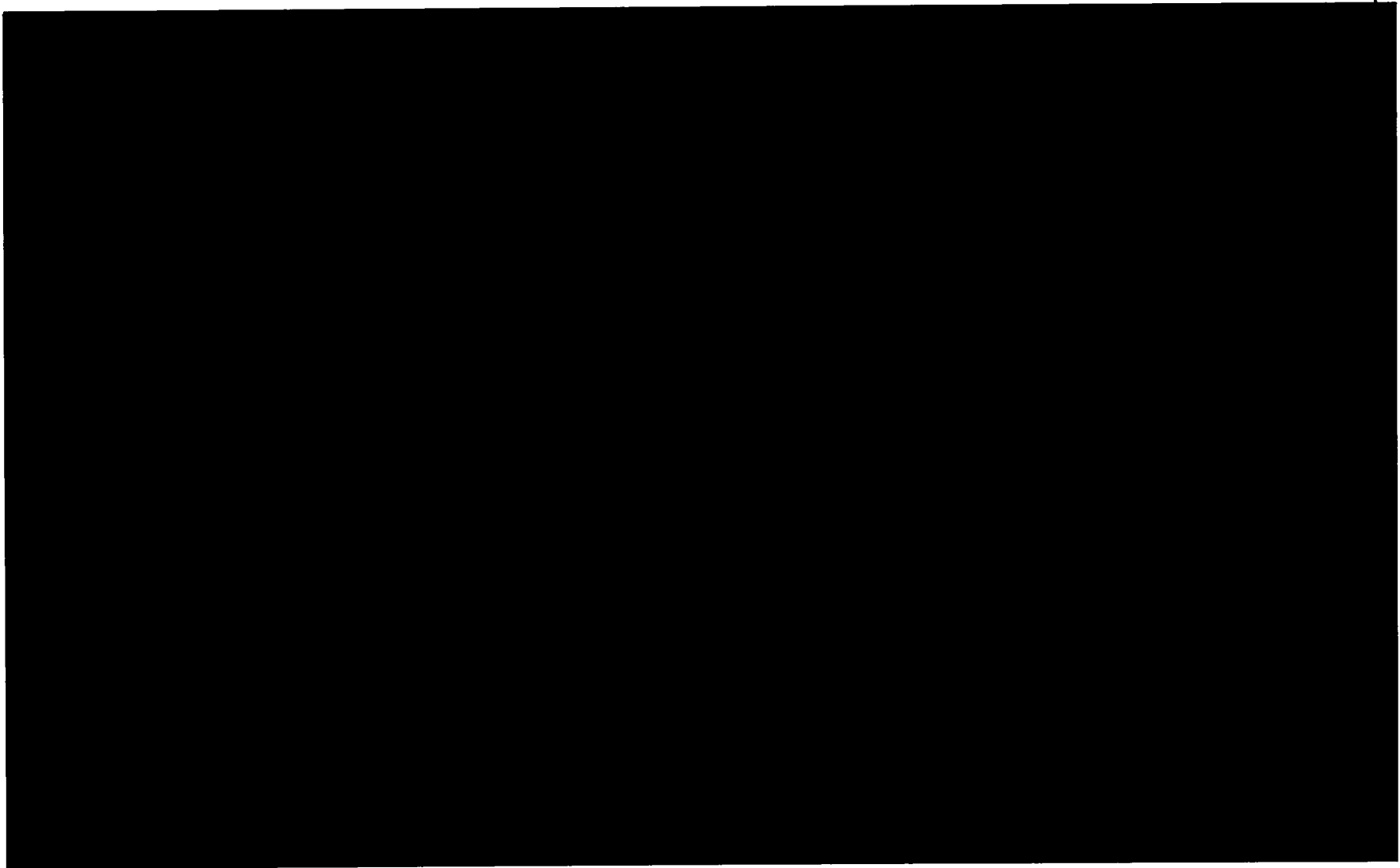


Table 3.7-2 Accident Sequence Descriptions
Page 27 of 64

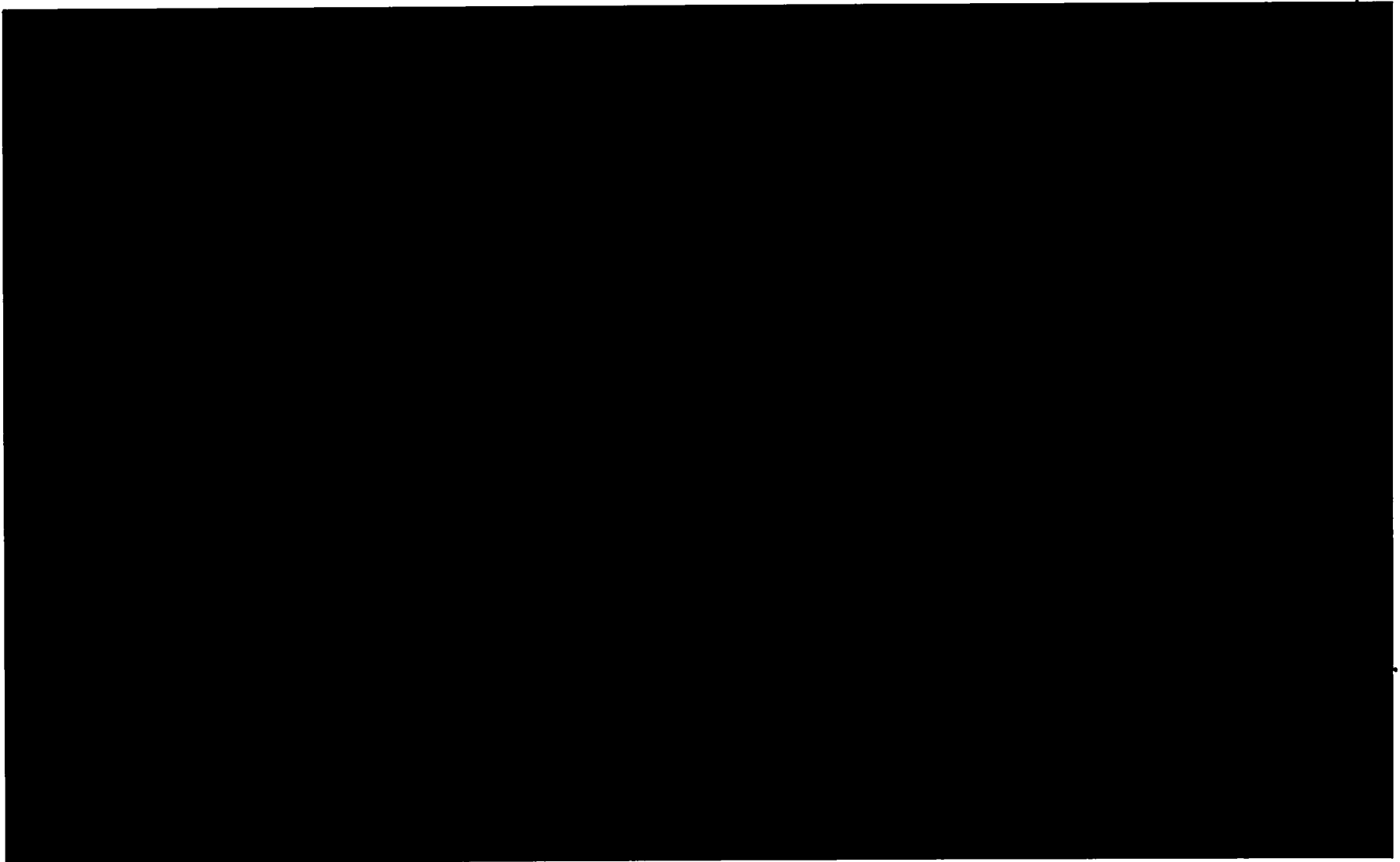


Table 3.7-2 Accident Sequence Descriptions
Page 28 of 64

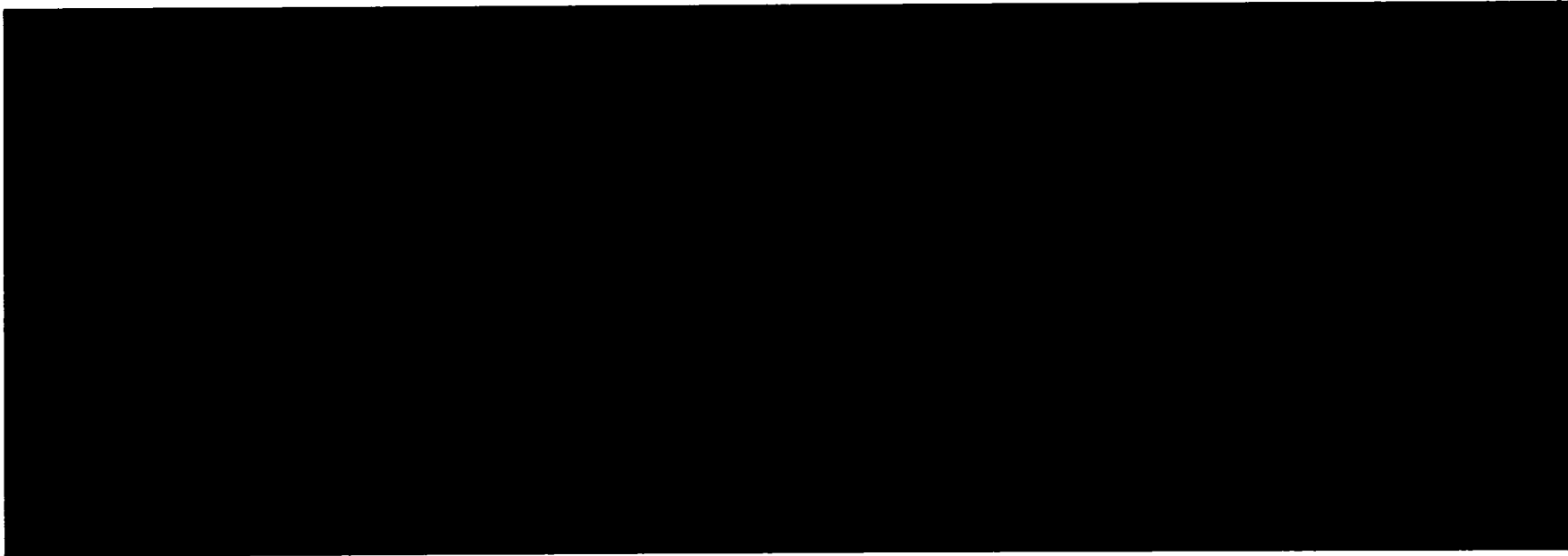


Table 3.7-2 Accident Sequence Descriptions

Page 29 of 64

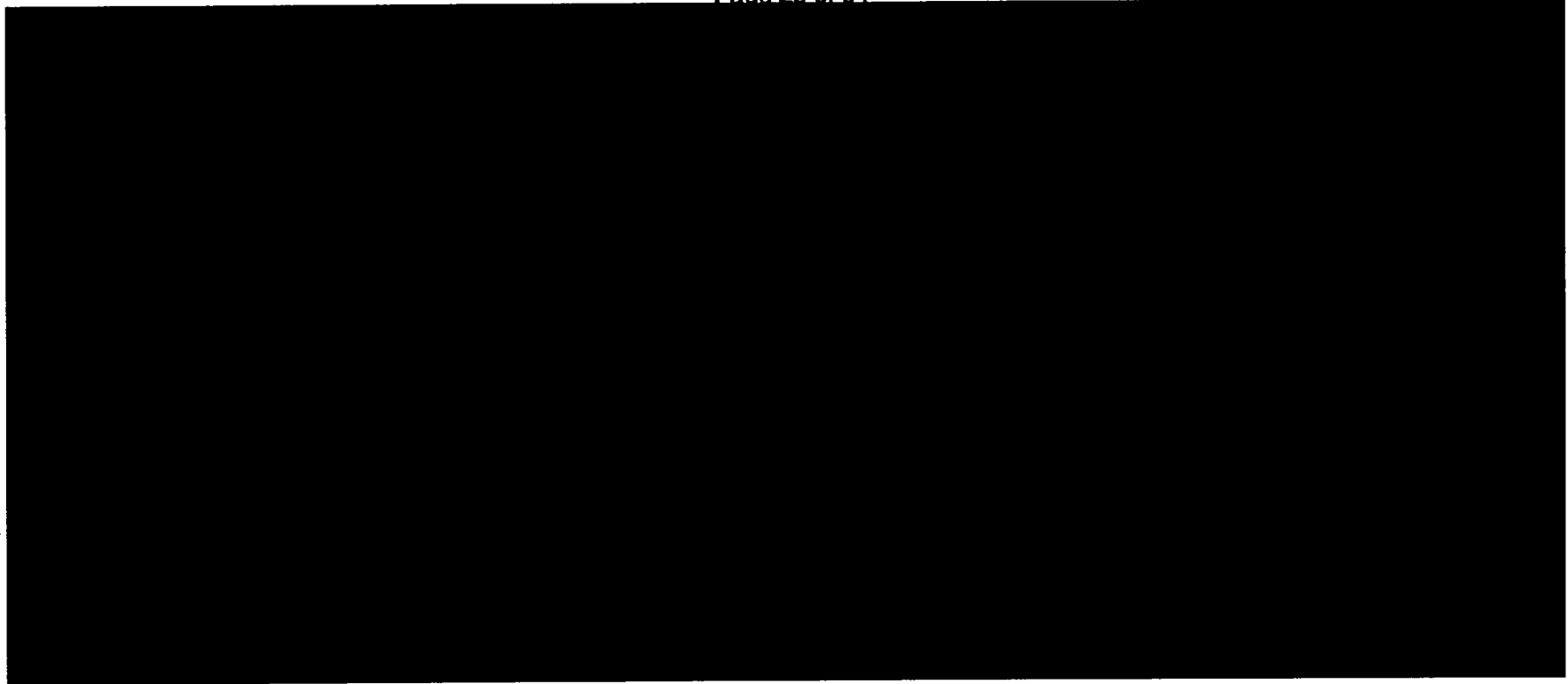


Table 3.7-2 Accident Sequence Descriptions

Page 30 of 64

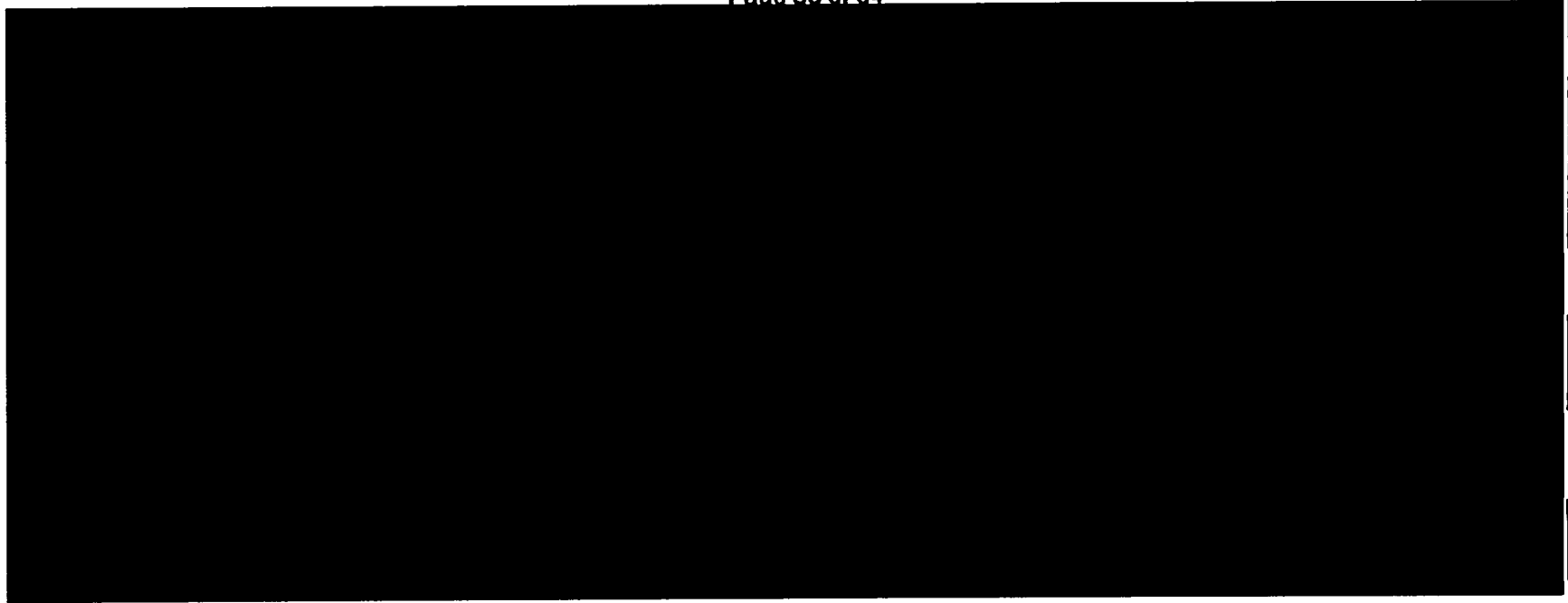


Table 3.7-2 Accident Sequence Descriptions

Page 31 of 64

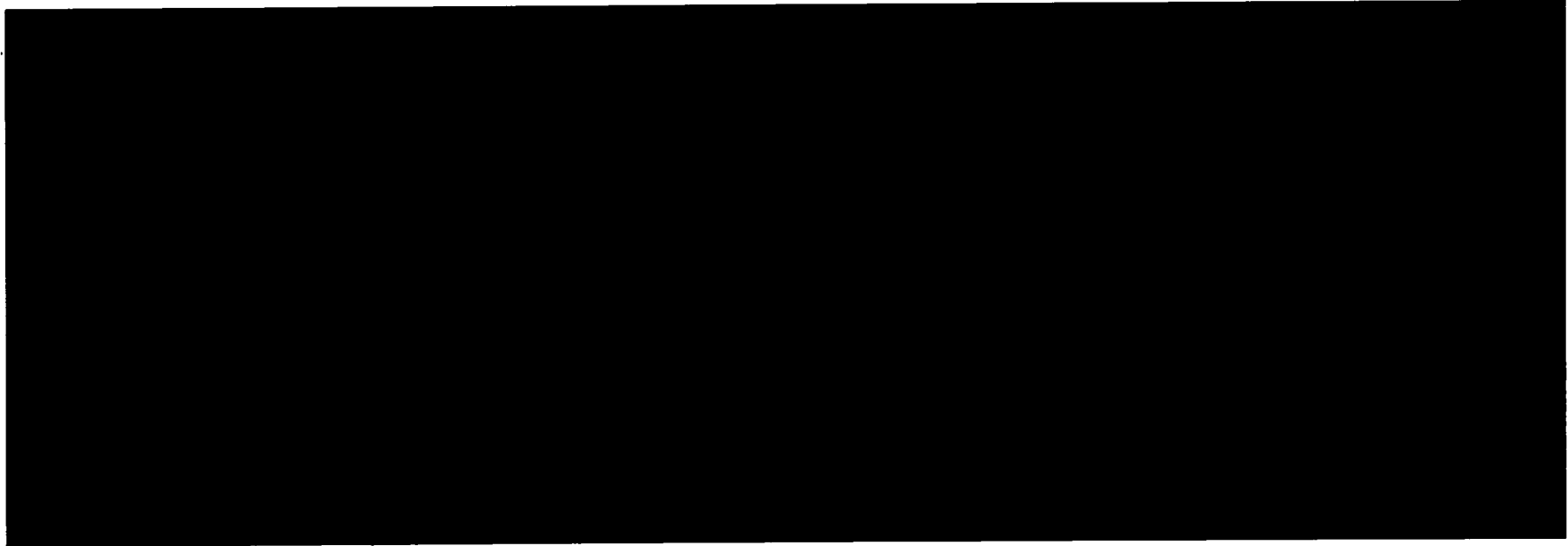


Table 3.7-2 Accident Sequence Descriptions

Page 32 of 64

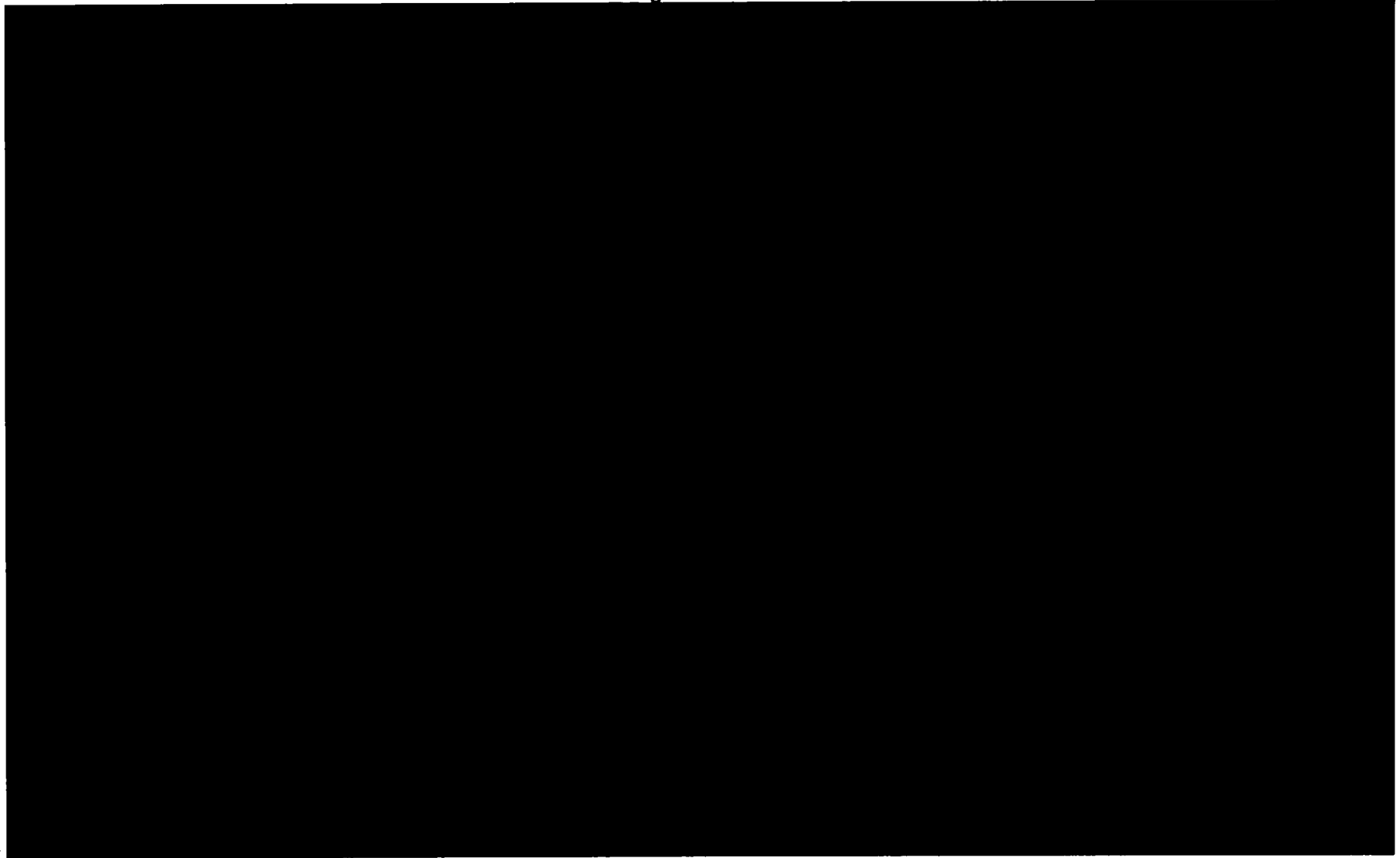


Table 3.7-2 Accident Sequence Descriptions

Page 33 of 64

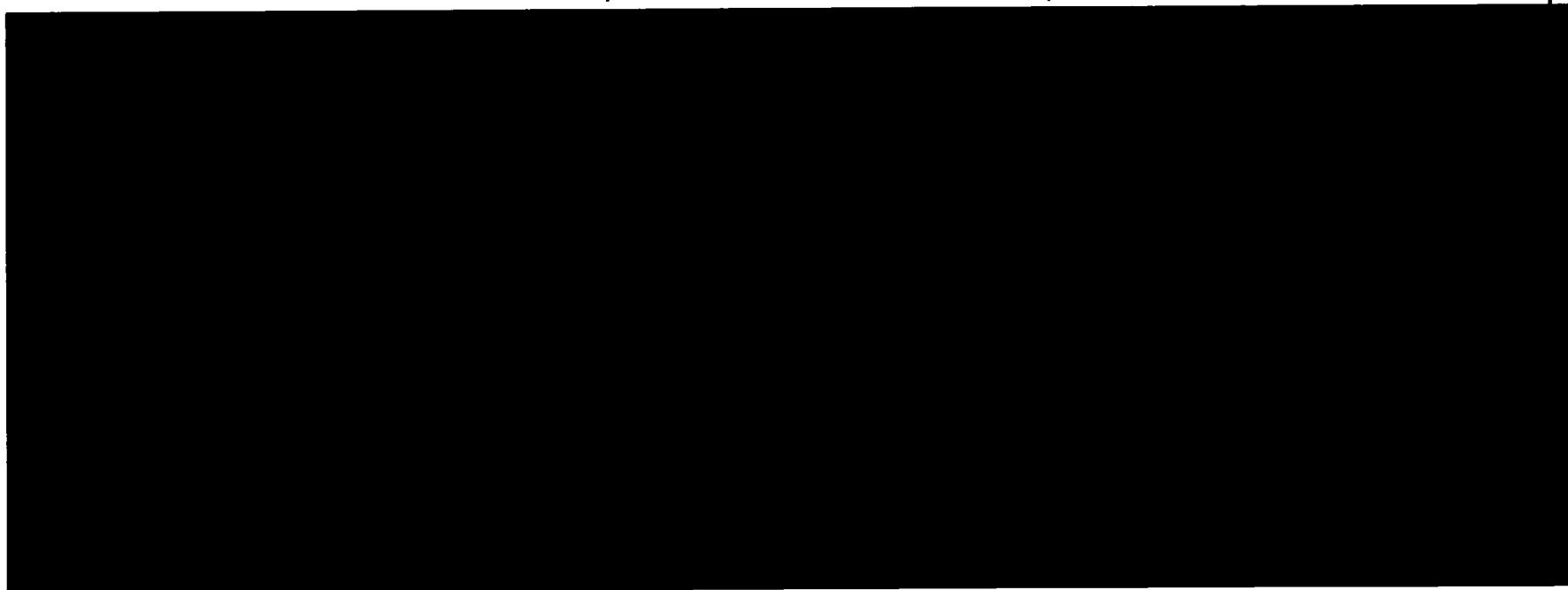


Table 3.7-2 Accident Sequence Descriptions
Page 34 of 64

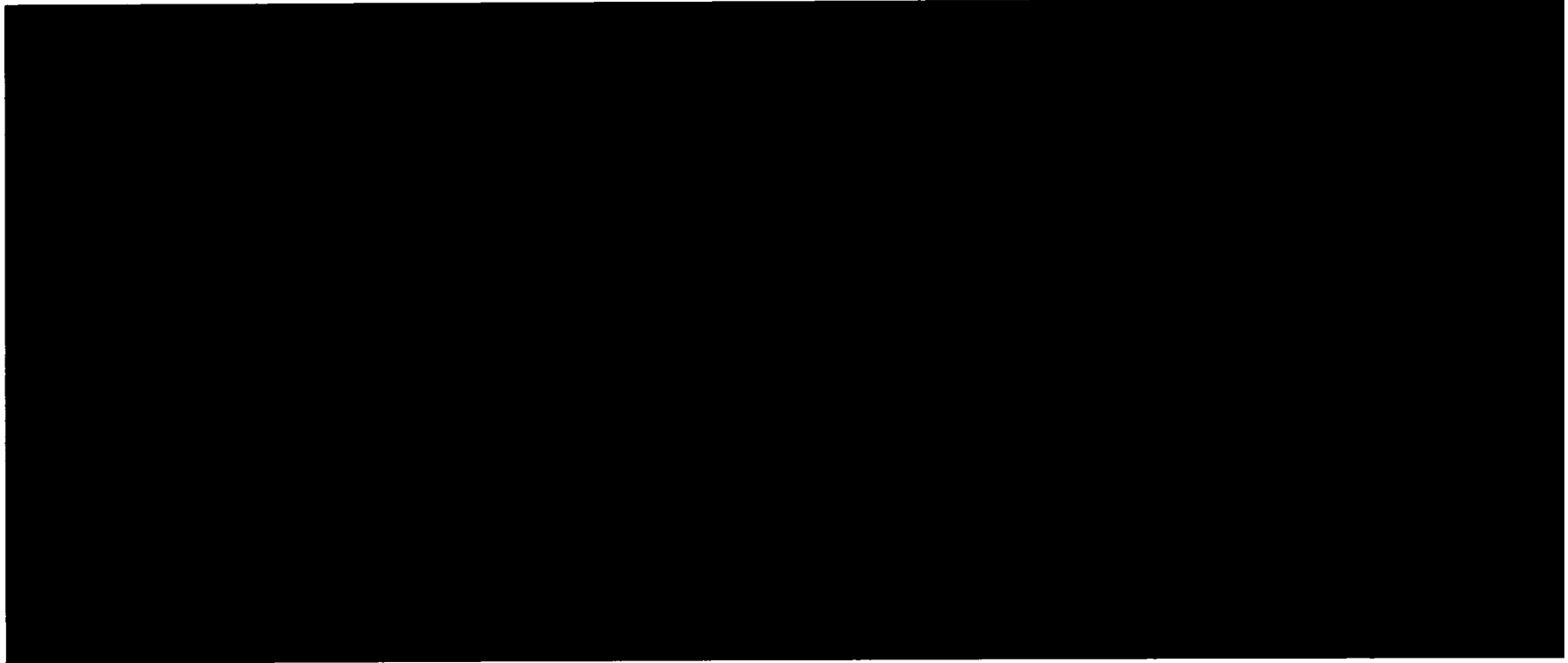


Table 3.7-2 Accident Sequence Descriptions

Page 35 of 64

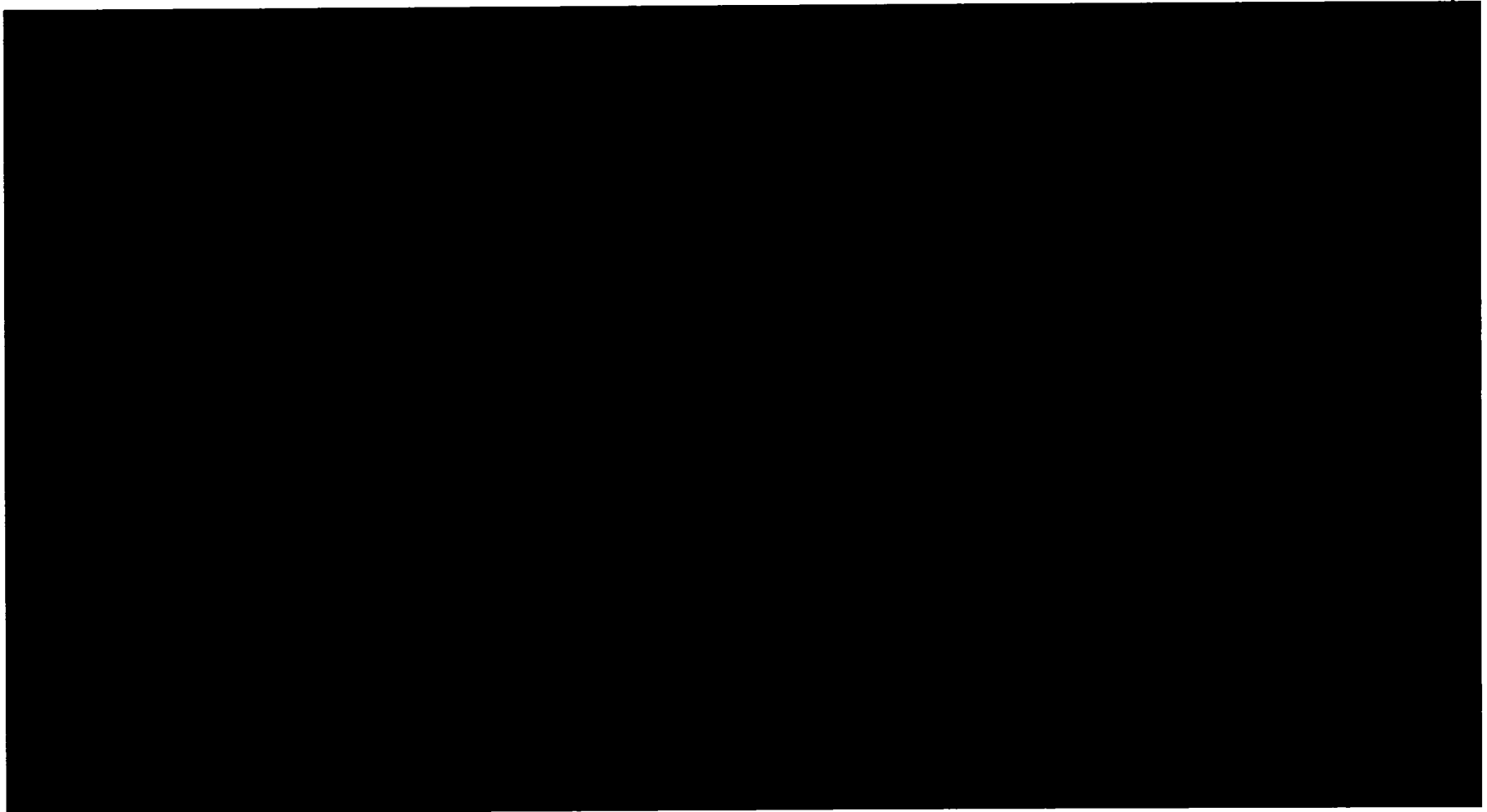


Table 3.7-2 Accident Sequence Descriptions

Page 36 of 64

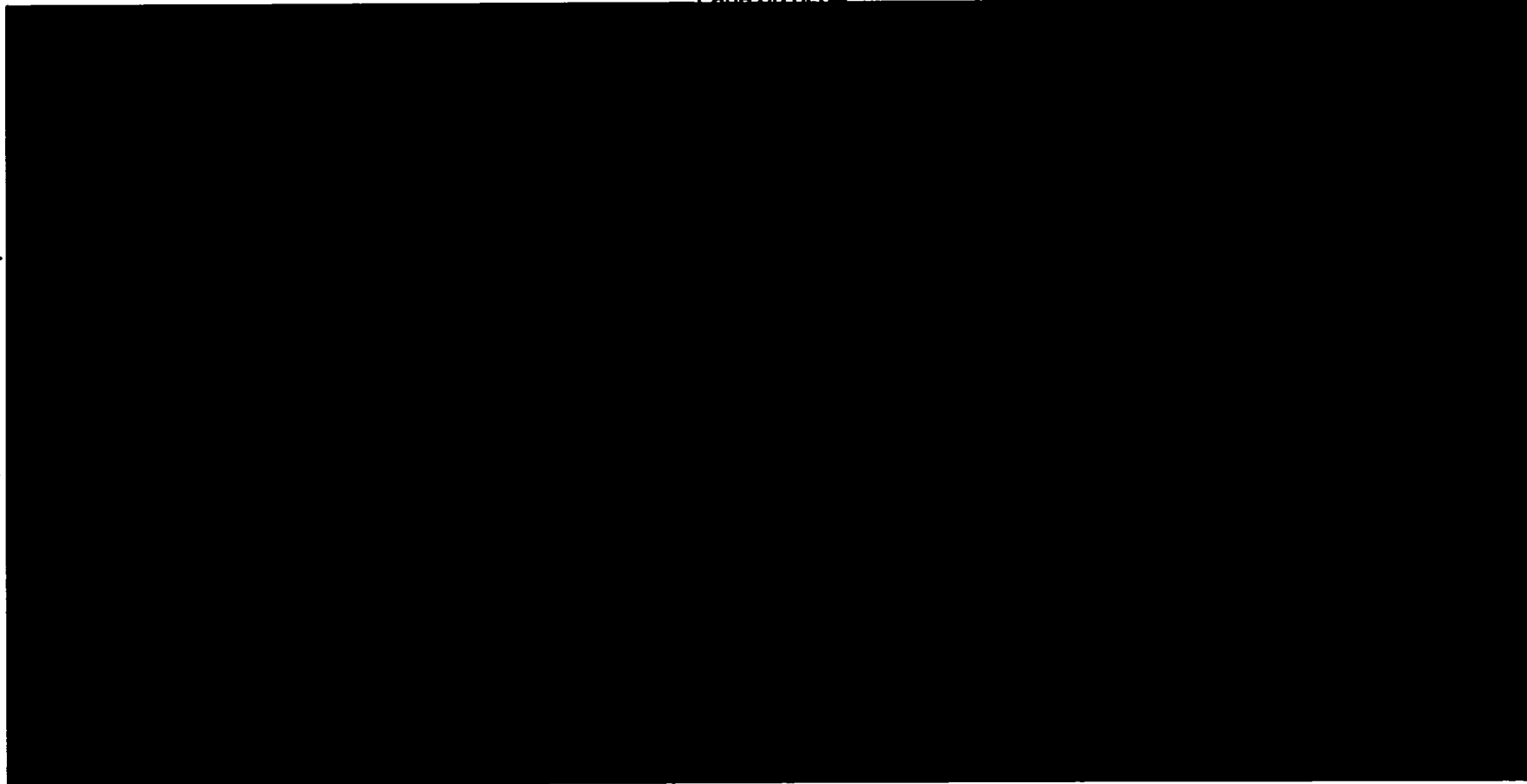


Table 3.7-2 Accident Sequence Descriptions

Page 37 of 64

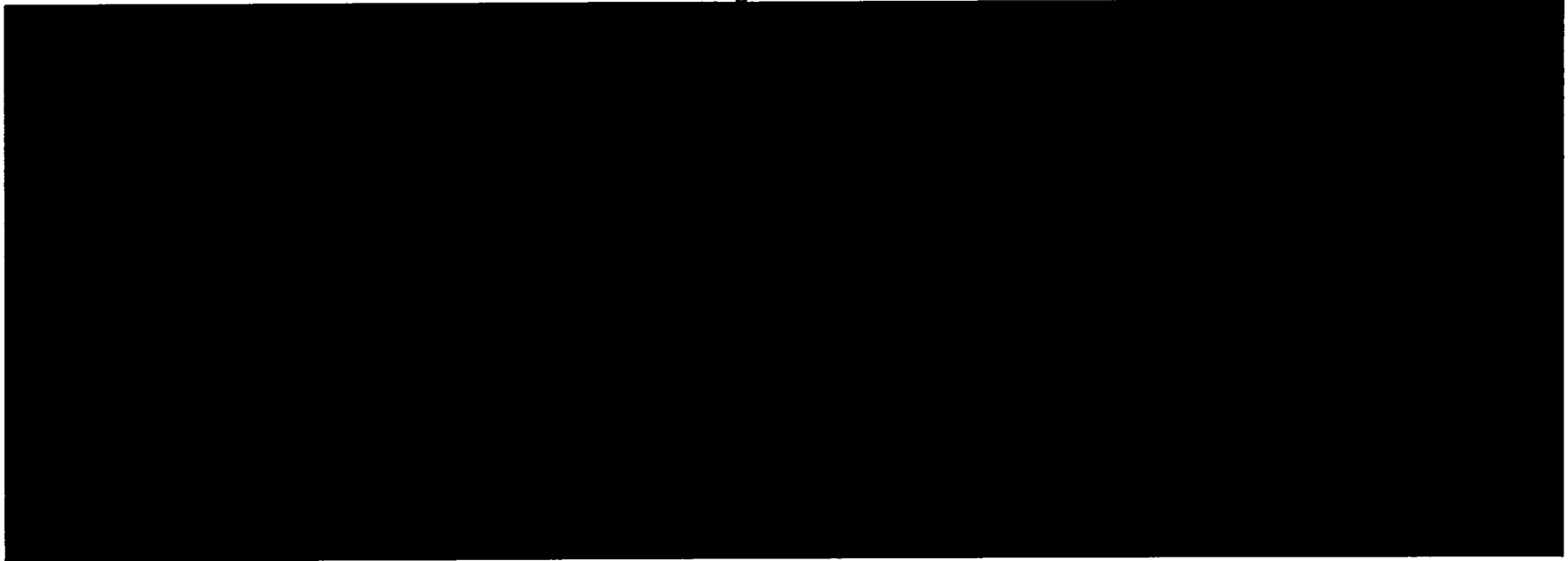


Table 3.7-2 Accident Sequence Descriptions
Page 38 of 64

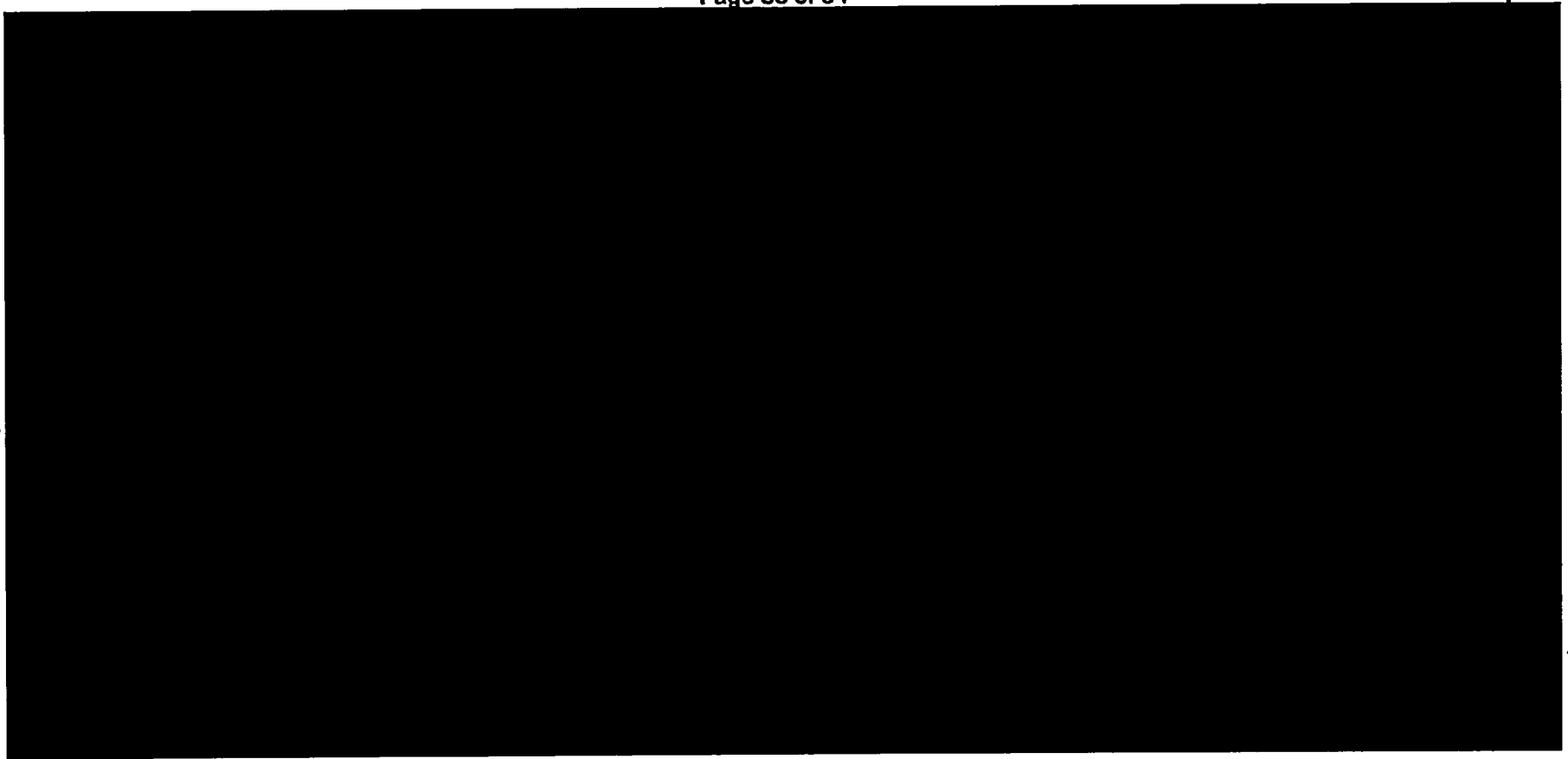


Table 3.7-2 Accident Sequence Descriptions

Page 39 of 64

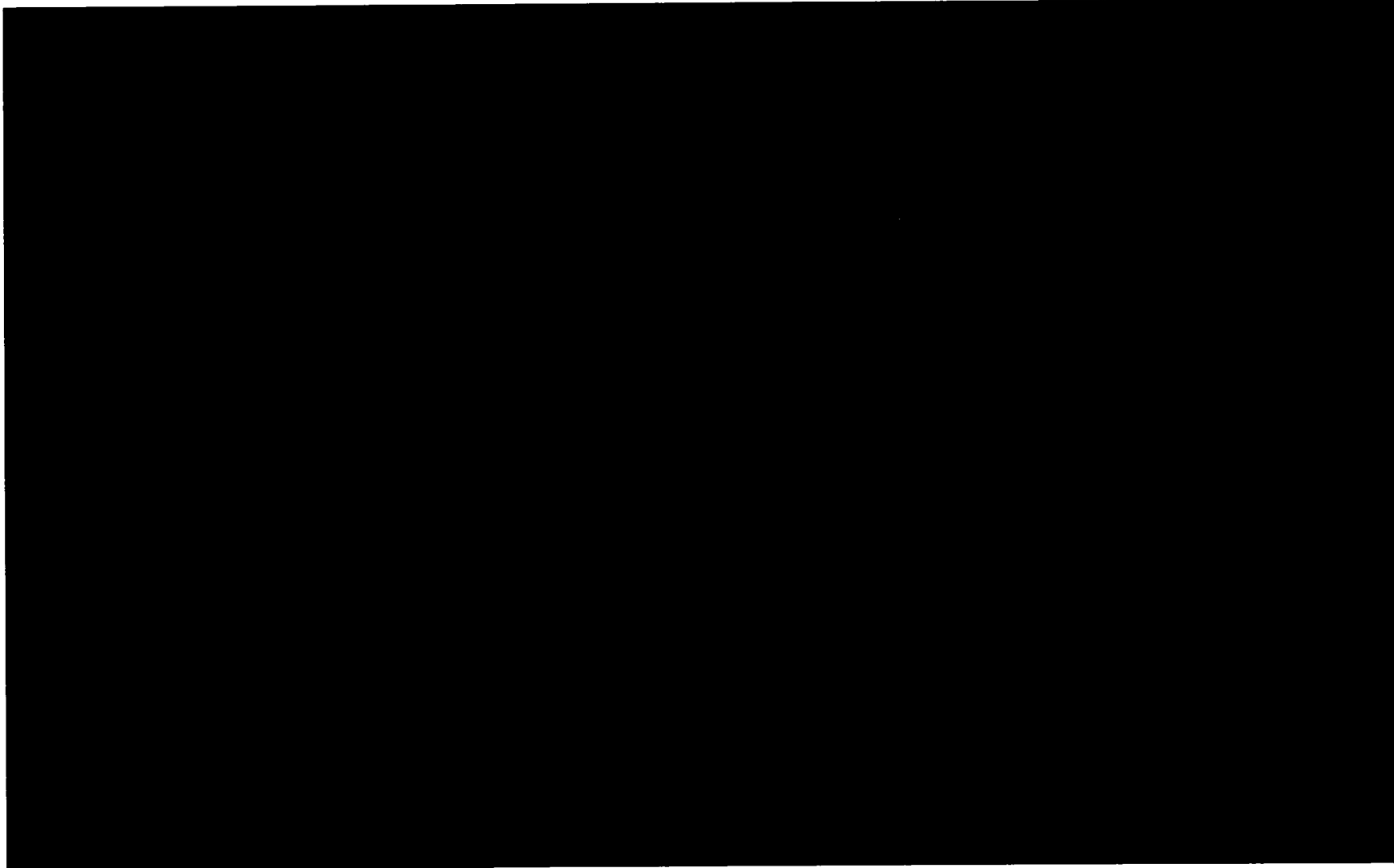


Table 3.7-2 Accident Sequence Descriptions

Page 40 of 64

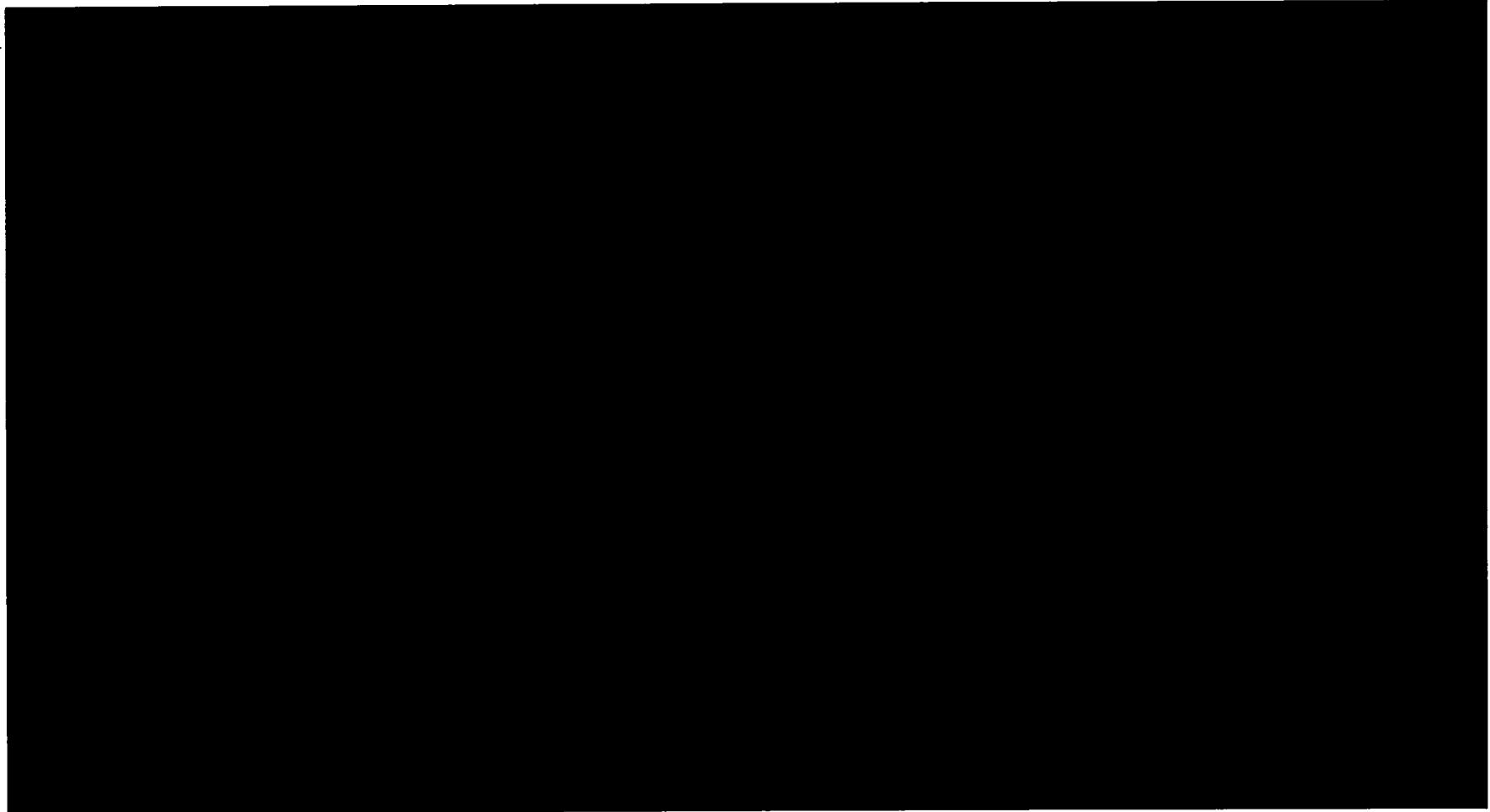


Table 3.7-2 Accident Sequence Descriptions

Page 41 of 64

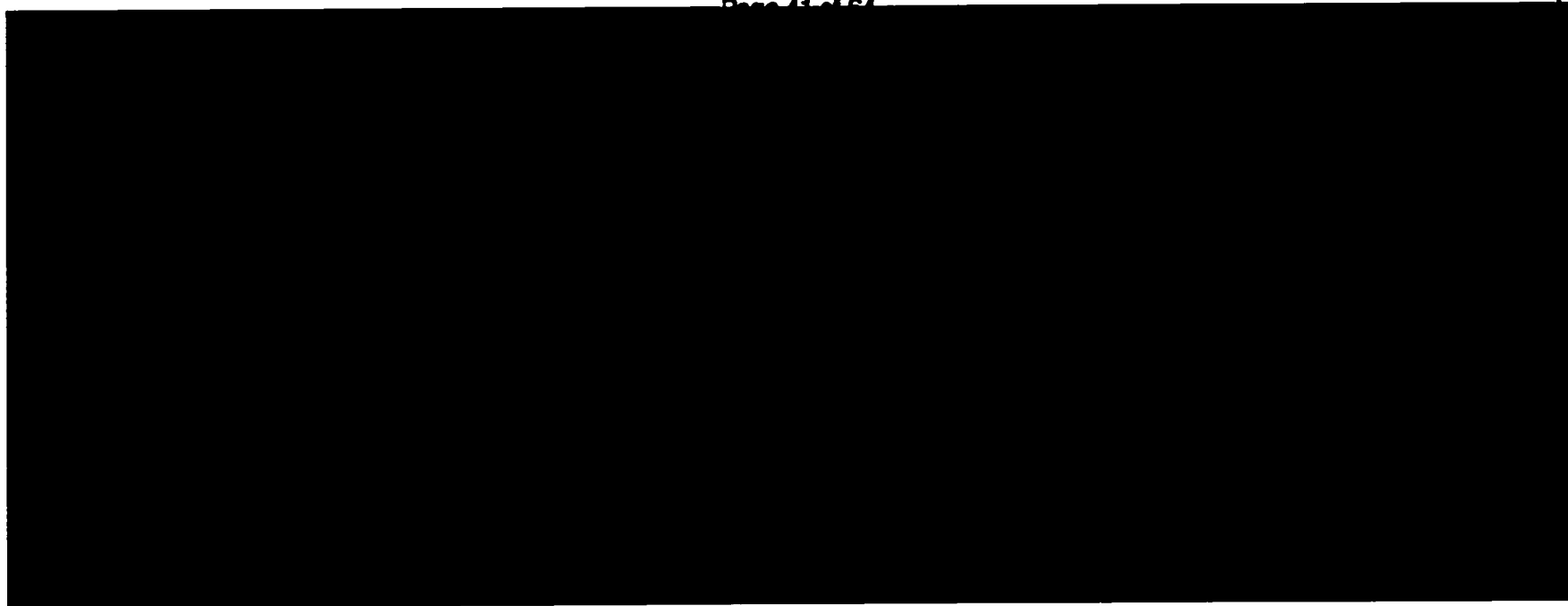


Table 3.7-2 Accident Sequence Descriptions
Page 42 of 64

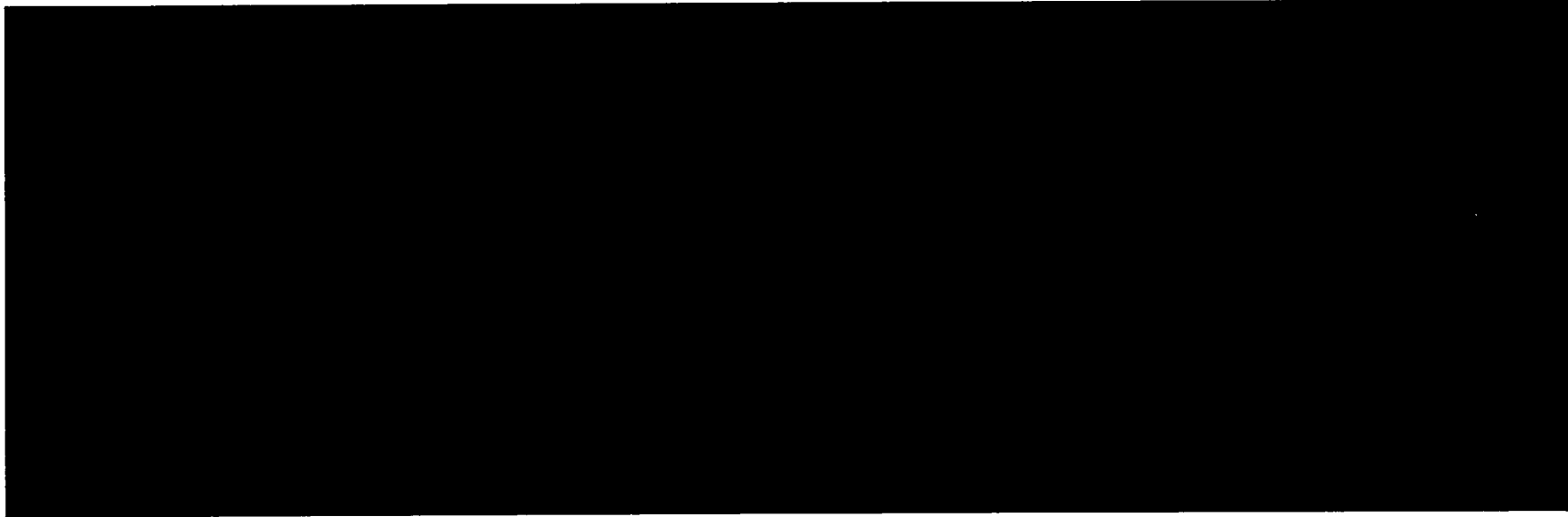


Table 3.7-2 Accident Sequence Descriptions

Page 43 of 64



Table 3.7-2 Accident Sequence Descriptions
Page 44 of 64

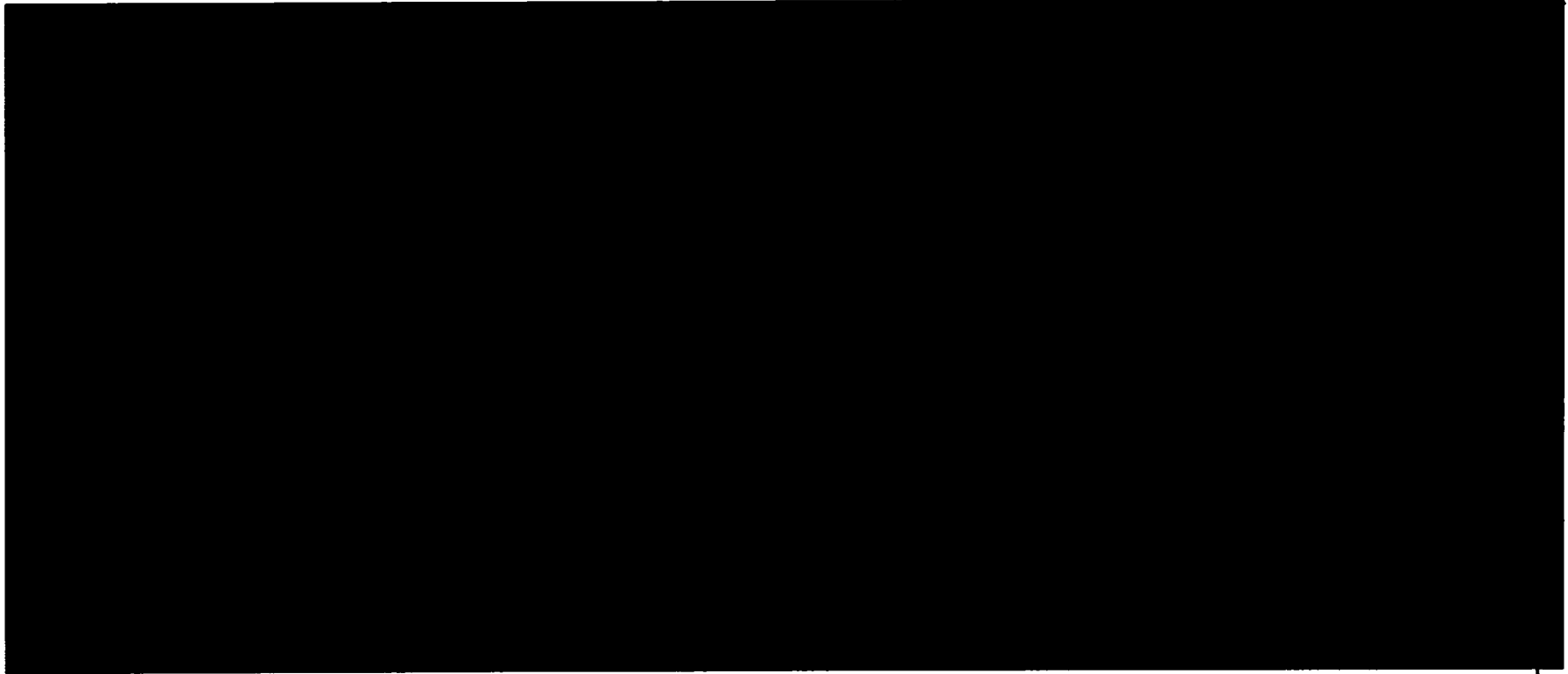


Table 3.7-2 Accident Sequence Descriptions

Page 45 of 64

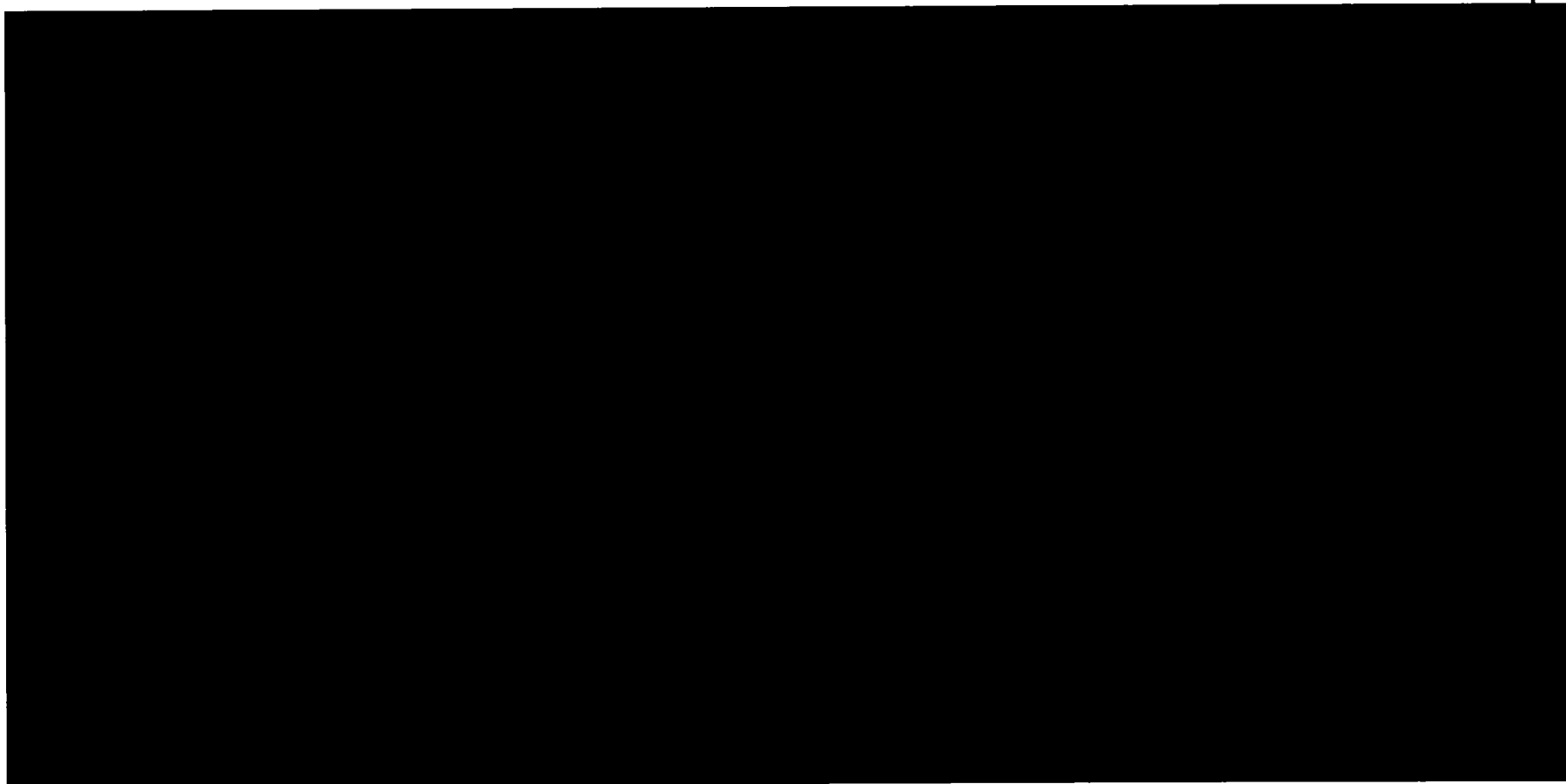


Table 3.7-2 Accident Sequence Descriptions
Page 46 of 64

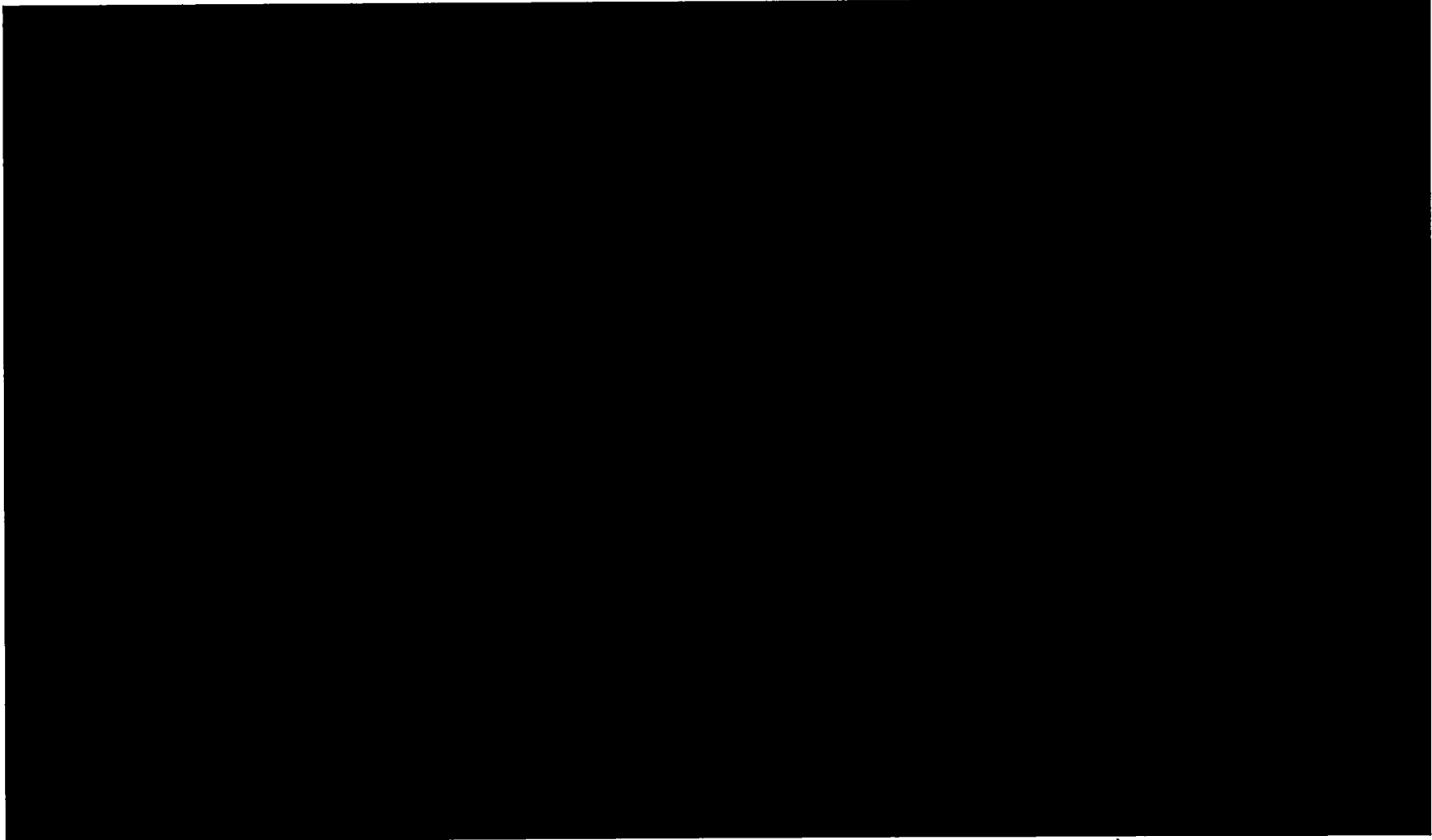


Table 3.7-2 Accident Sequence Descriptions

Page 47 of 64



Table 3.7-2 Accident Sequence Descriptions
Page 48 of 64

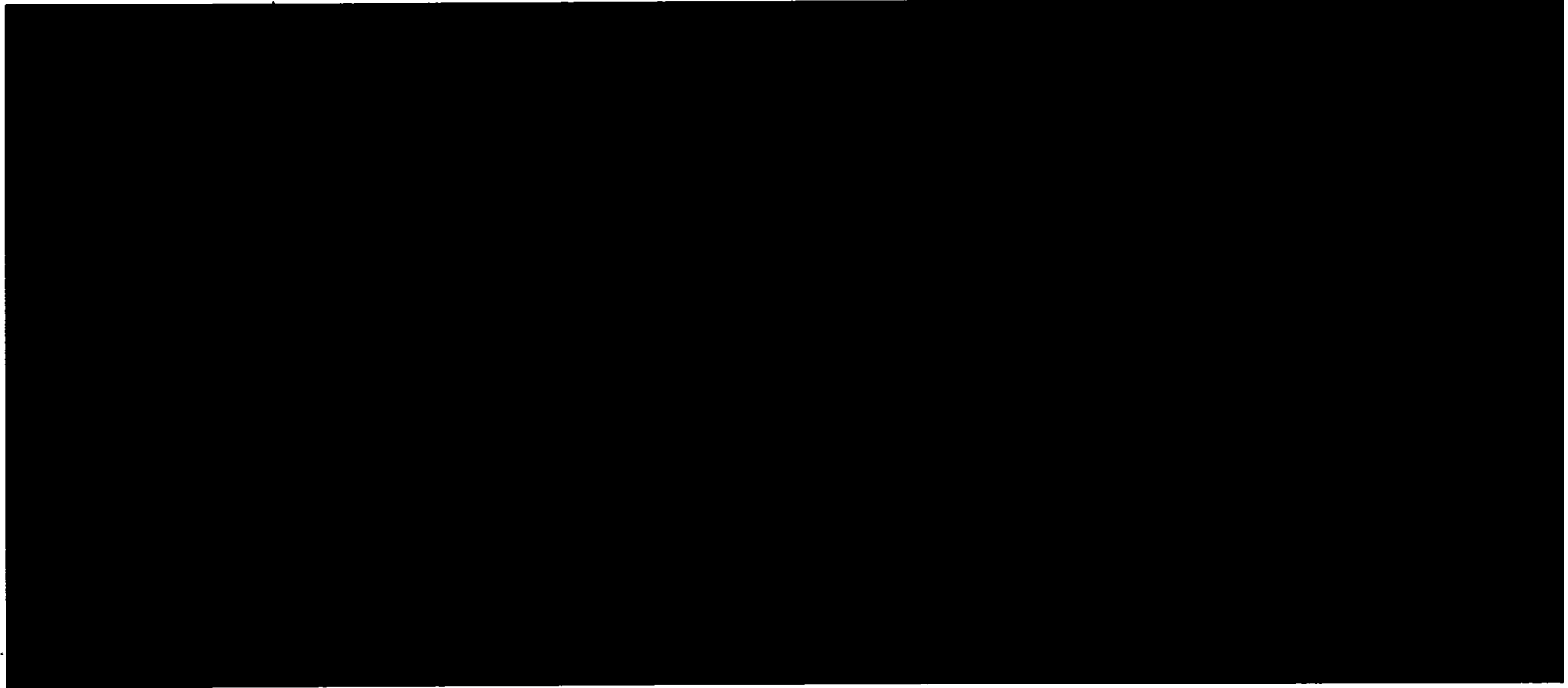


Table 3.7-2 Accident Sequence Descriptions

Page 49 of 64

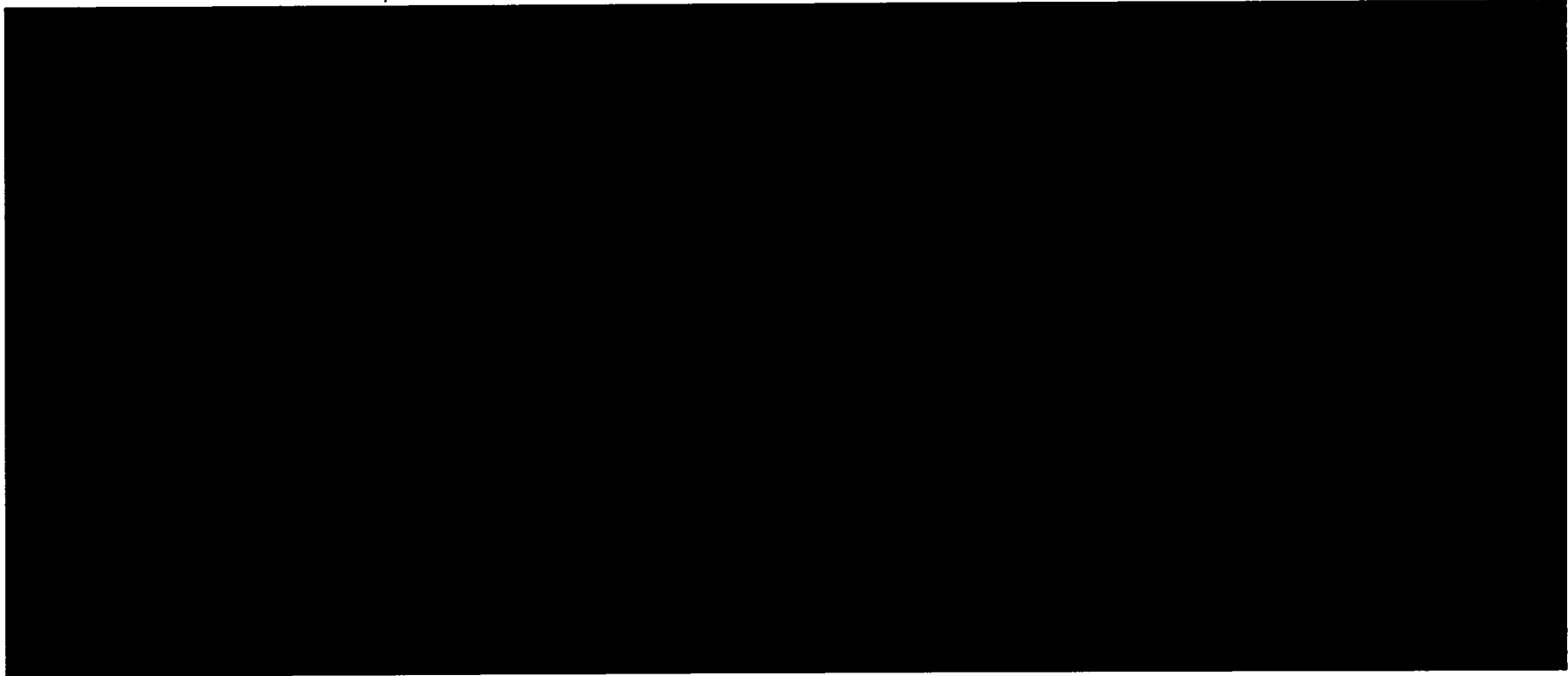


Table 3.7-2 Accident Sequence Descriptions

Page 50 of 64



Table 3.7-2 Accident Sequence Descriptions
Page 51 of 64

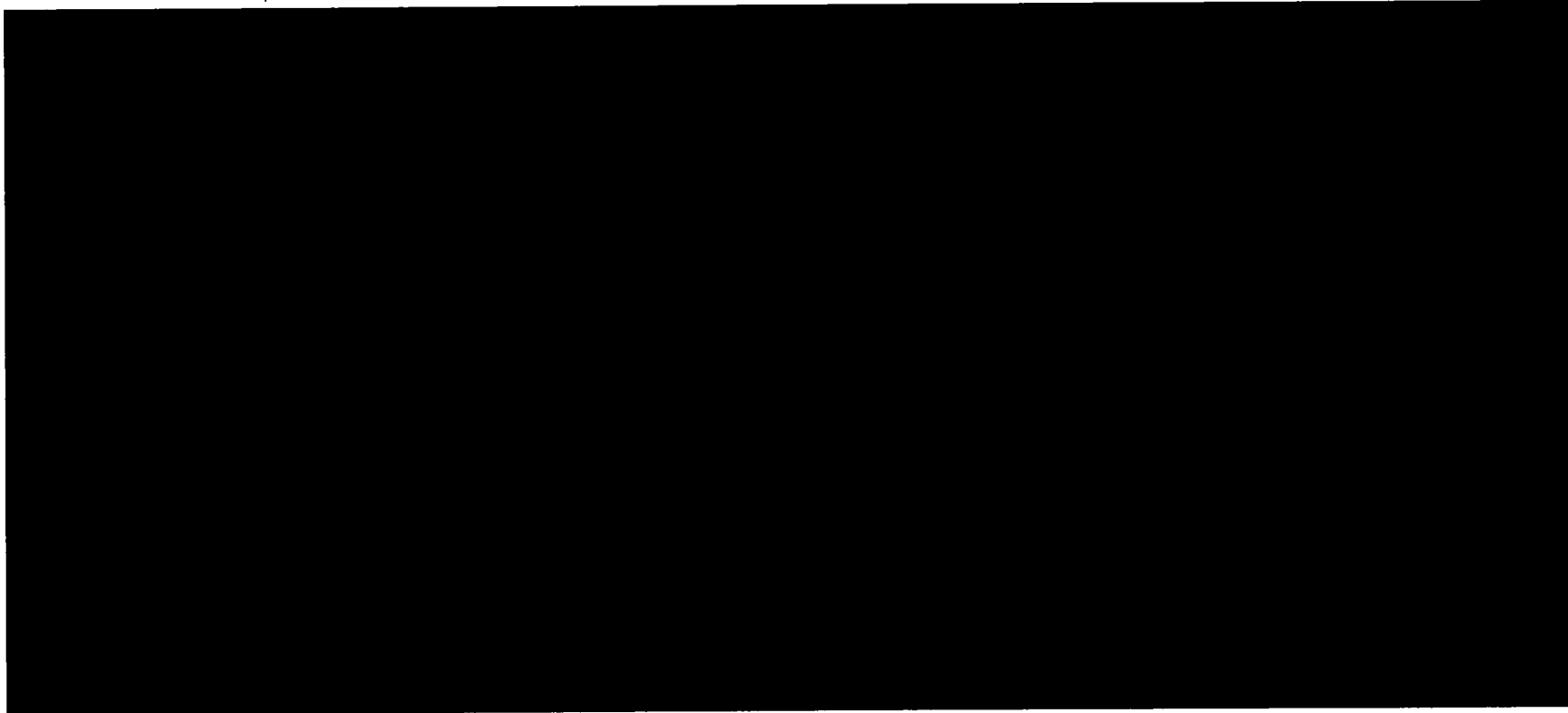


Table 3.7-2 Accident Sequence Descriptions
Page 52 of 64

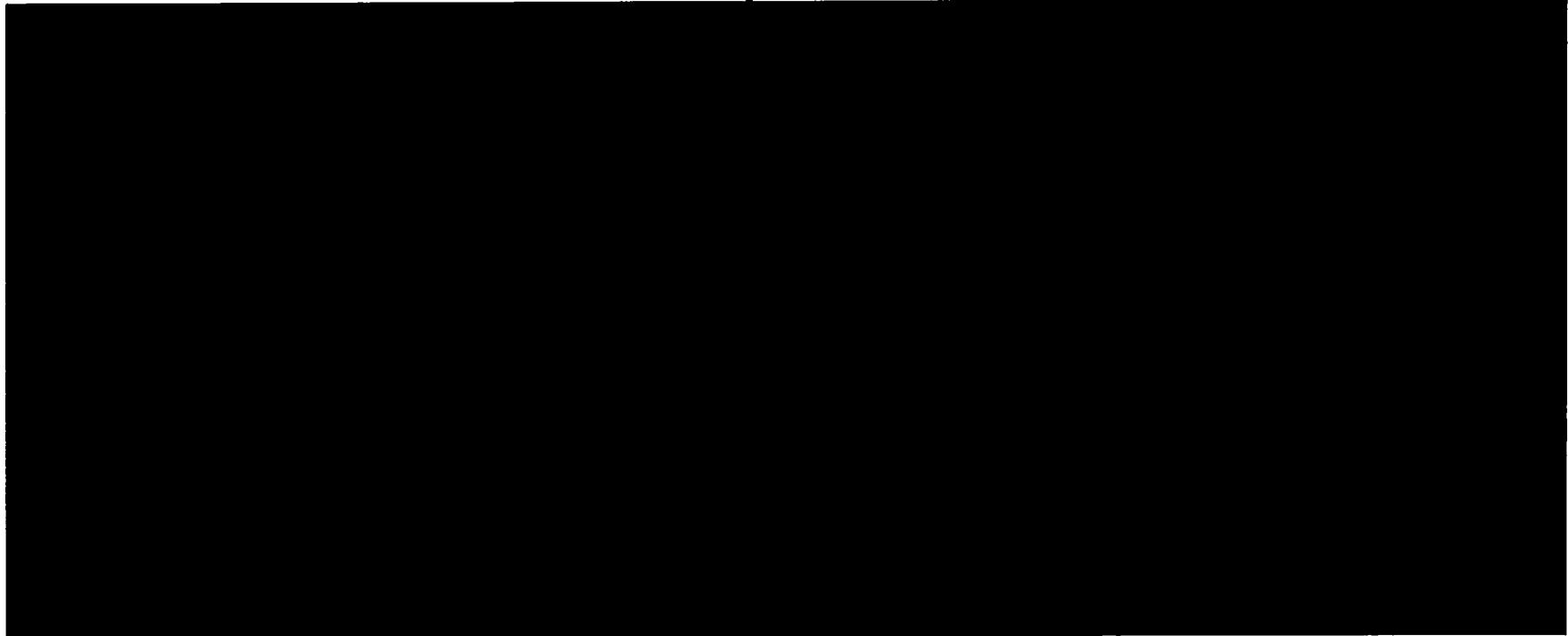


Table 3.7-2 Accident Sequence Descriptions

Page 53 of 64

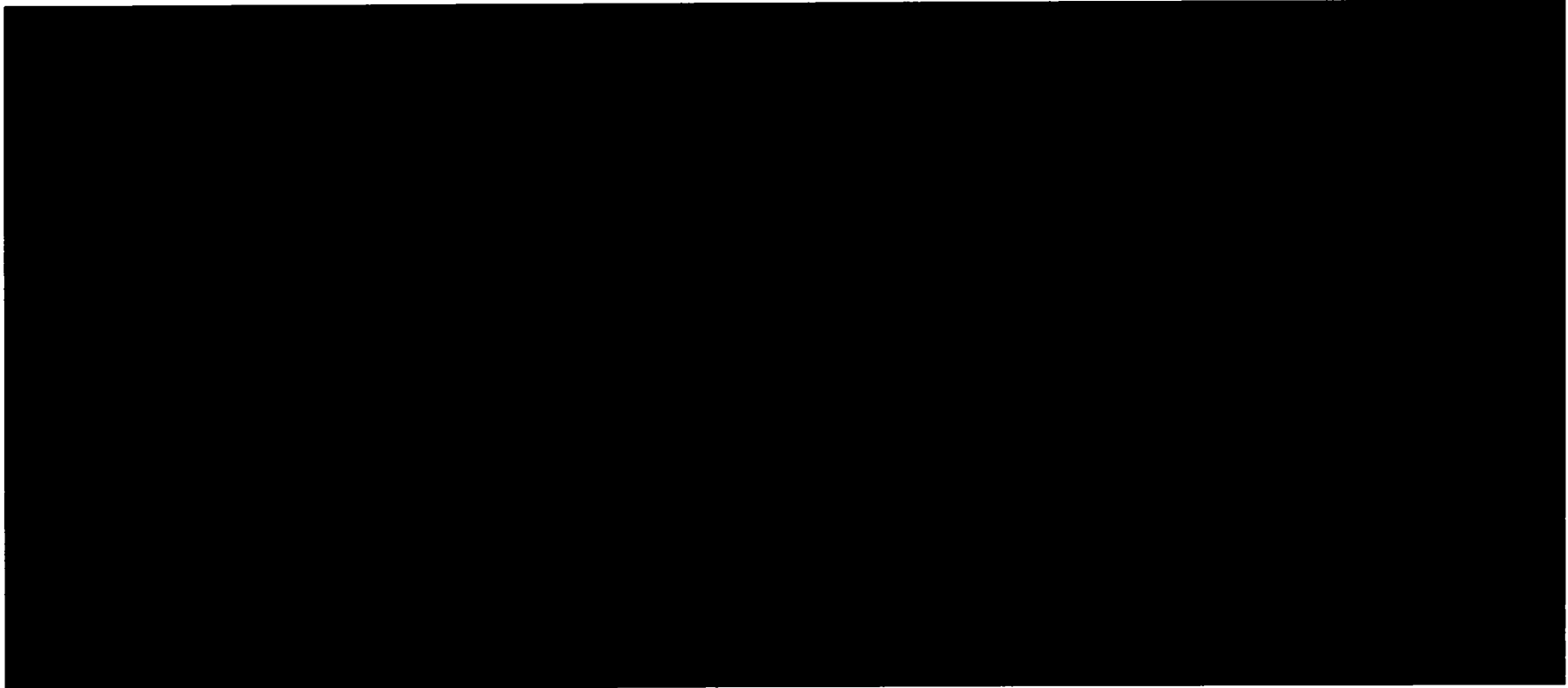


Table 3.7-2 Accident Sequence Descriptions
Page 54 of 64

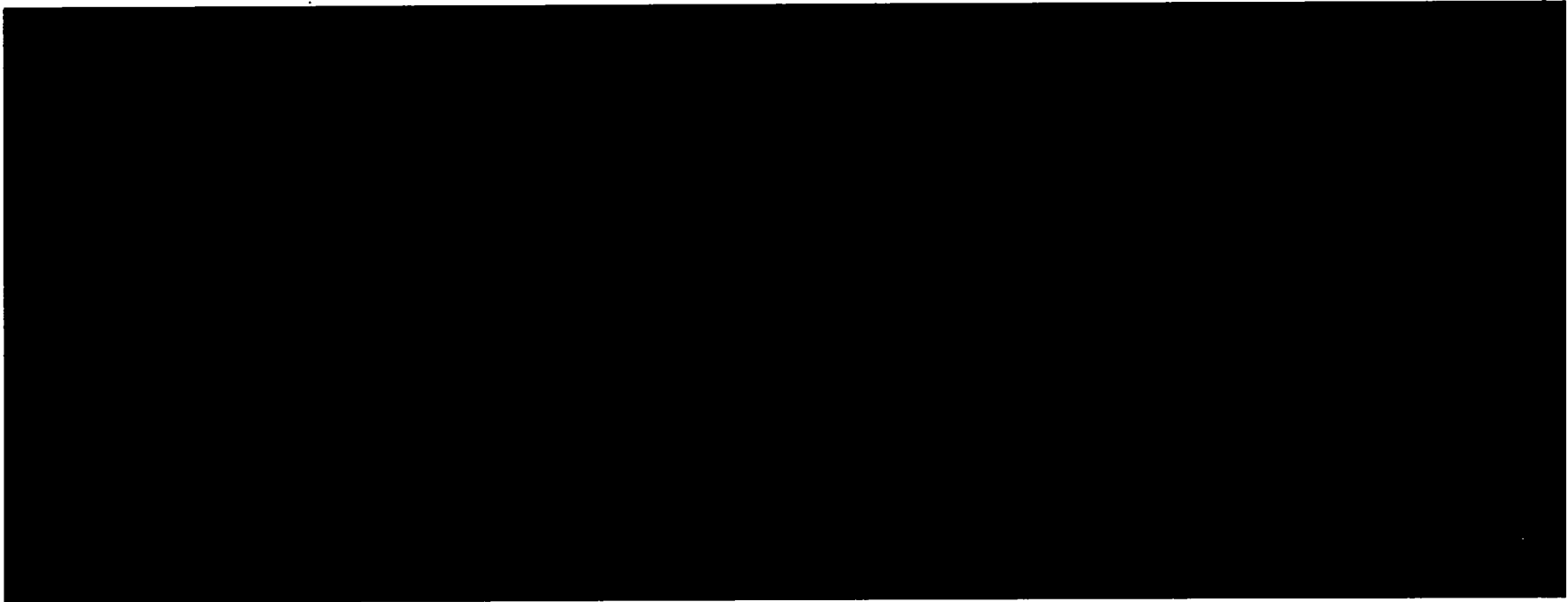


Table 3.7-2 Accident Sequence Descriptions

Page 55 of 64

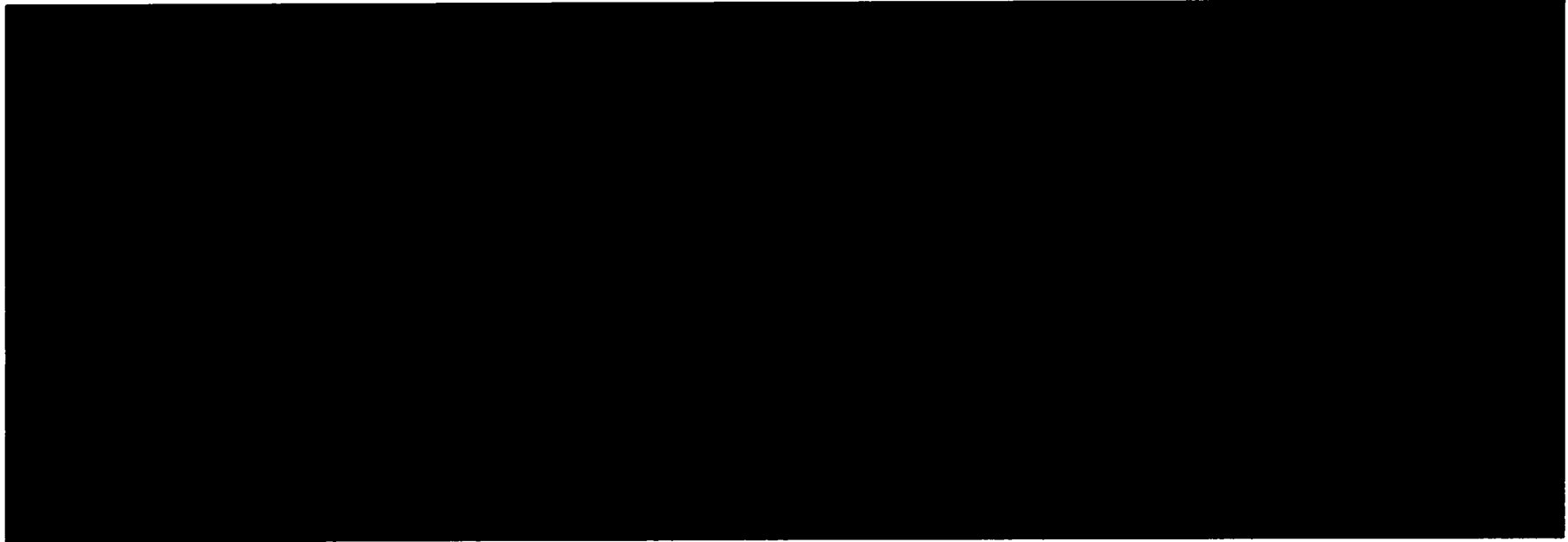


Table 3.7-2 Accident Sequence Descriptions

Page 56 of 64

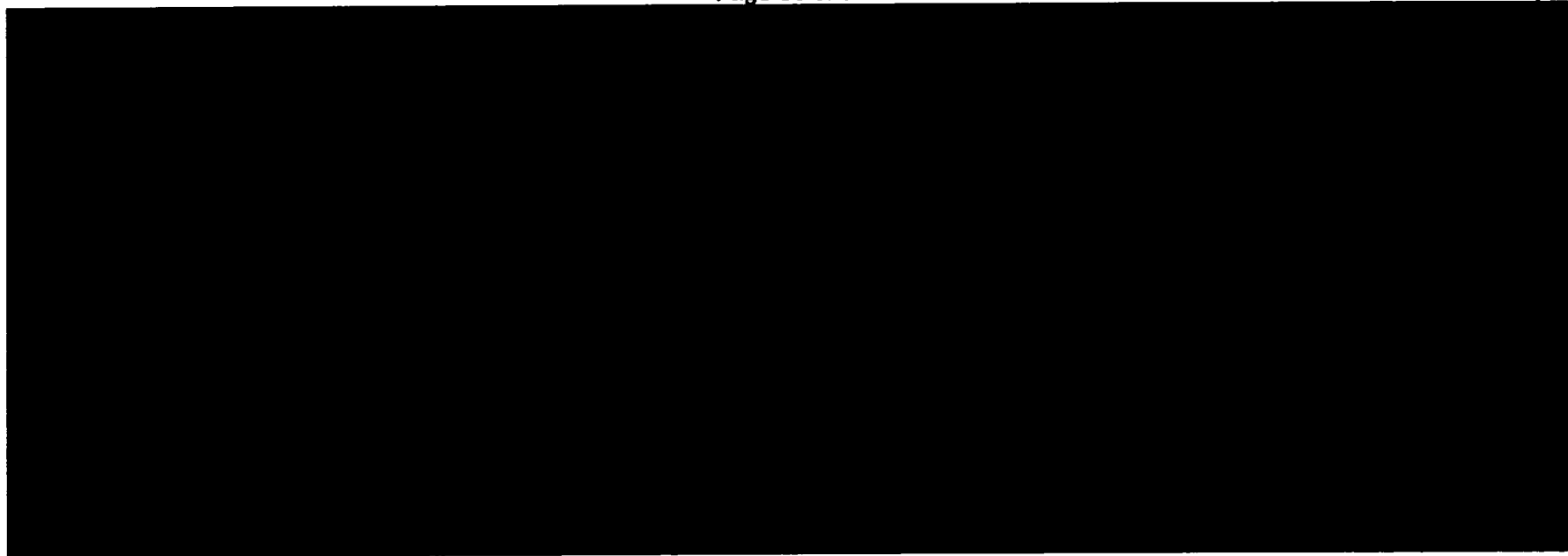


Table 3.7-2 Accident Sequence Descriptions

Page 57 of 64

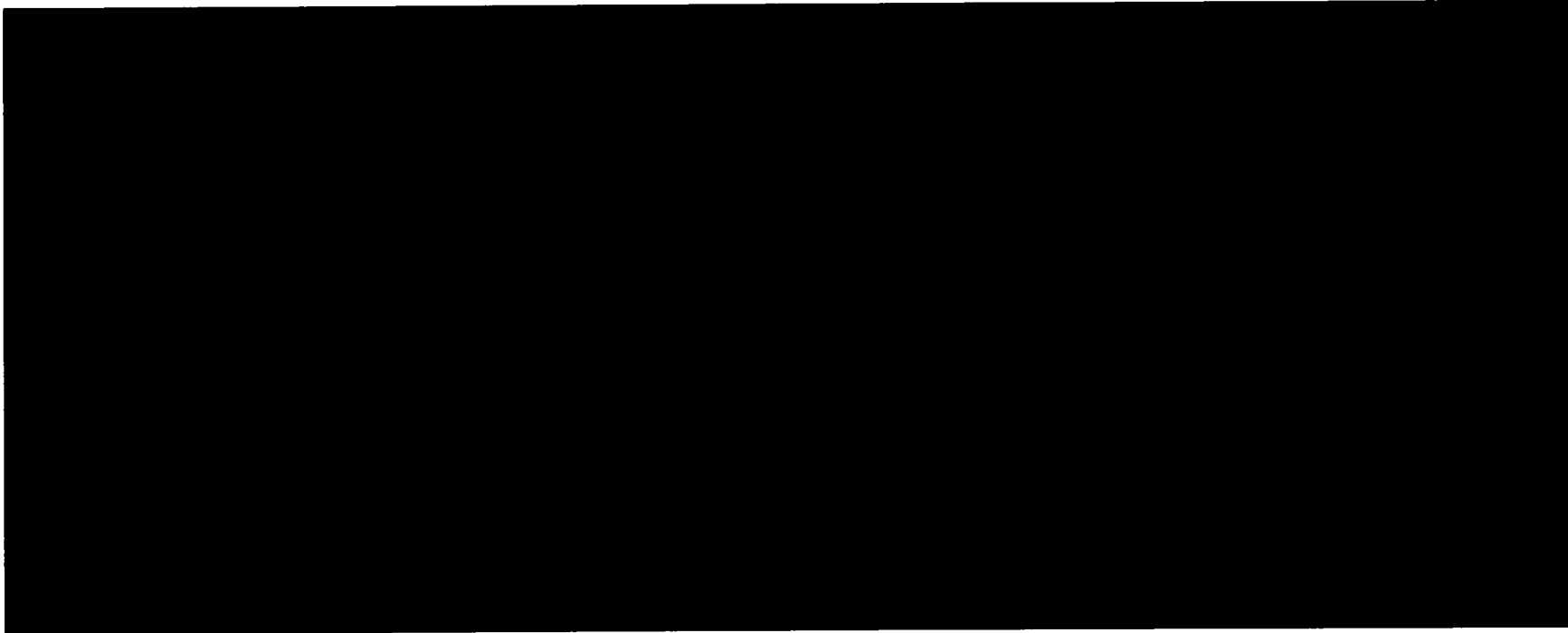


Table 3.7-2 Accident Sequence Descriptions
Page 58 of 64

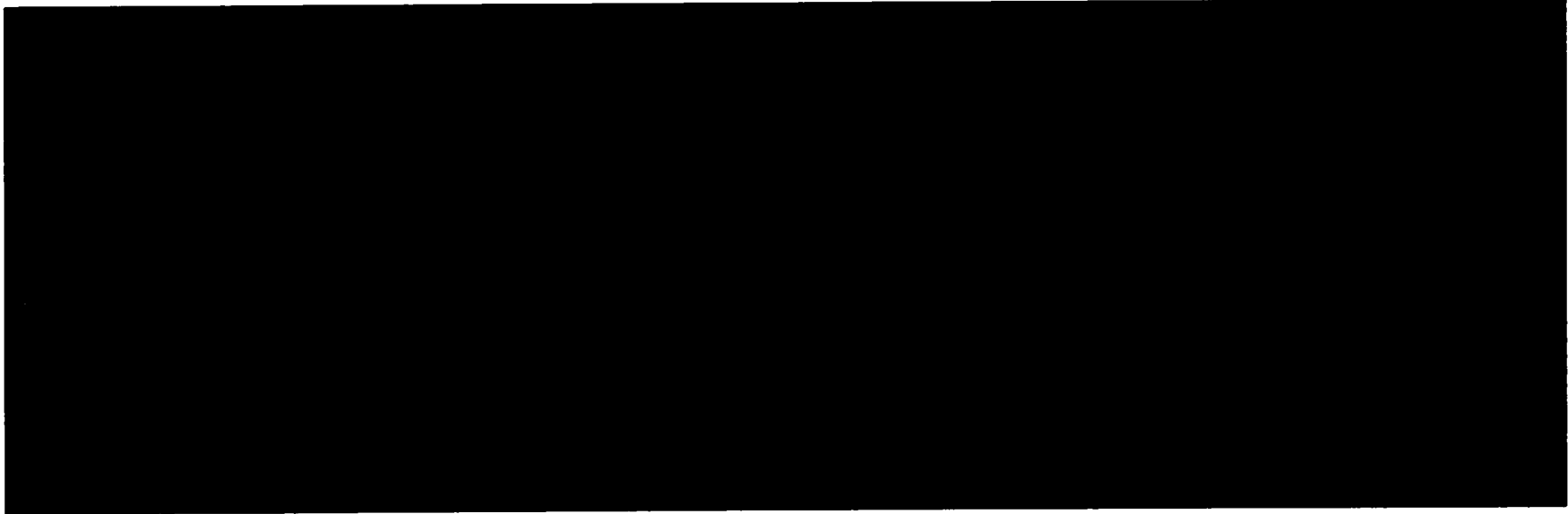


Table 3.7-2 Accident Sequence Descriptions

Page 59 of 64

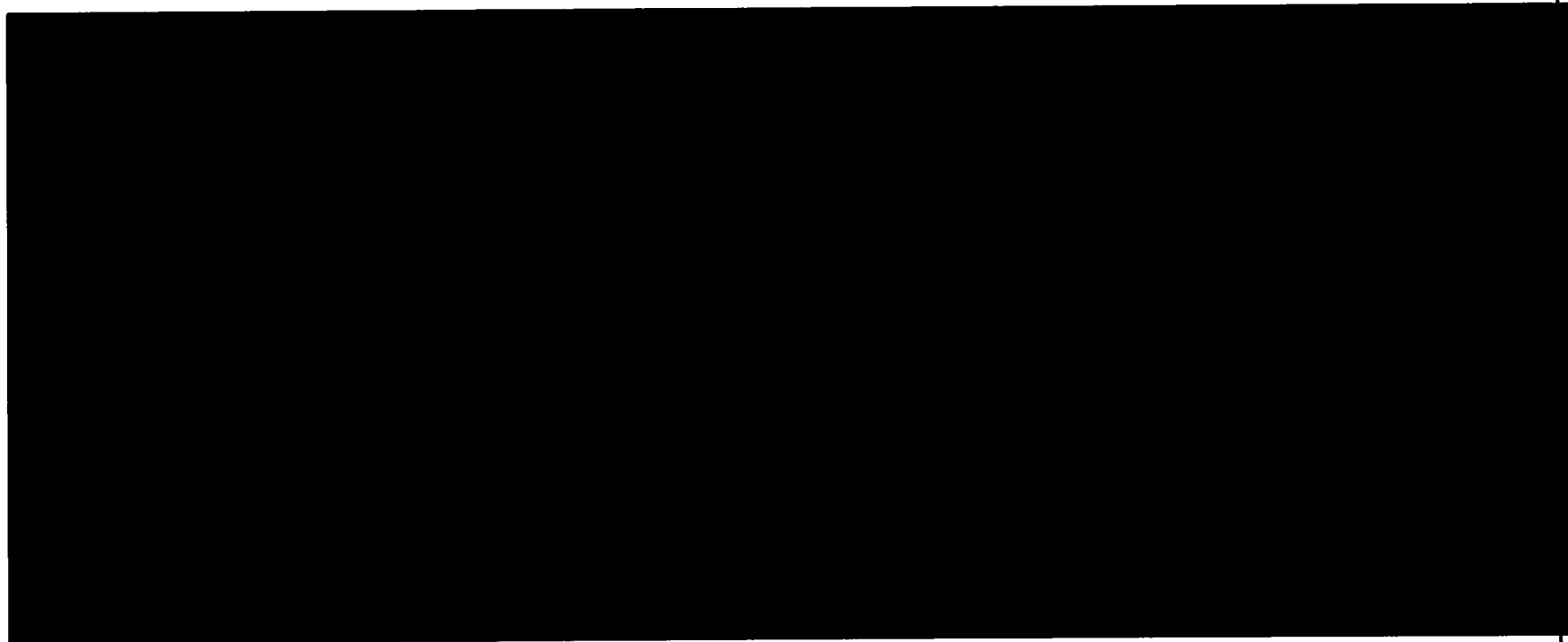


Table 3.7-2 Accident Sequence Descriptions

Page 60 of 64

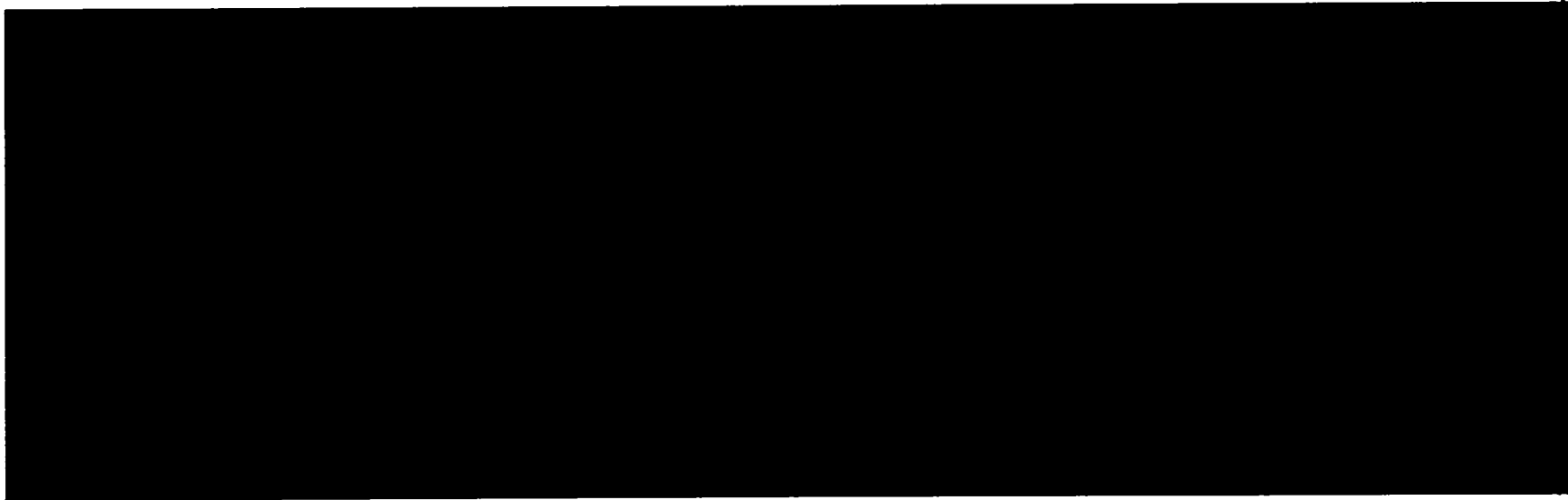


Table 3.7-2 Accident Sequence Descriptions
Page 61 of 64

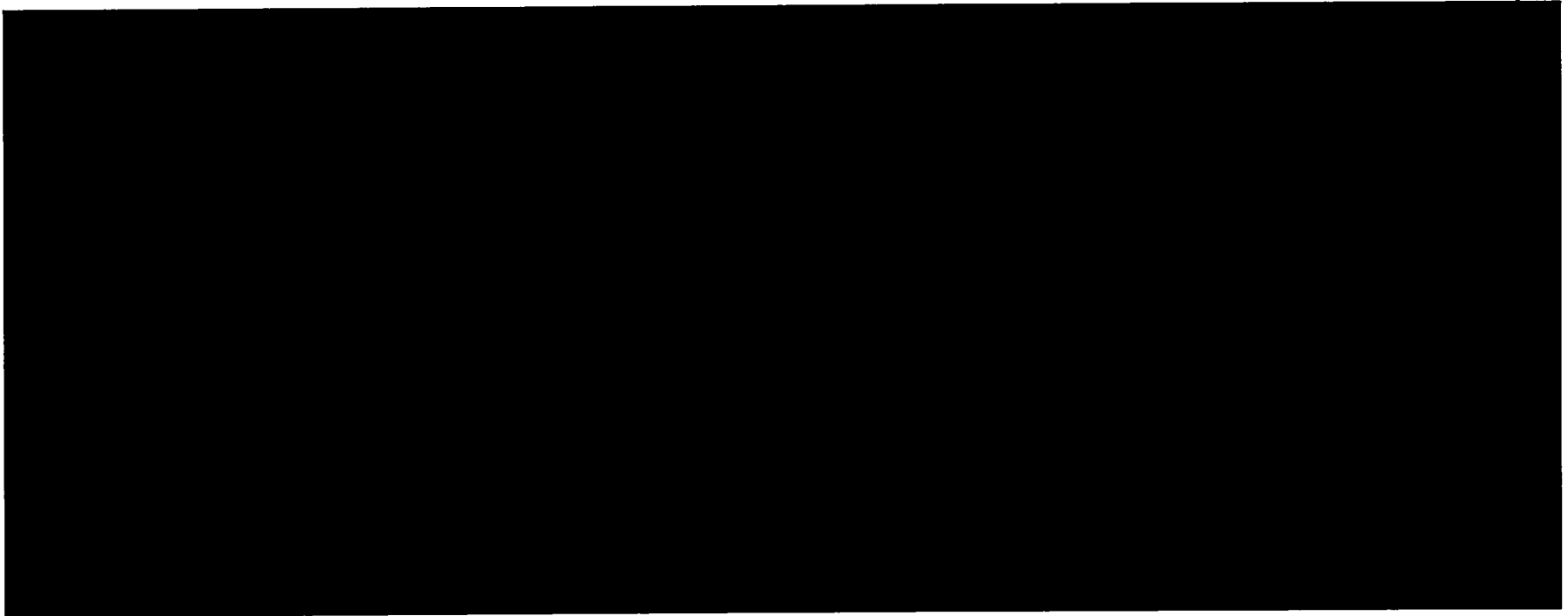


Table 3.7-2 Accident Sequence Descriptions
Page 62 of 64

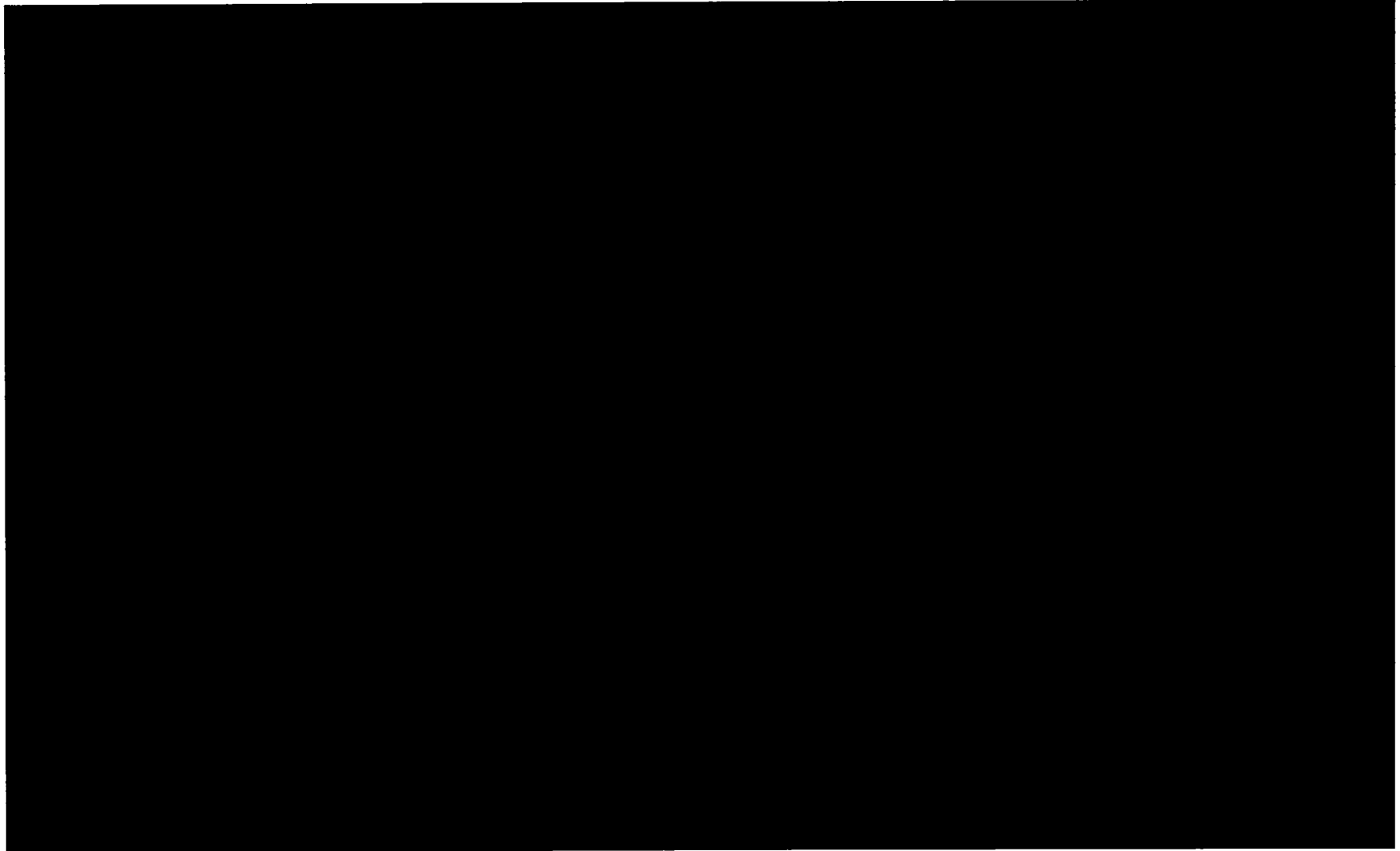


Table 3.7-2 Accident Sequence Descriptions

Page 63 of 64

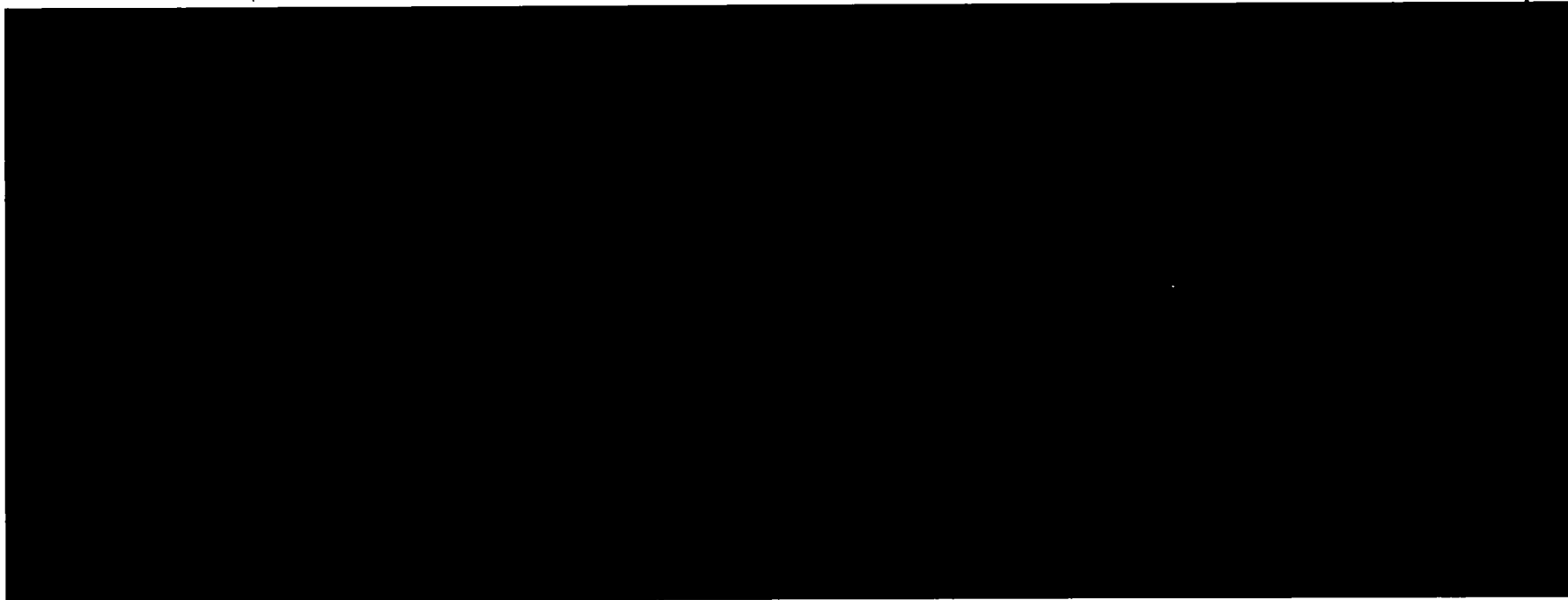


Table 3.7-2 Accident Sequence Descriptions
Page 64 of 64

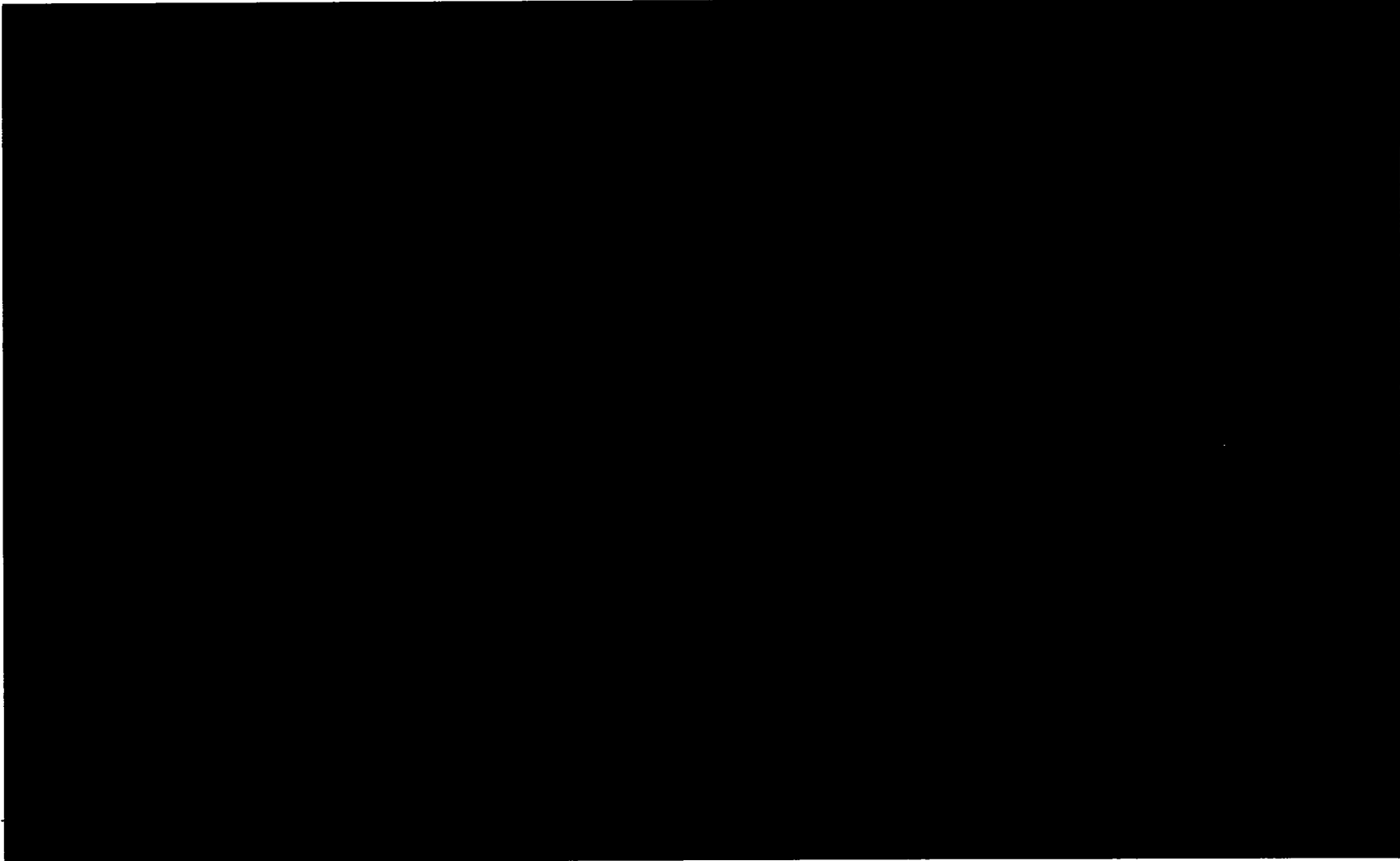


Table 3.7-3 External Events and Fire Accident Sequences And Risk Index
Page 1 of 8

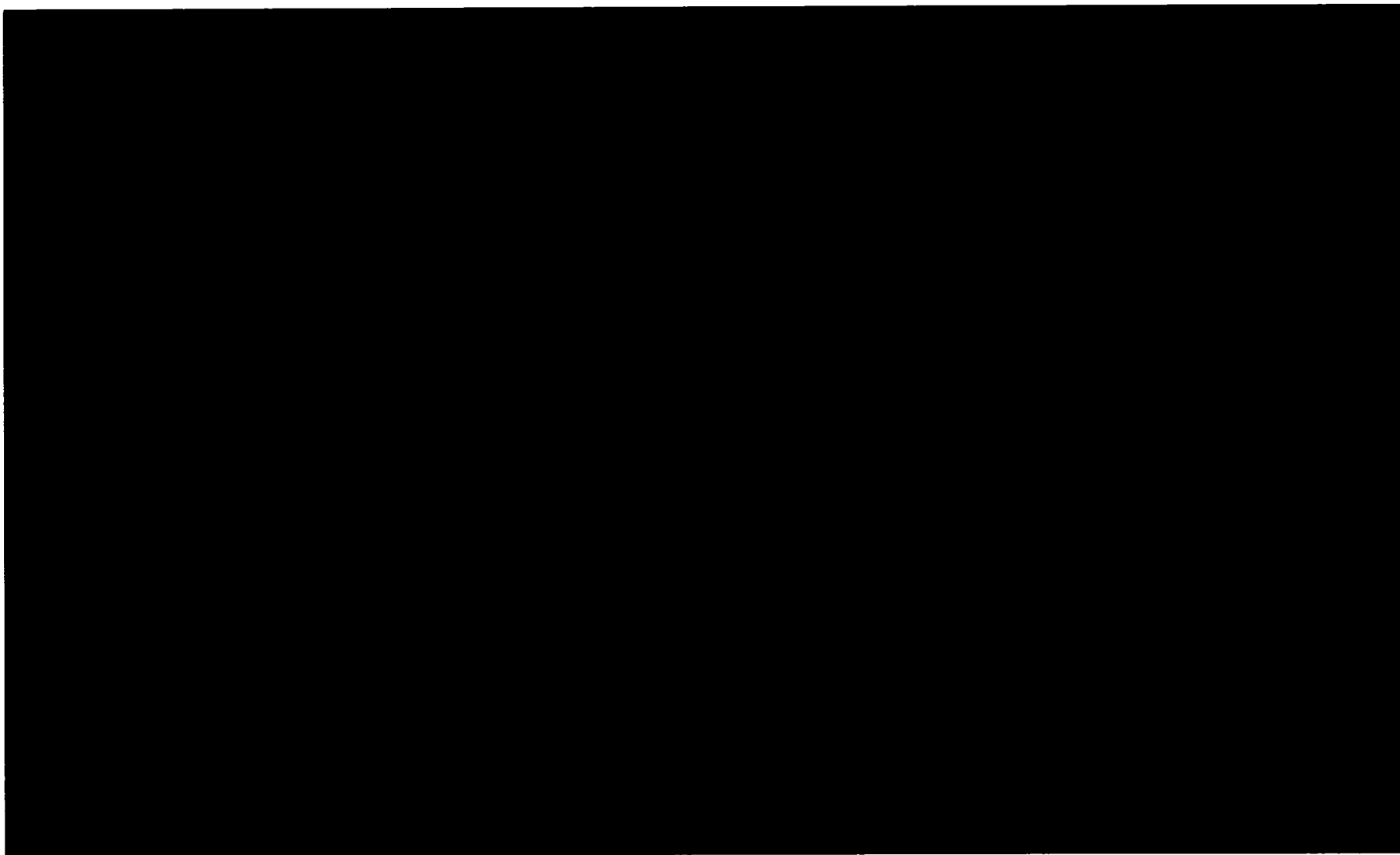


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index

Page 2 of 8

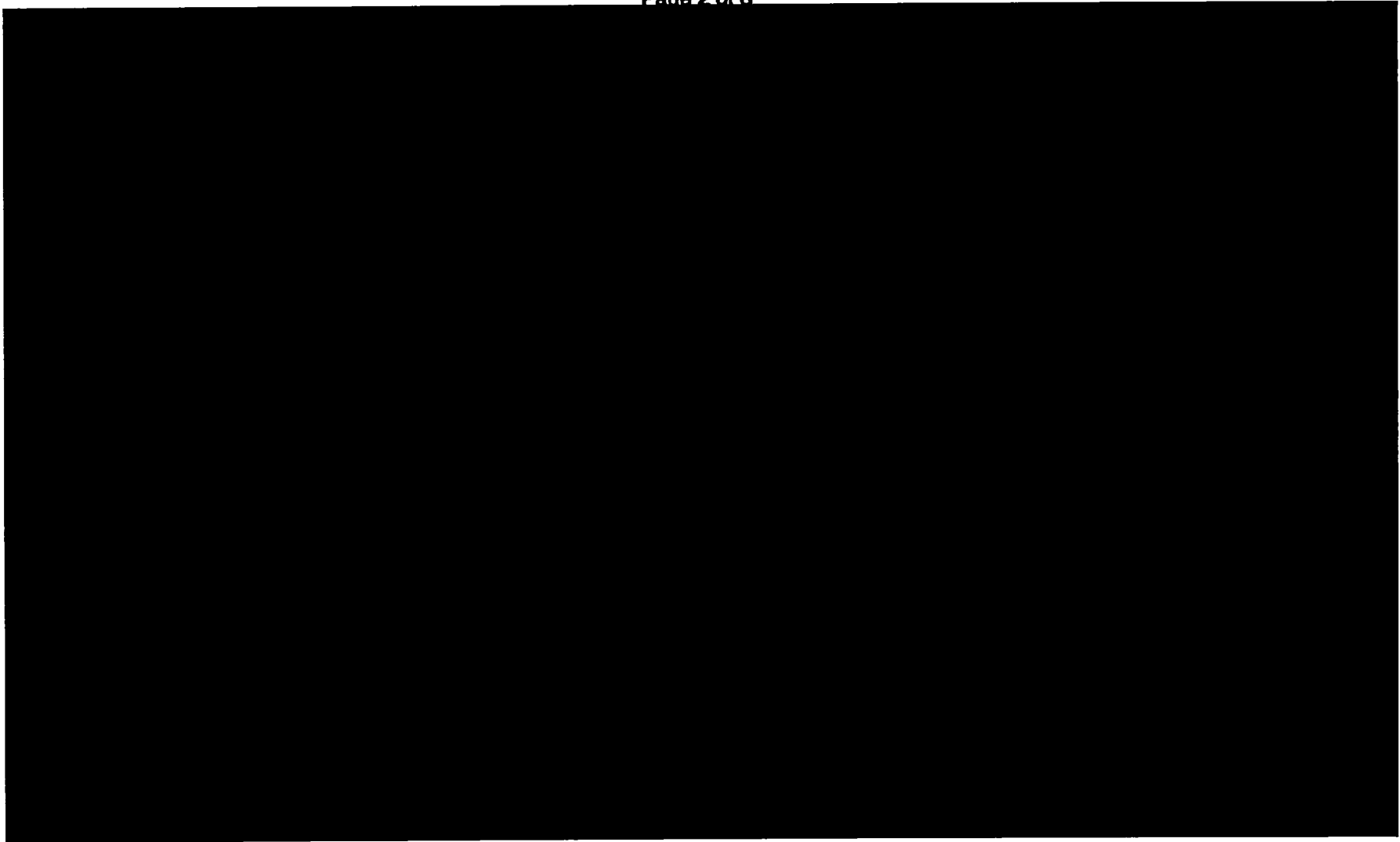


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index

Page 3 of 8

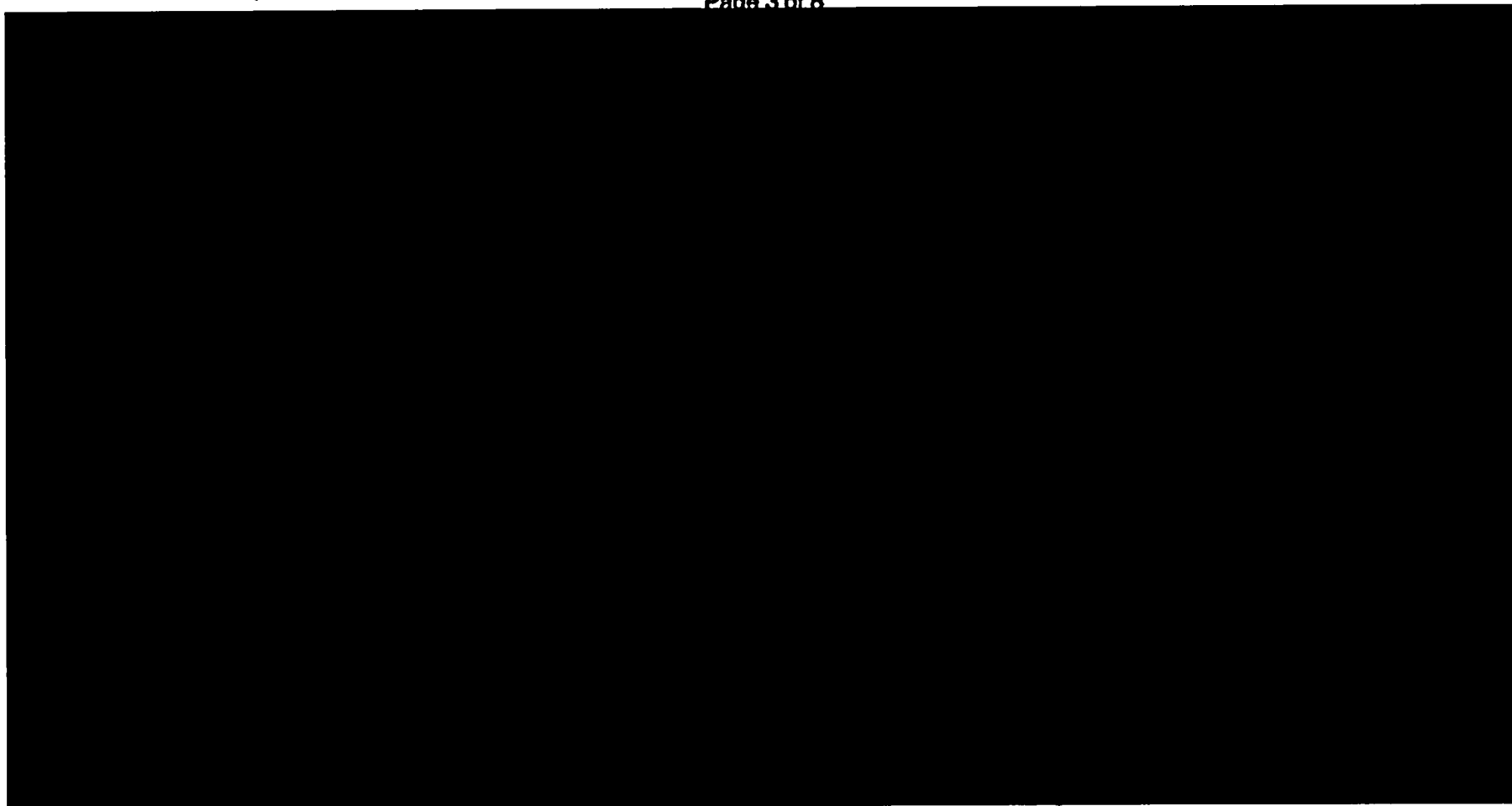


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index
Page 4 of 8

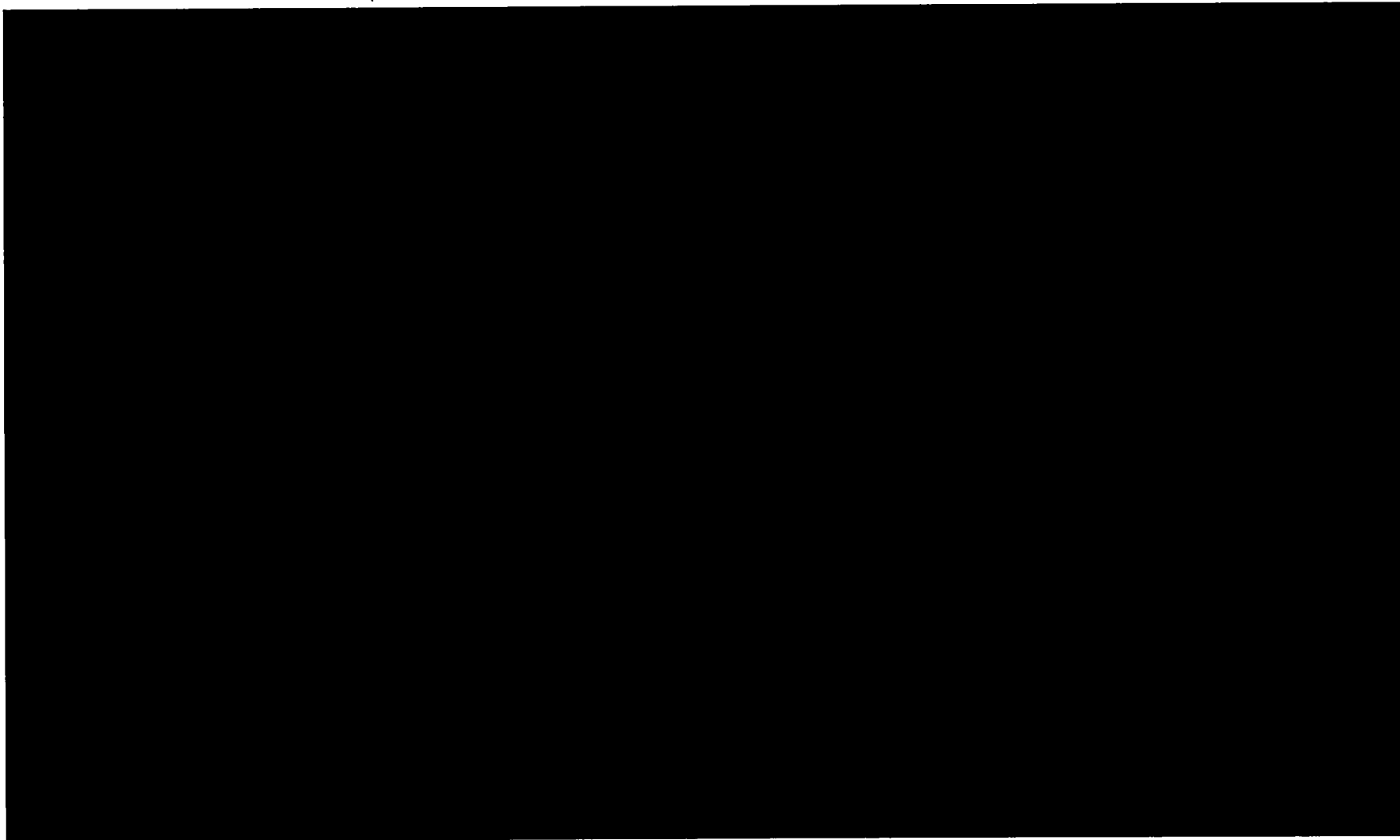


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index
Page 5 of 8

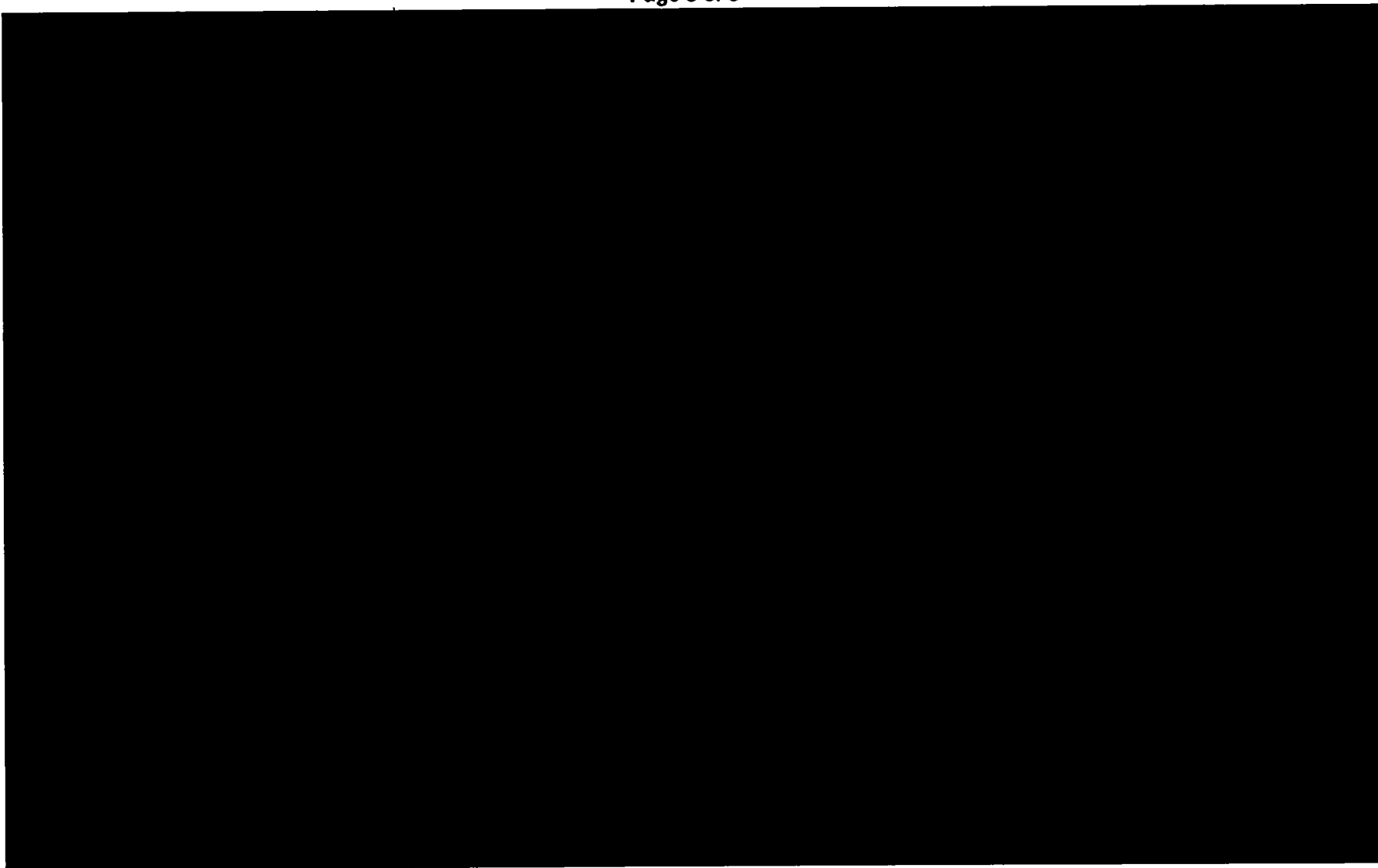


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index
Page 6 of 8

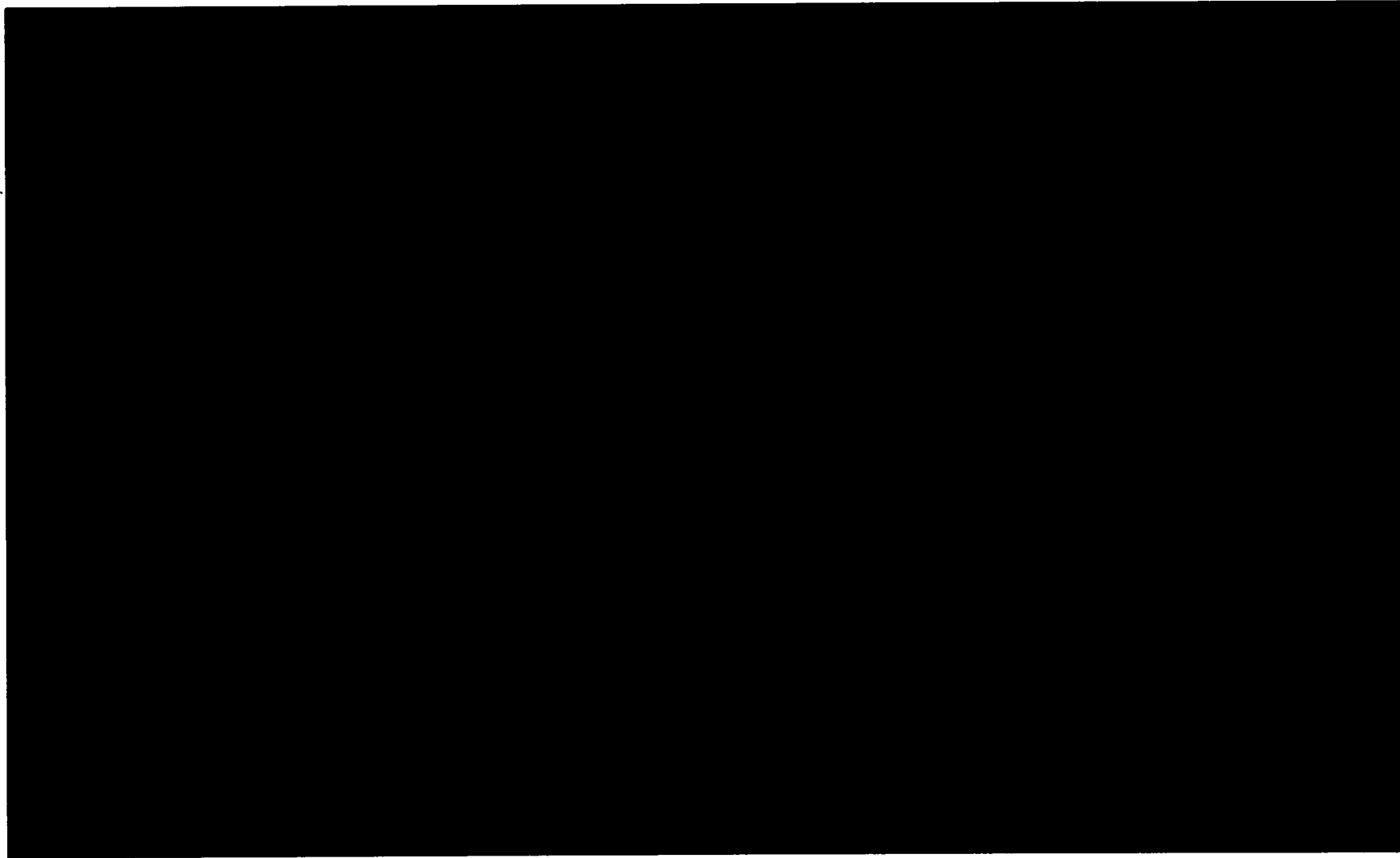


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index
Page 7 of 8

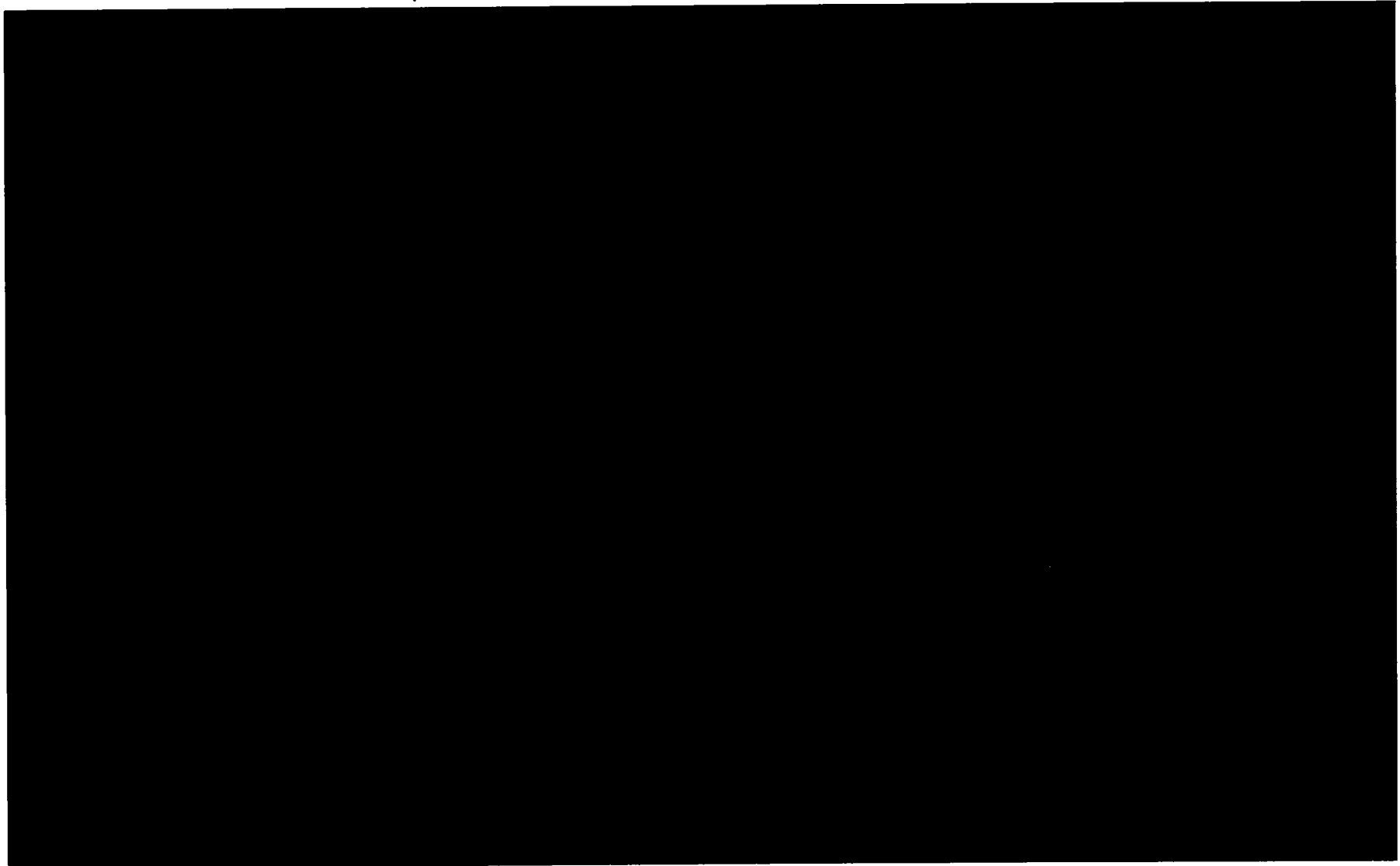


Table 3.7-3 External Events And Fire Accident Sequences And Risk Index
Page 8 of 8

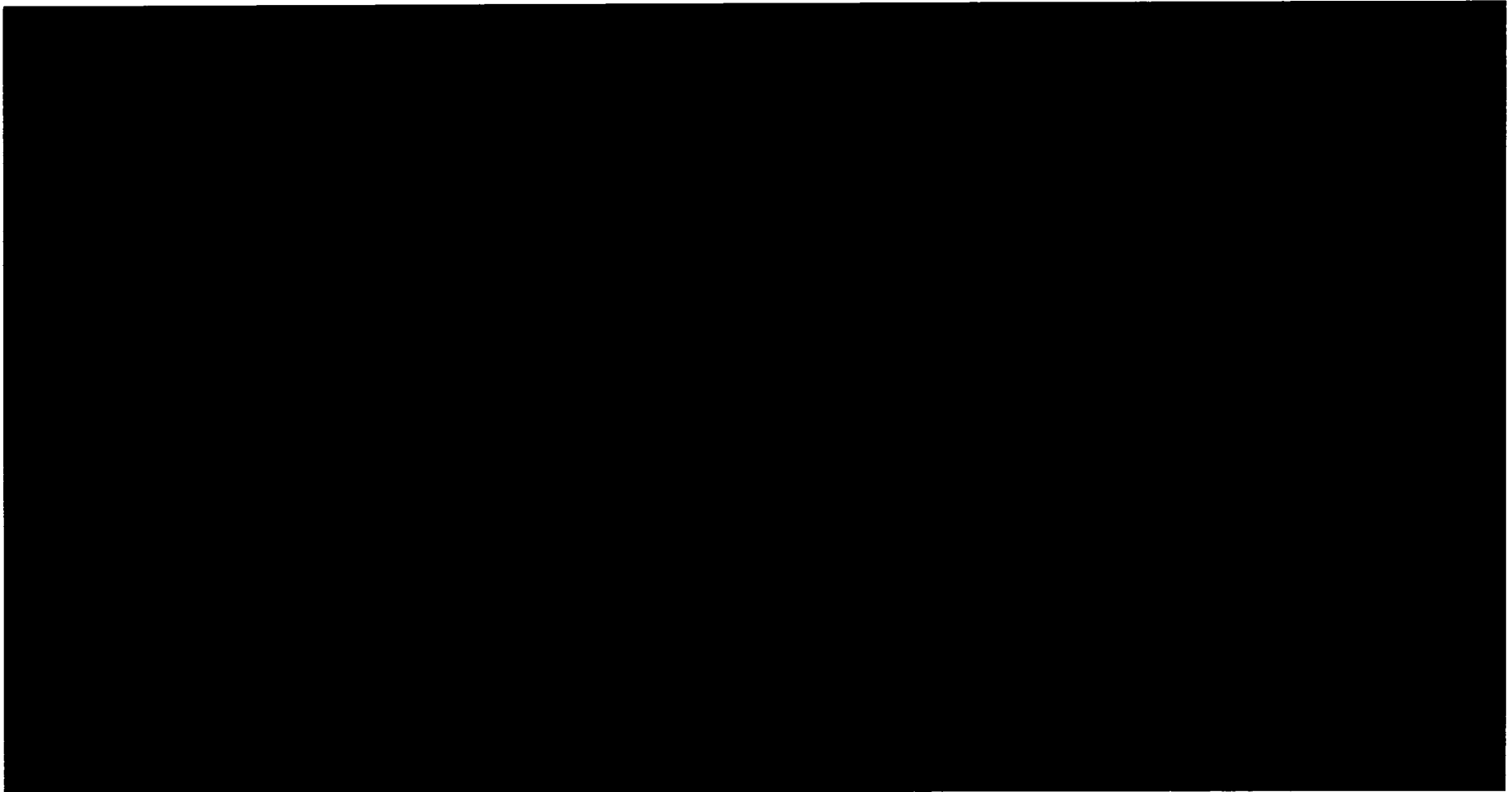


Table 3.7-4 External Events and Fire Accident Descriptions

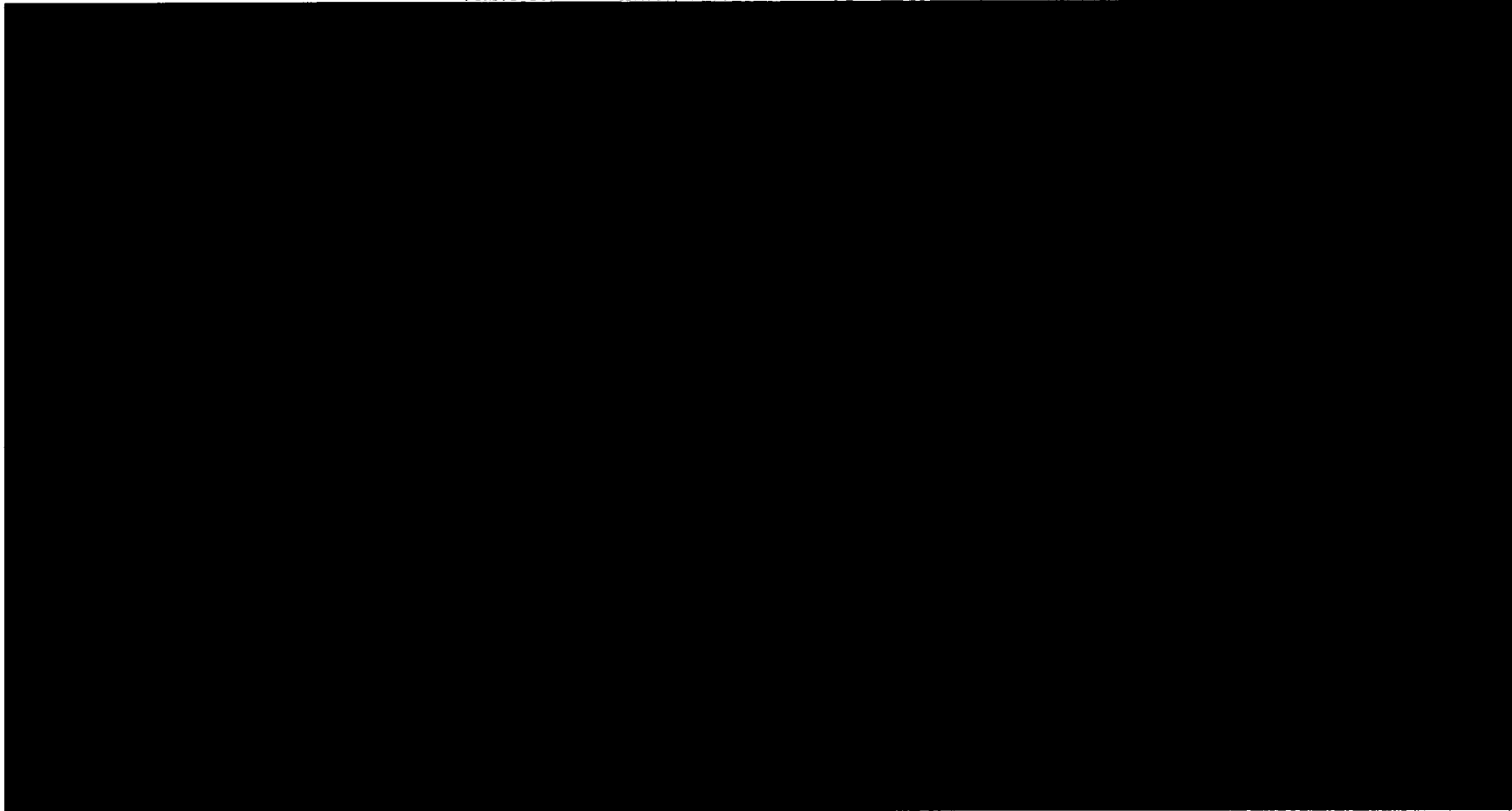


Table 3.7-4 External Events and Fire Accident Descriptions
Page 2 of 35

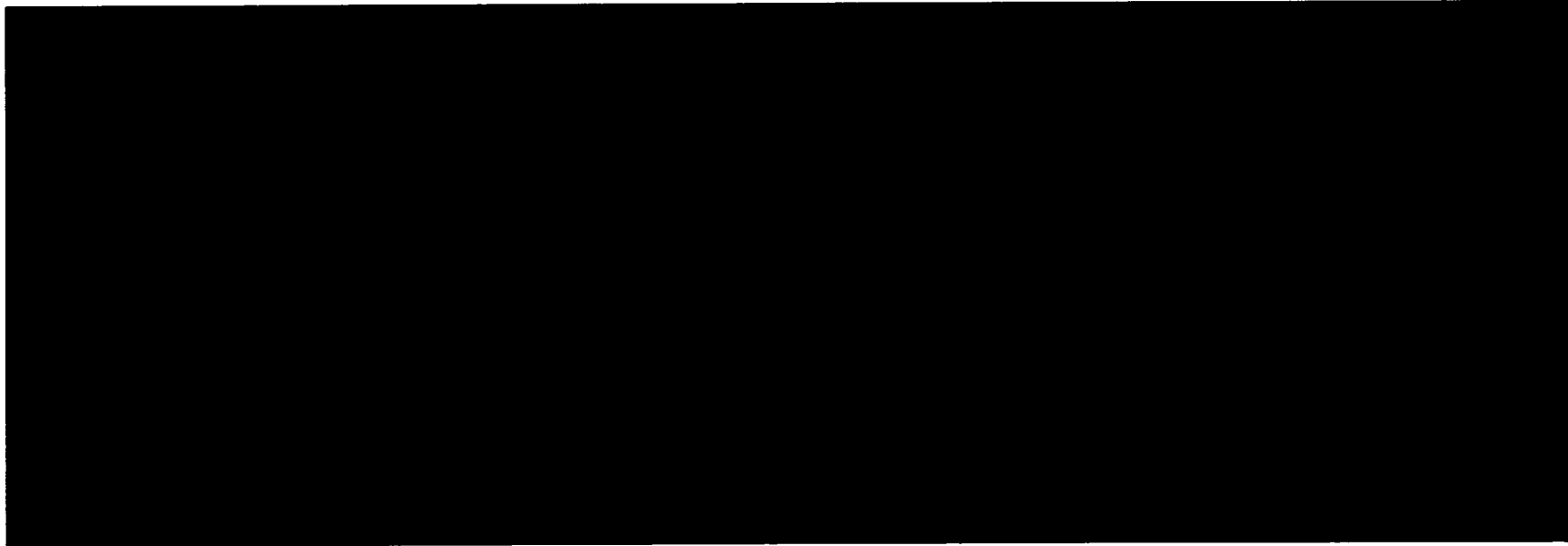


Type of Accident – T for Chemical
CR for Criticality

NEF ISA Summary

Revision 4, April 2005

Table 3.7-4 External Events and Fire Accident Descriptions
Page 3 of 35



Type of Accident – T for Chemical
CR for Criticality

Table 3.7-4 External Events and Fire Accident Descriptions
Page 4 of 35

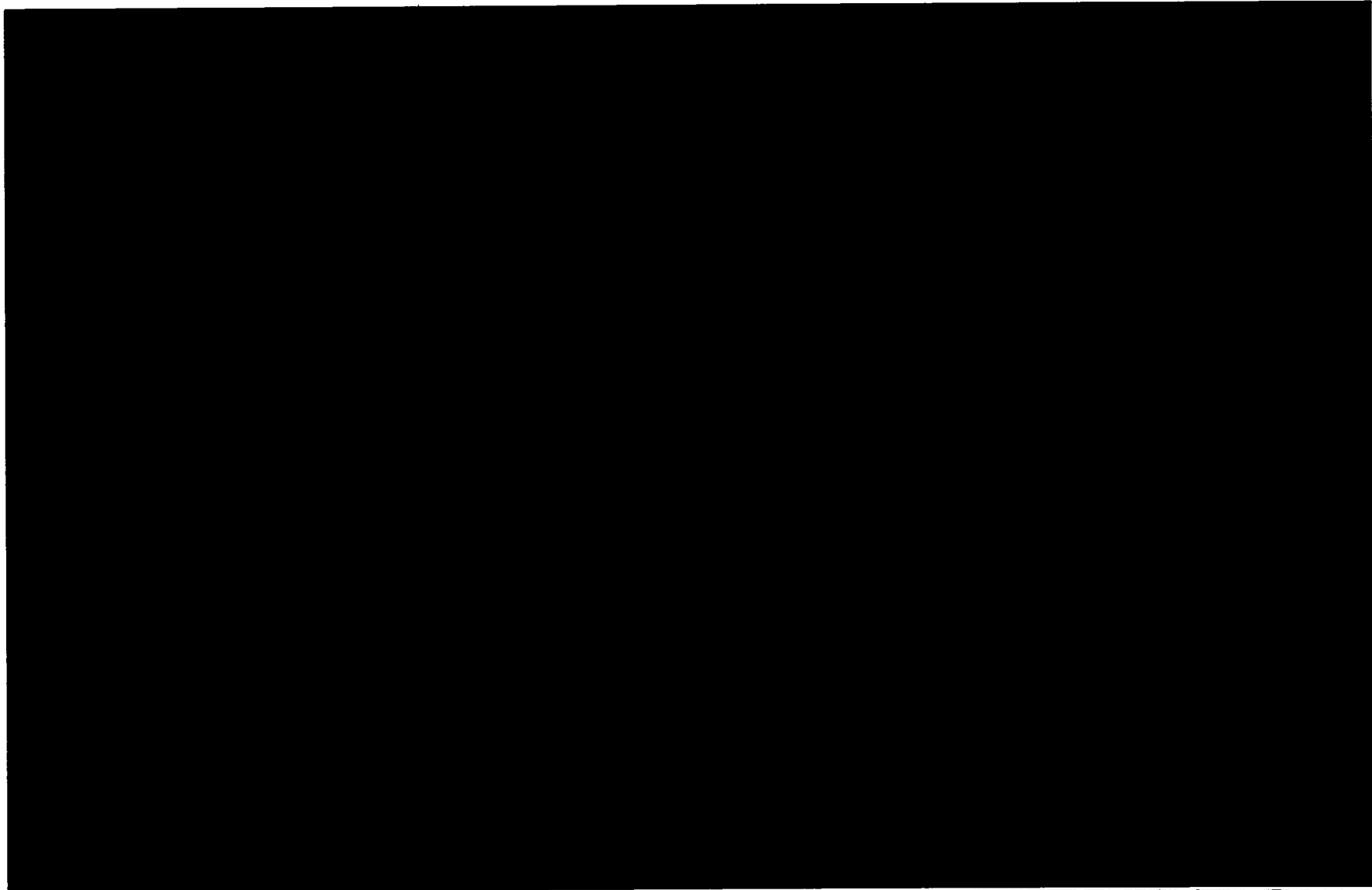


Table 3.7-4 External Events and Fire Accident Descriptions
Page 5 of 35

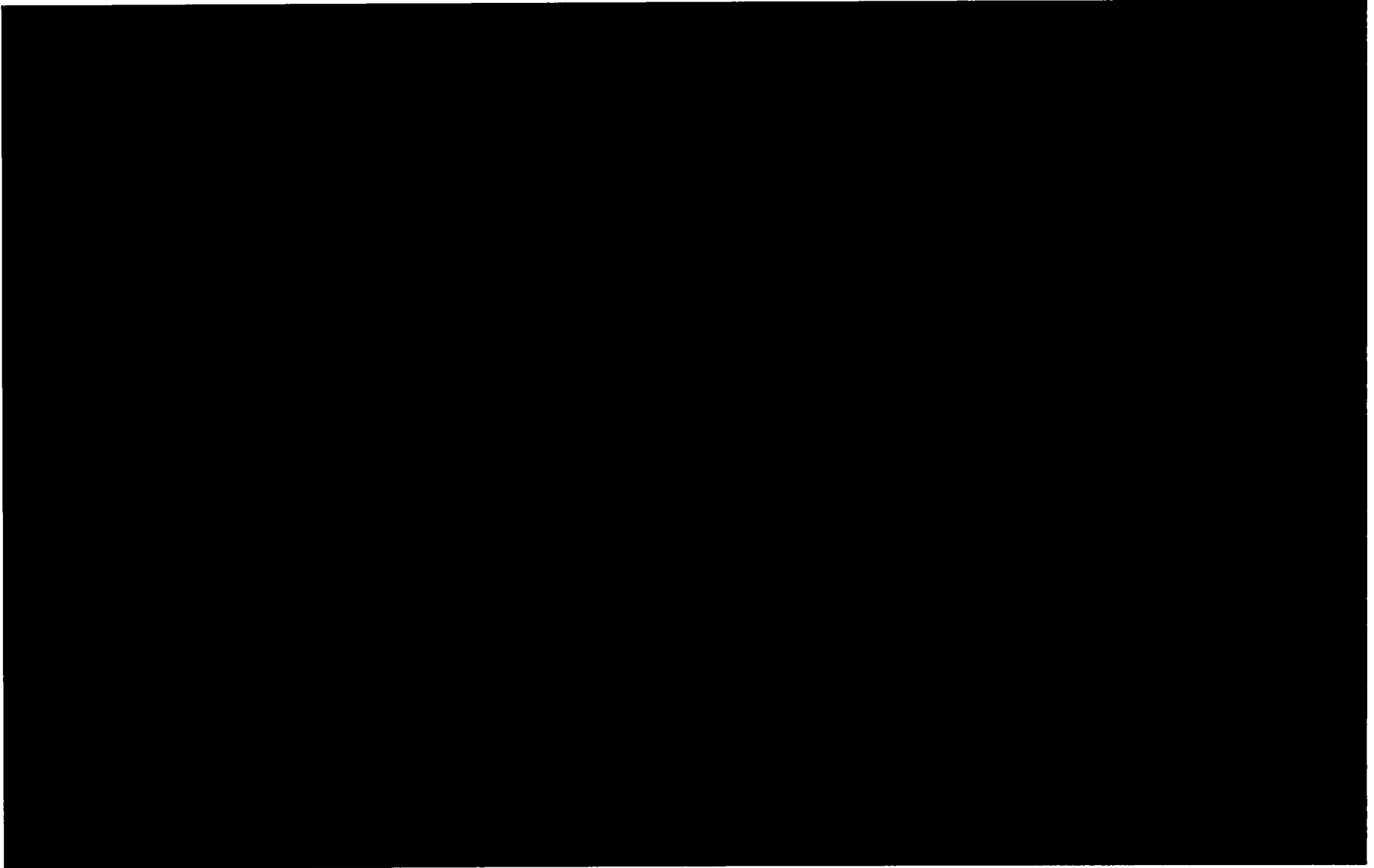


Table 3.7-4 External Events and Fire Accident Descriptions
Page 6 of 35

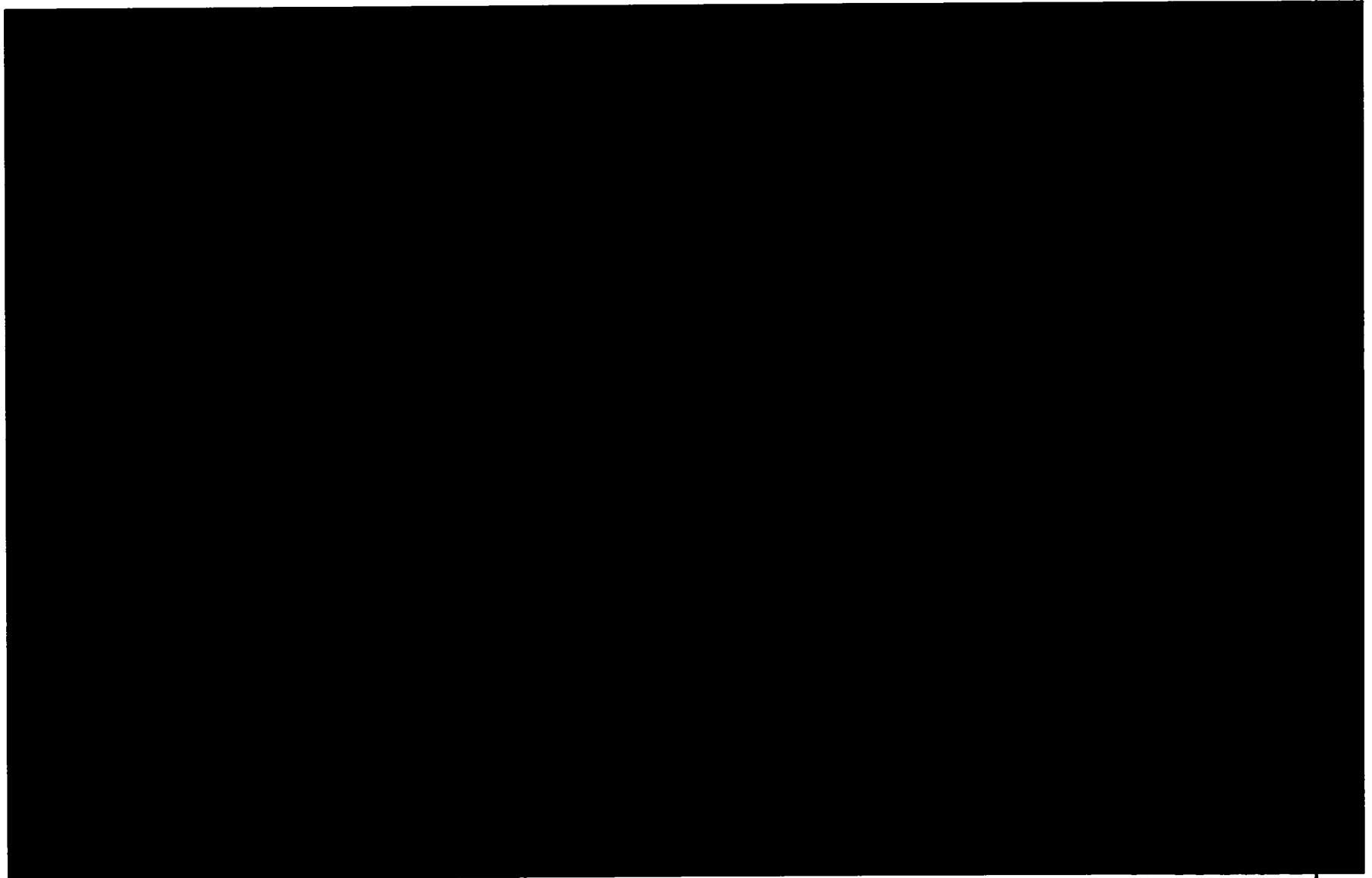


Table 3.7-4 External Events and Fire Accident Descriptions
Page 7 of 35

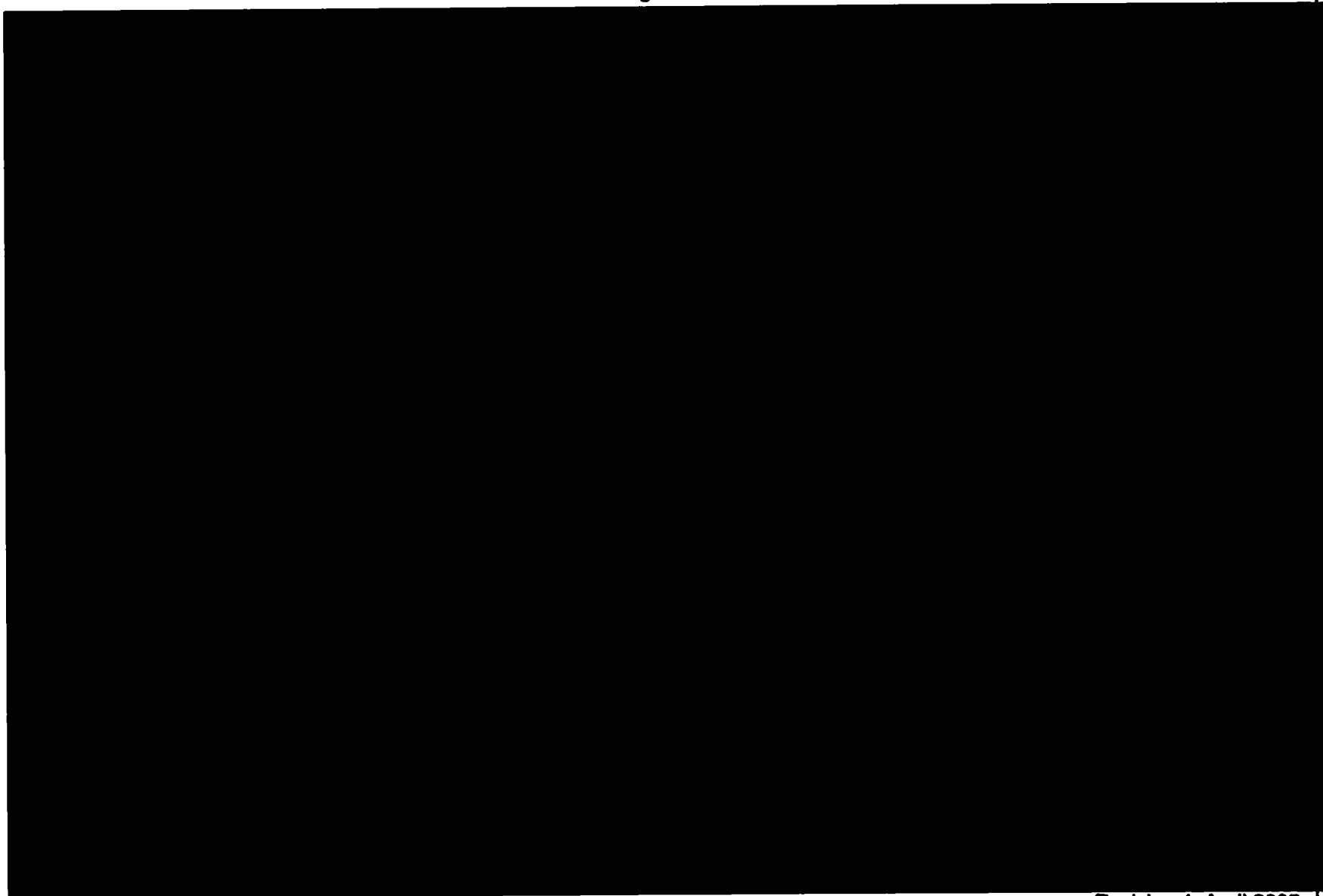


Table 3.7-4 External Events and Fire Accident Descriptions
Page 8 of 35

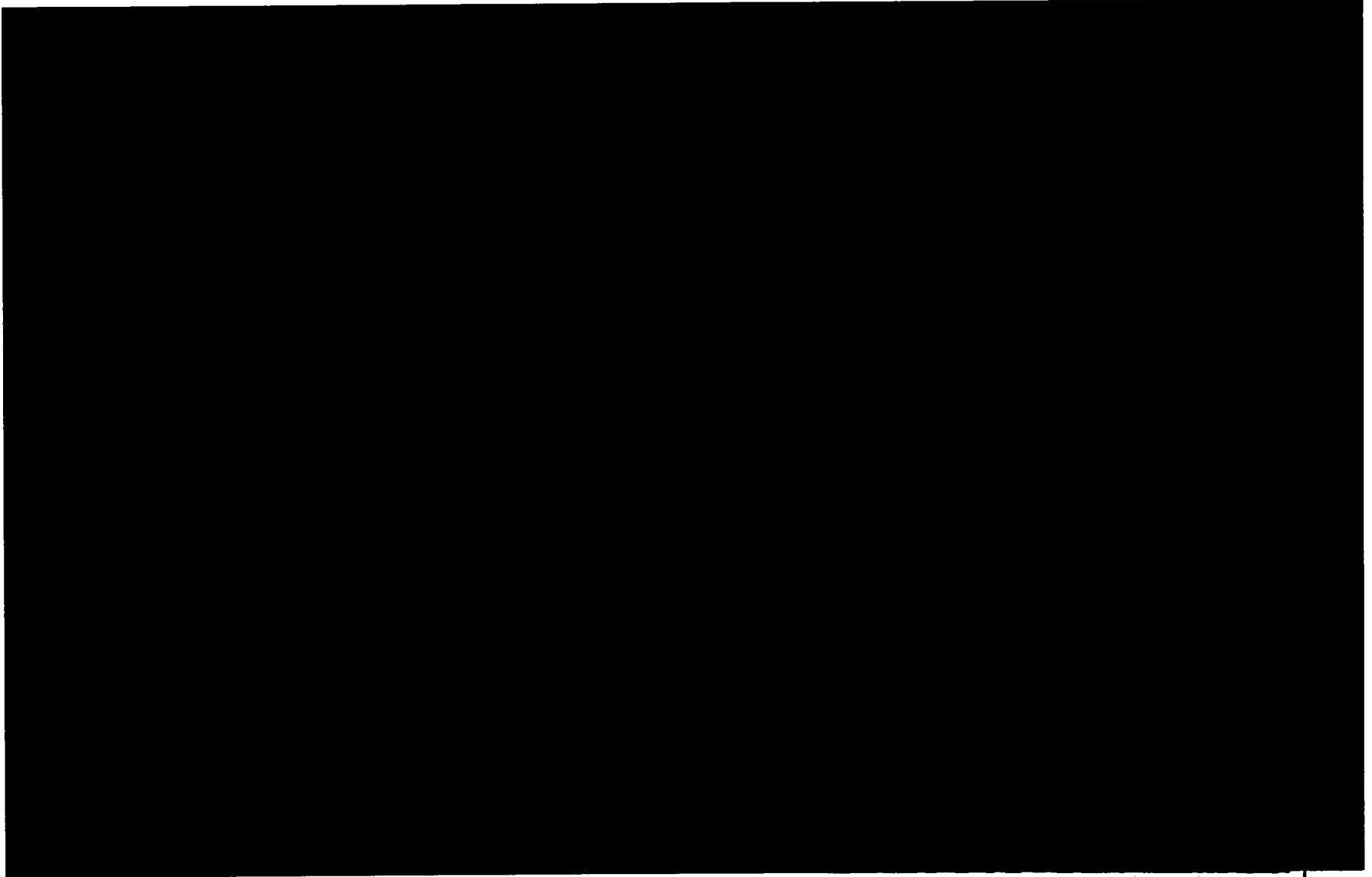


Table 3.7-4 External Events and Fire Accident Descriptions
Page 9 of 35

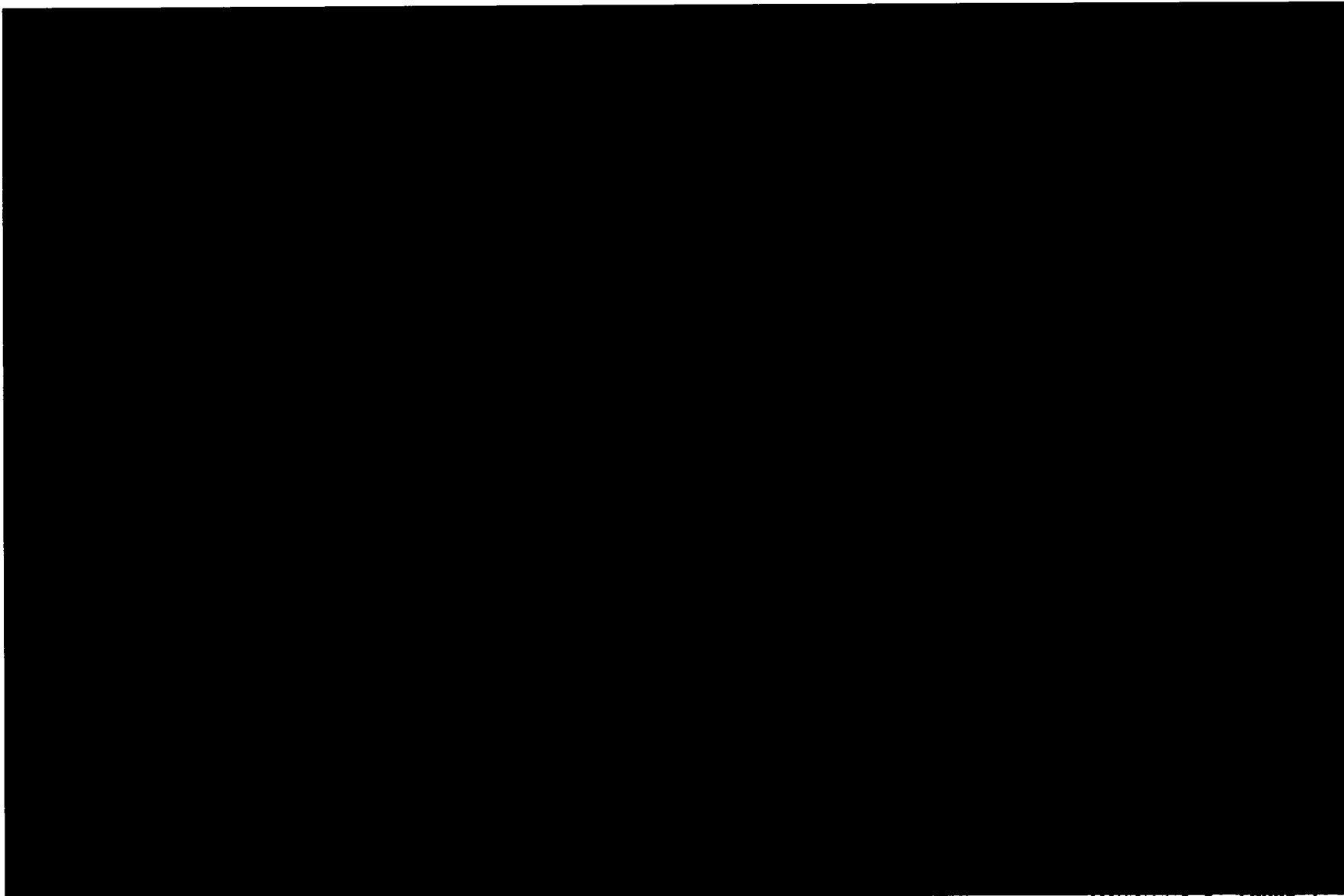


Table 3.7-4 External Events and Fire Accident Descriptions
Page 10 of 35

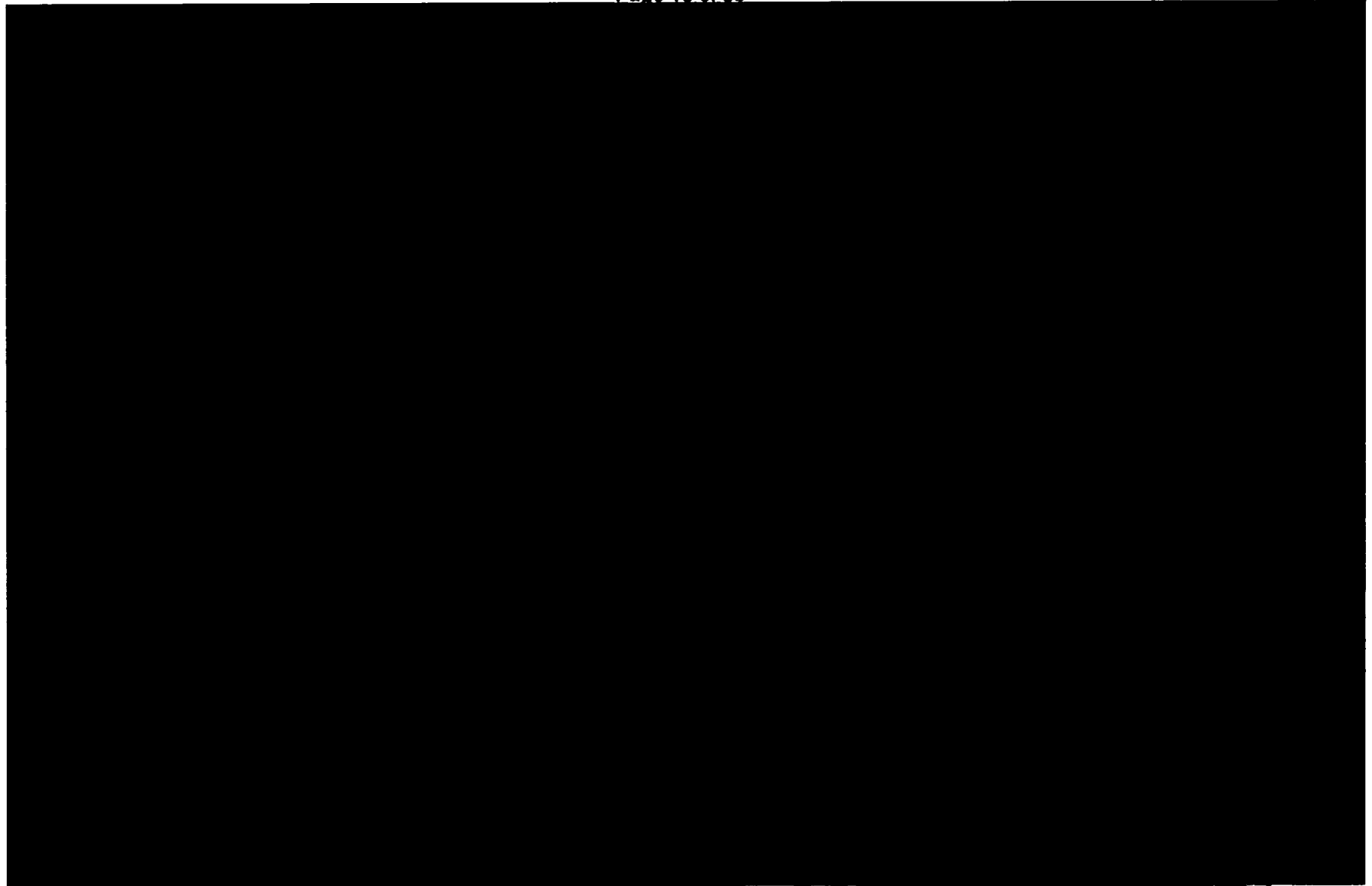


Table 3.7-4 External Events and Fire Accident Descriptions
Page 11 of 35

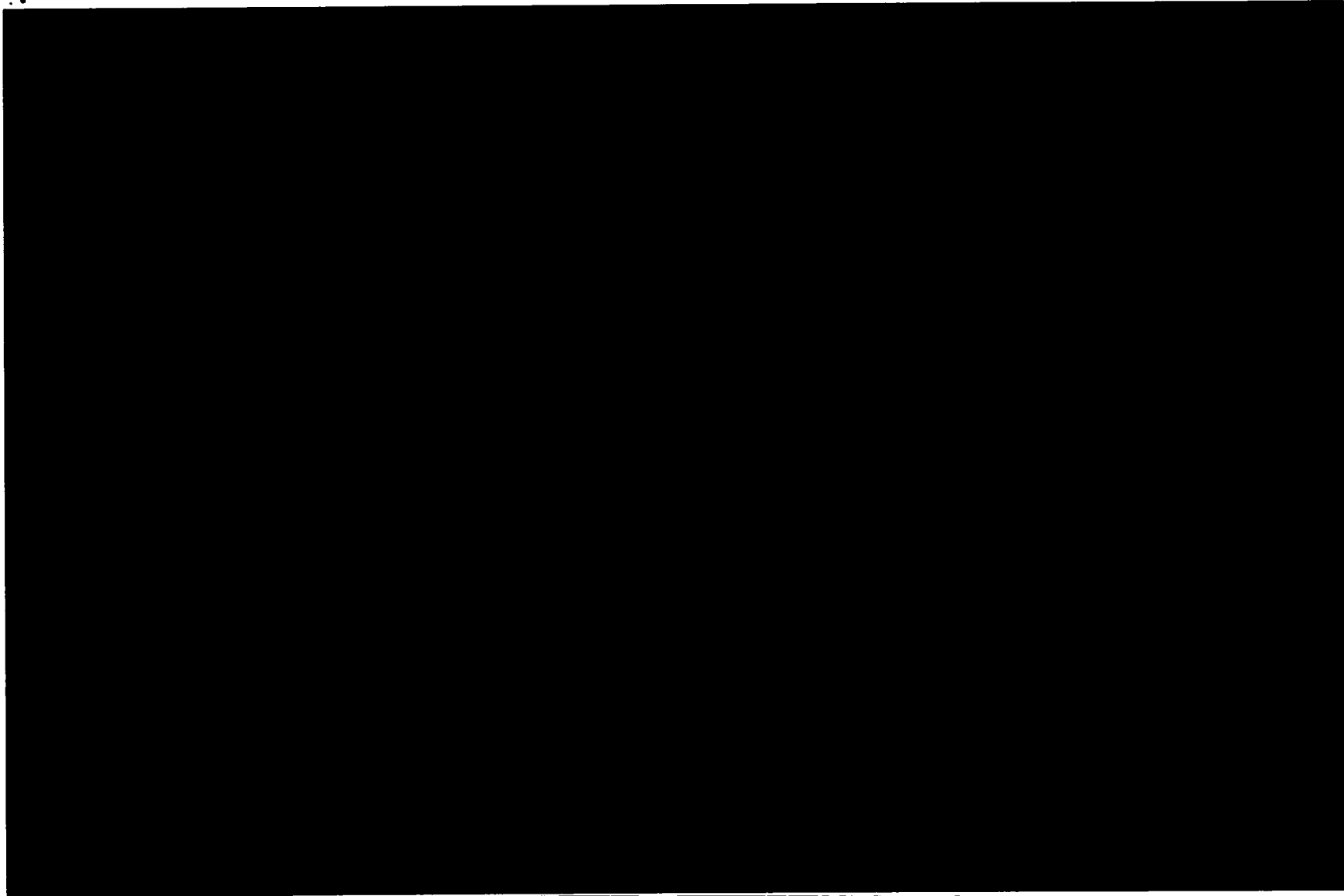


Table 3.7-4 External Events and Fire Accident Descriptions
Page 12 of 35

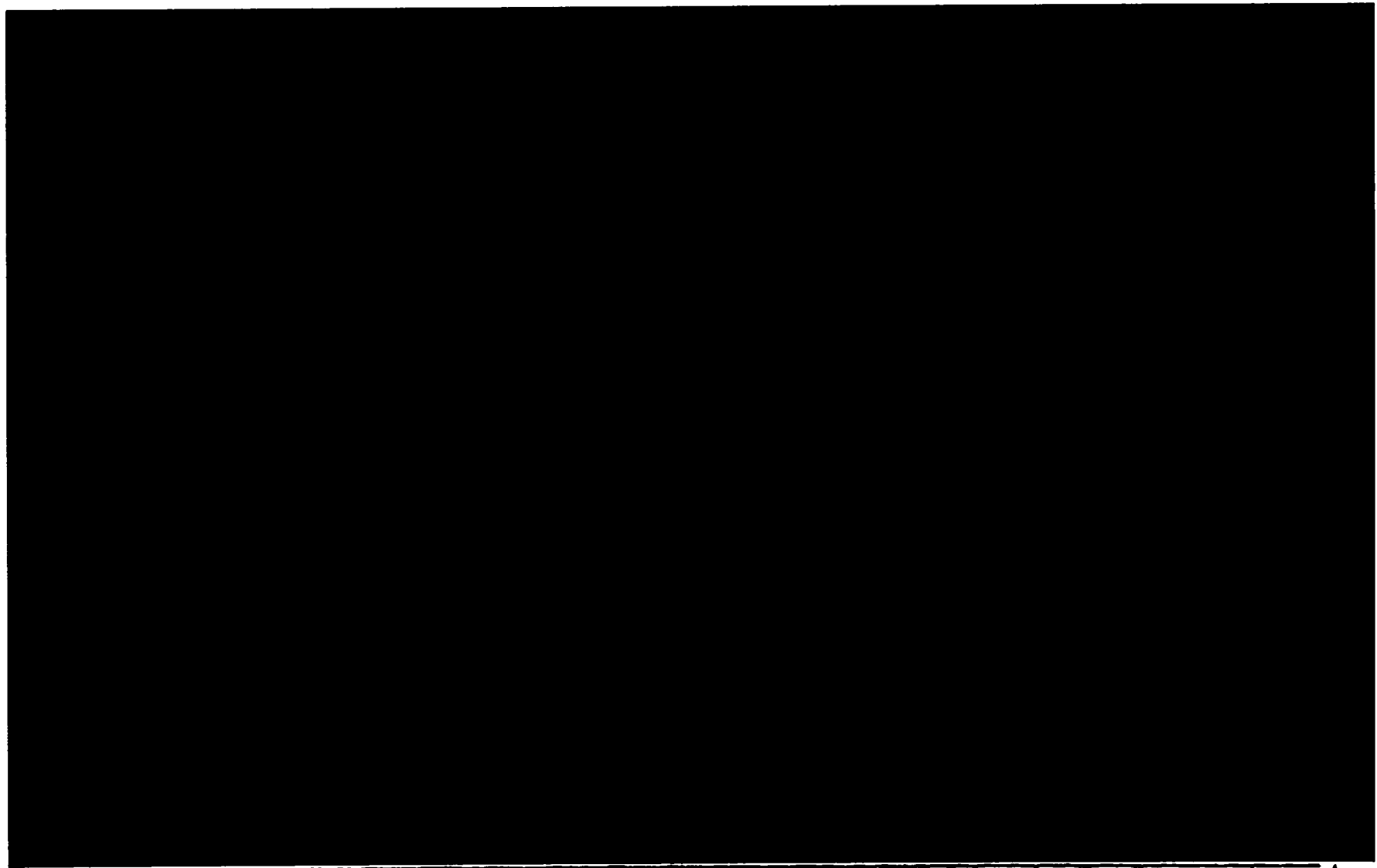


Table 3.7-4 External Events and Fire Accident Descriptions
Page 13 of 35

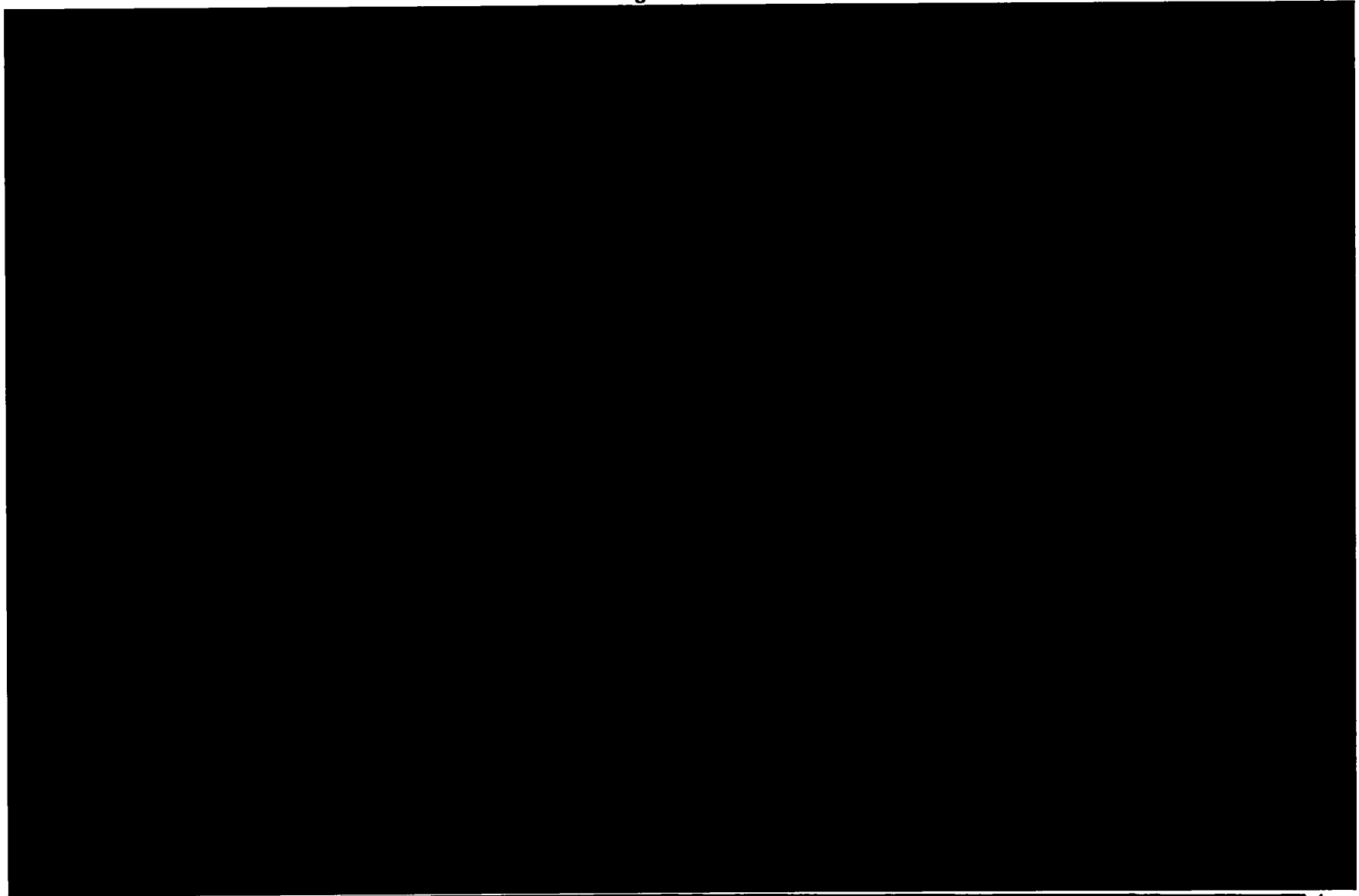


Table 3.7-4 External Events and Fire Accident Descriptions
Page 14 of 35

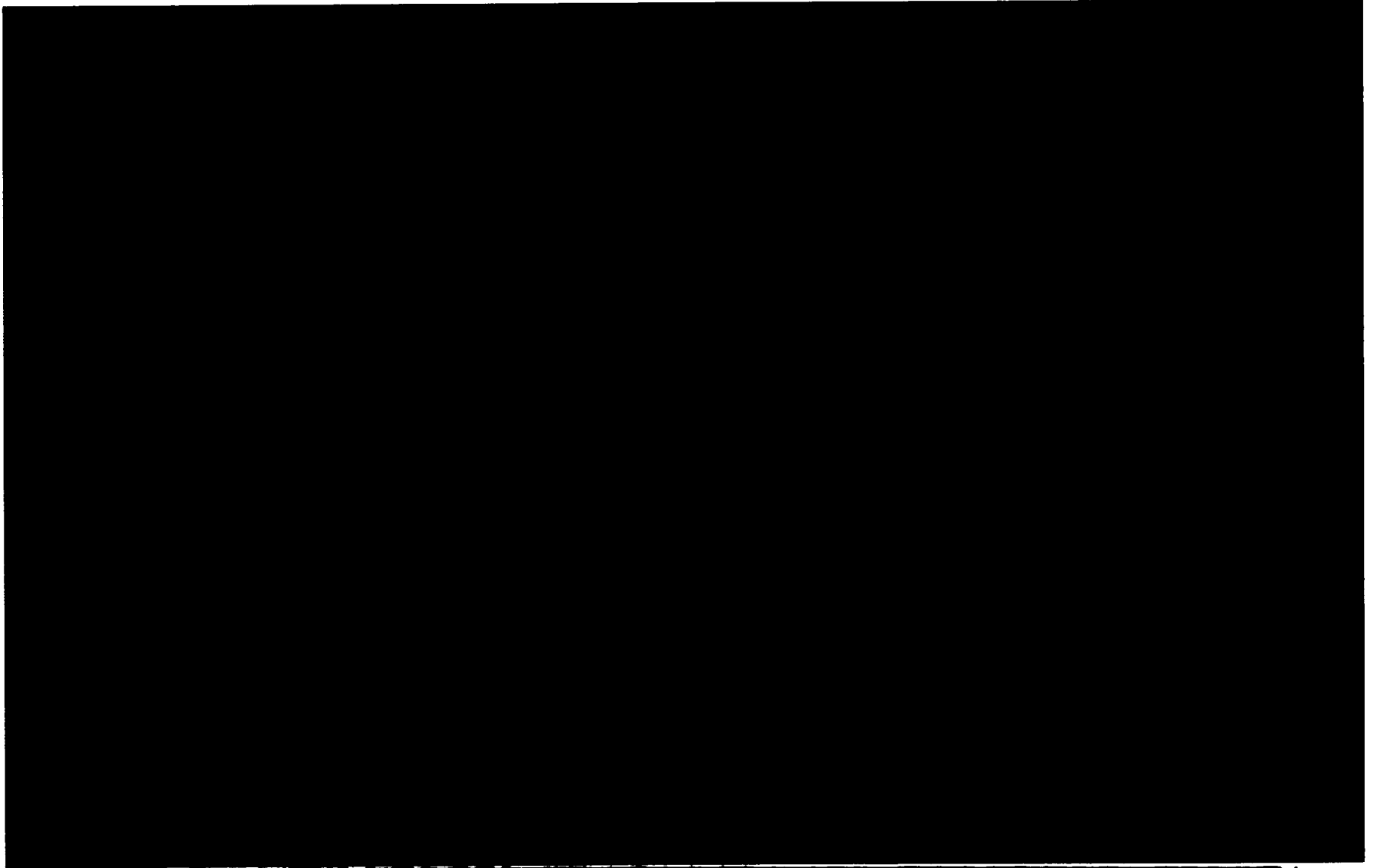


Table 3.7-4 External Events and Fire Accident Descriptions

Page 15 of 35

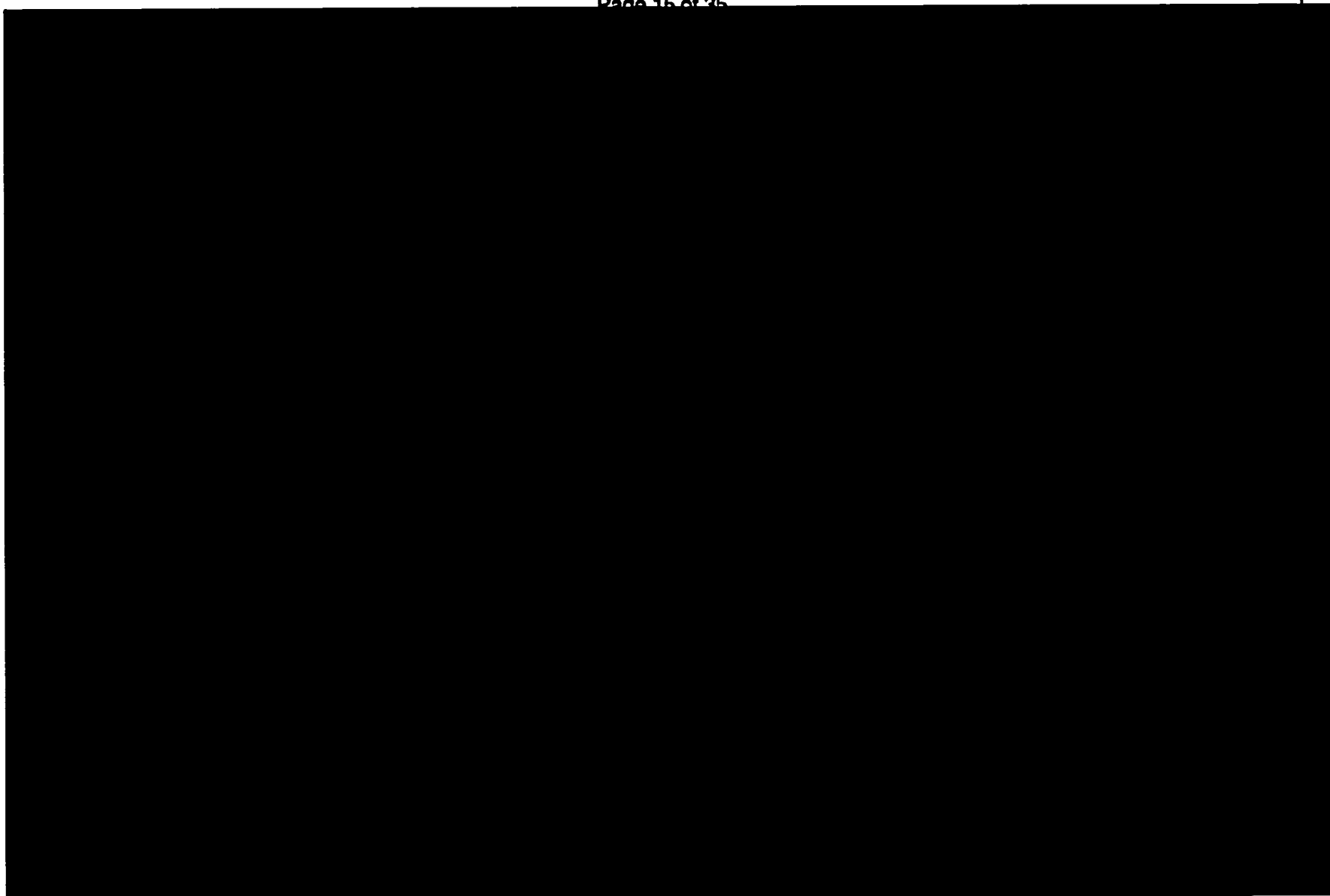


Table 3.7-4 External Events and Fire Accident Descriptions
Page 16 of 35

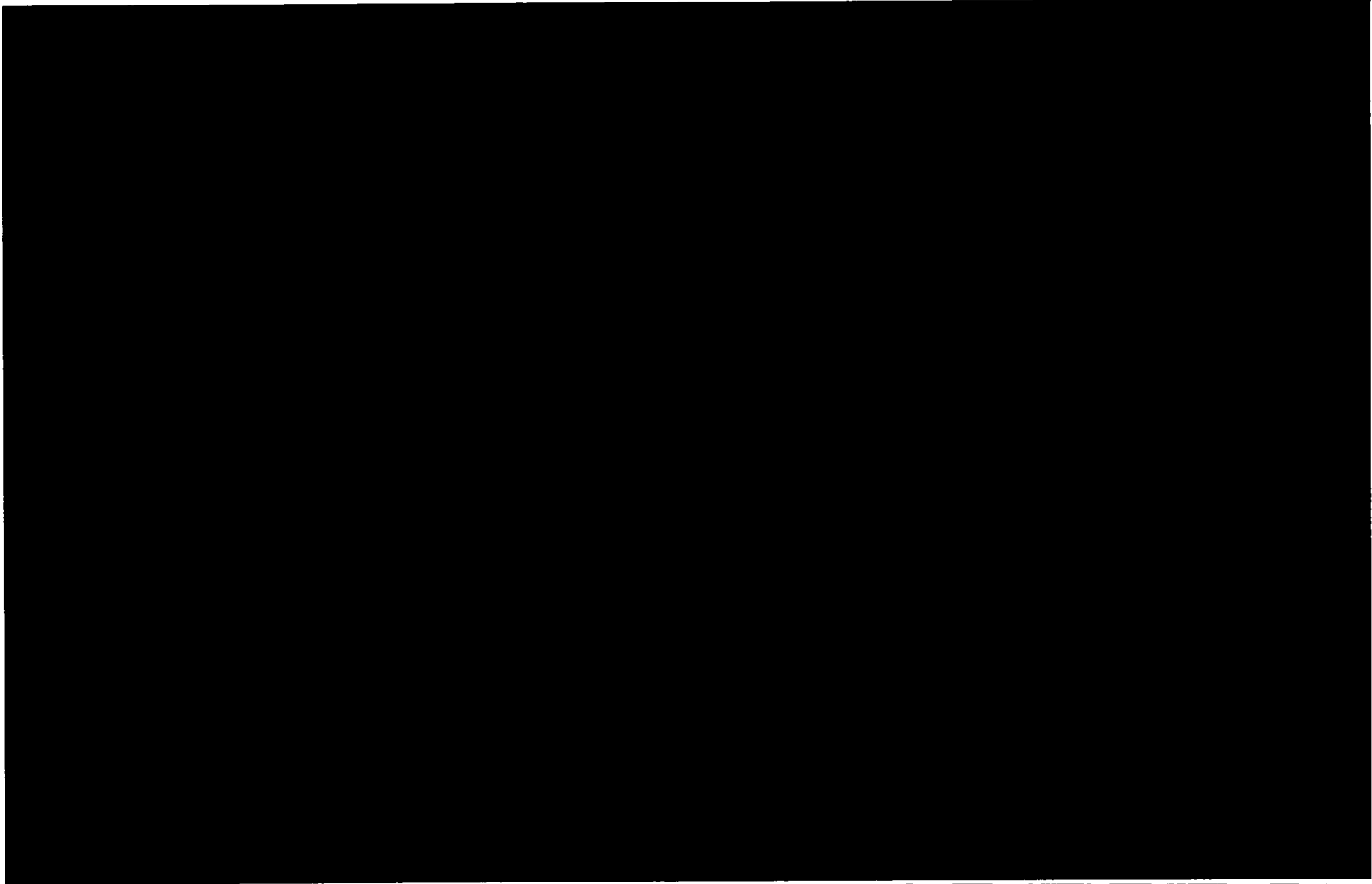


Table 3.7-4 External Events and Fire Accident Descriptions
Page 17 of 35

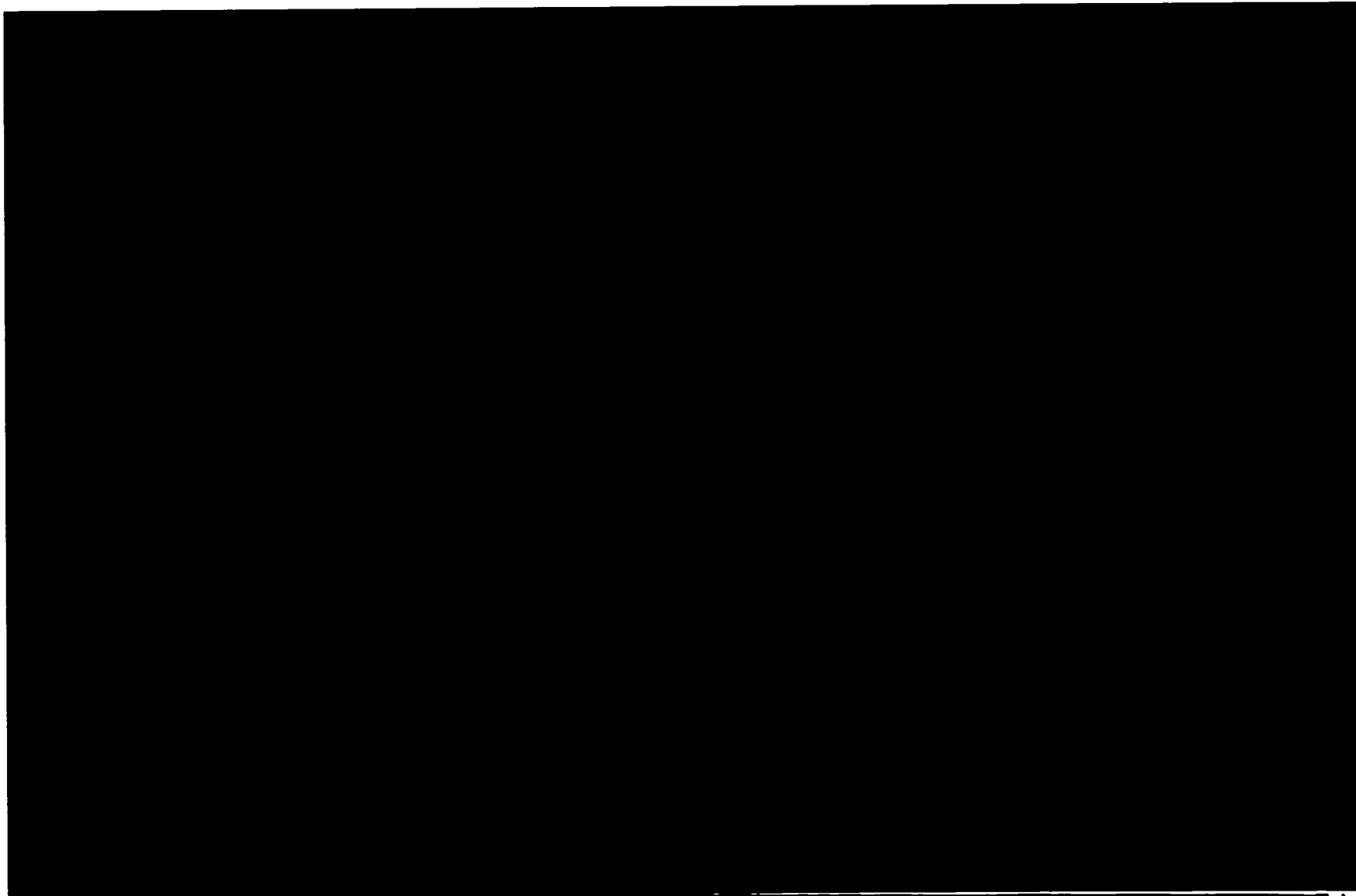


Table 3.7-4 External Events and Fire Accident Descriptions
Page 18 of 35



Table 3.7-4 External Events and Fire Accident Descriptions
Page 19 of 35



Table 3.7-4 External Events and Fire Accident Descriptions
Page 20 of 35

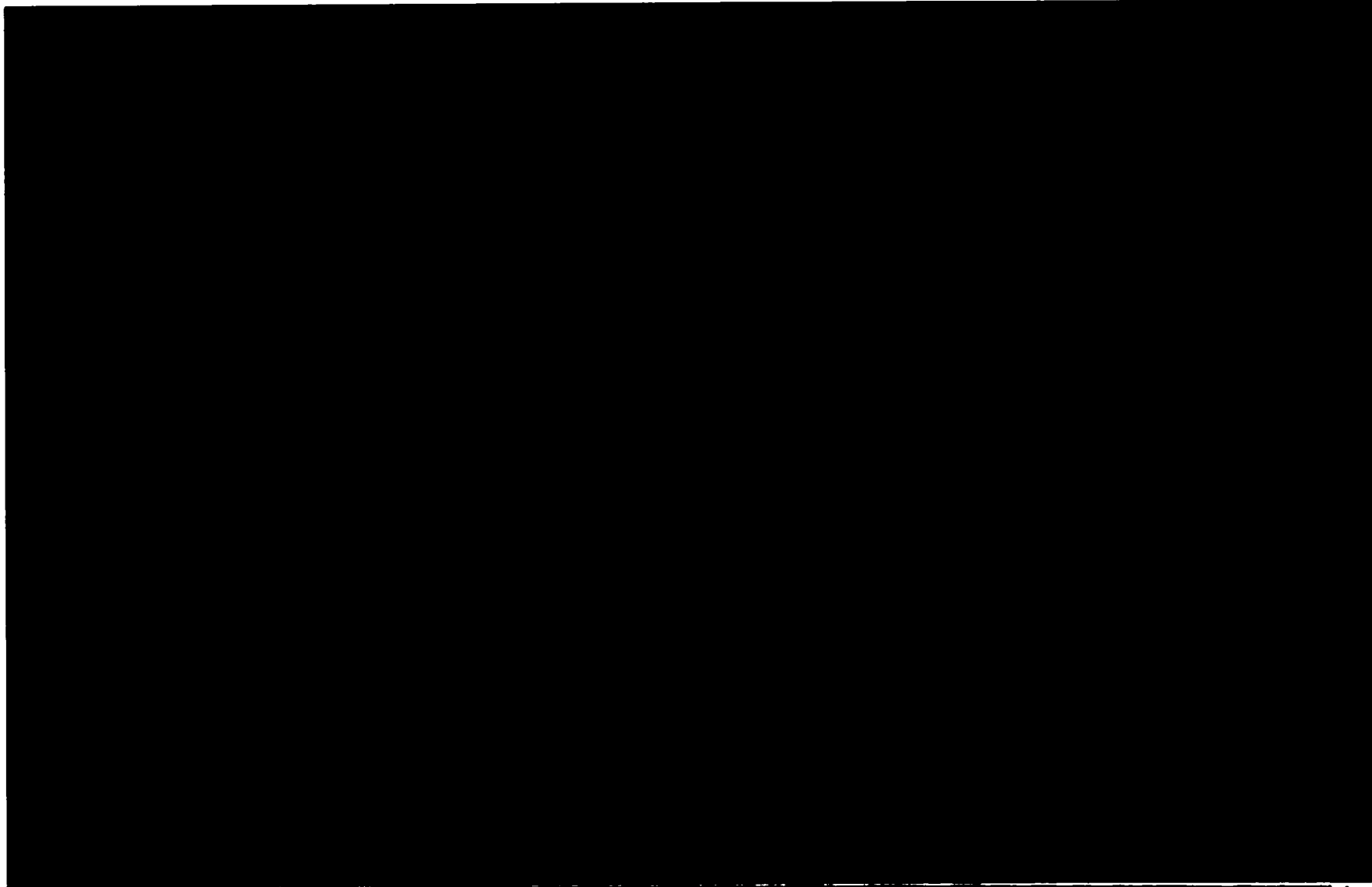


Table 3.7-4 External Events and Fire Accident Descriptions
Page 21 of 35

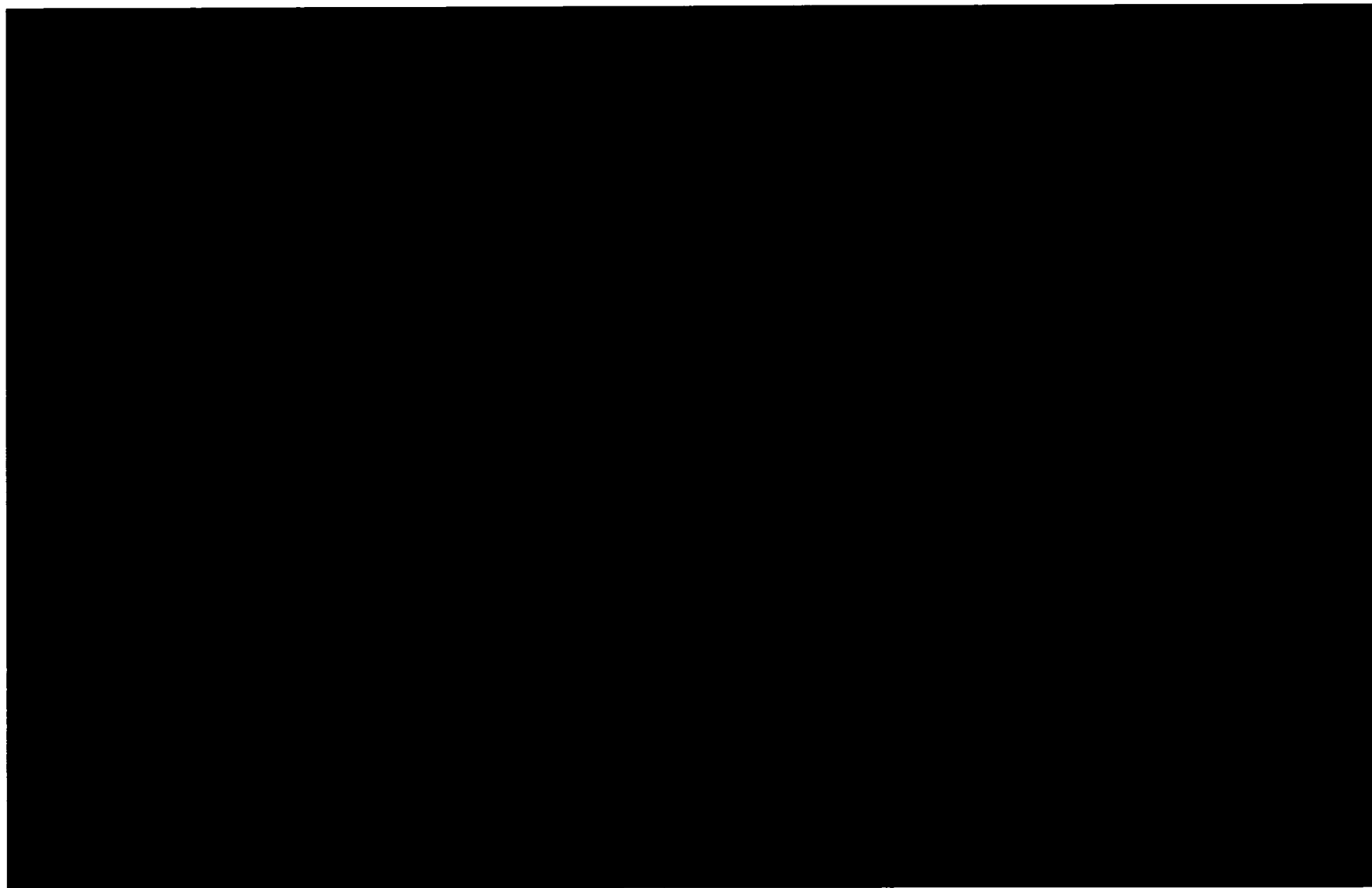


Table 3.7-4 External Events and Fire Accident Descriptions
Page 22 of 35

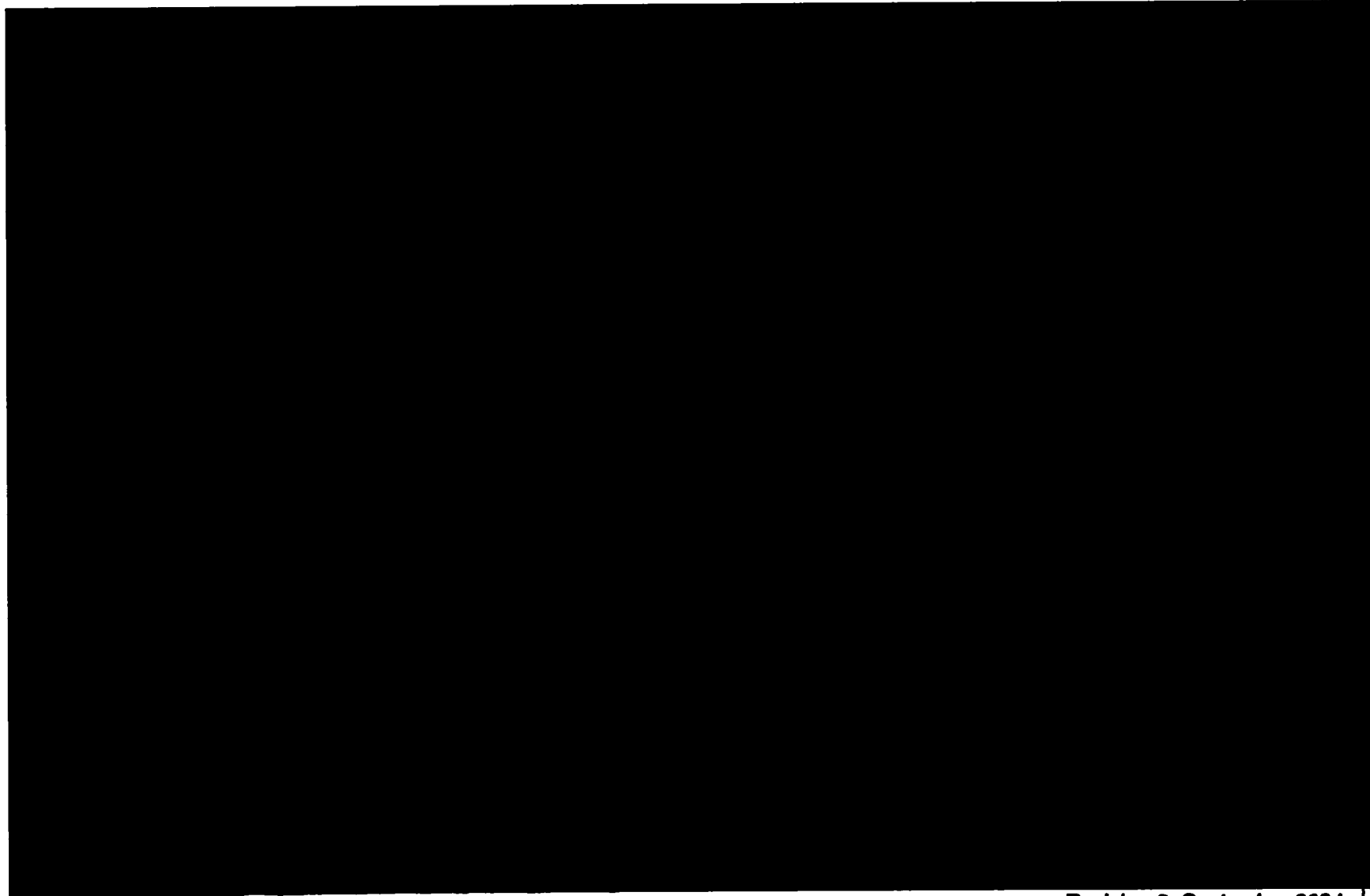


Table 3.7-4 External Events and Fire Accident Descriptions
Page 23 of 35



Table 3.7-4 External Events and Fire Accident Descriptions
Page 24 of 35



Table 3.7-4 External Events and Fire Accident Descriptions
Page 25 of 35

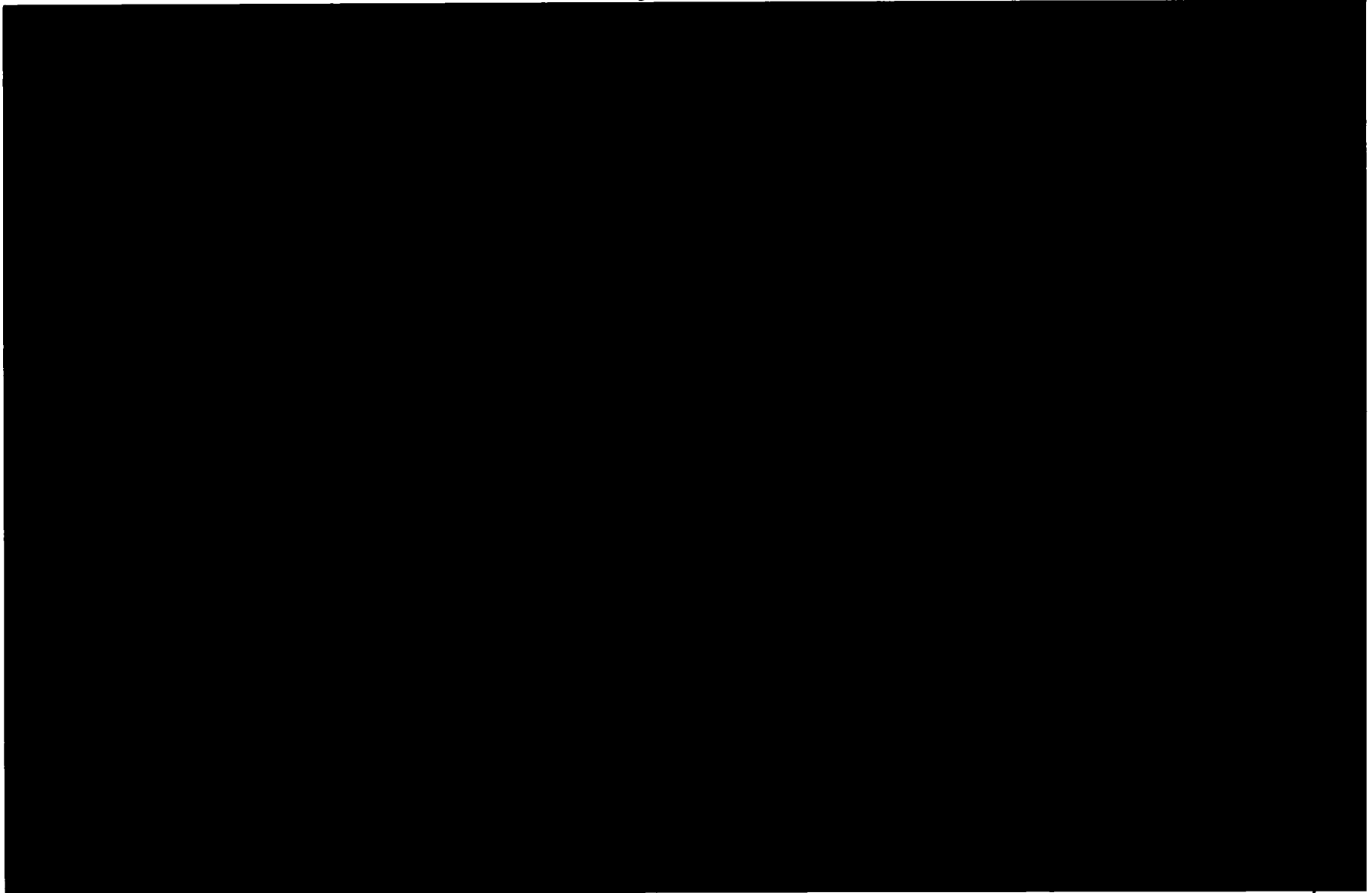


Table 3.7-4 External Events and Fire Accident Descriptions
Page 26 of 35

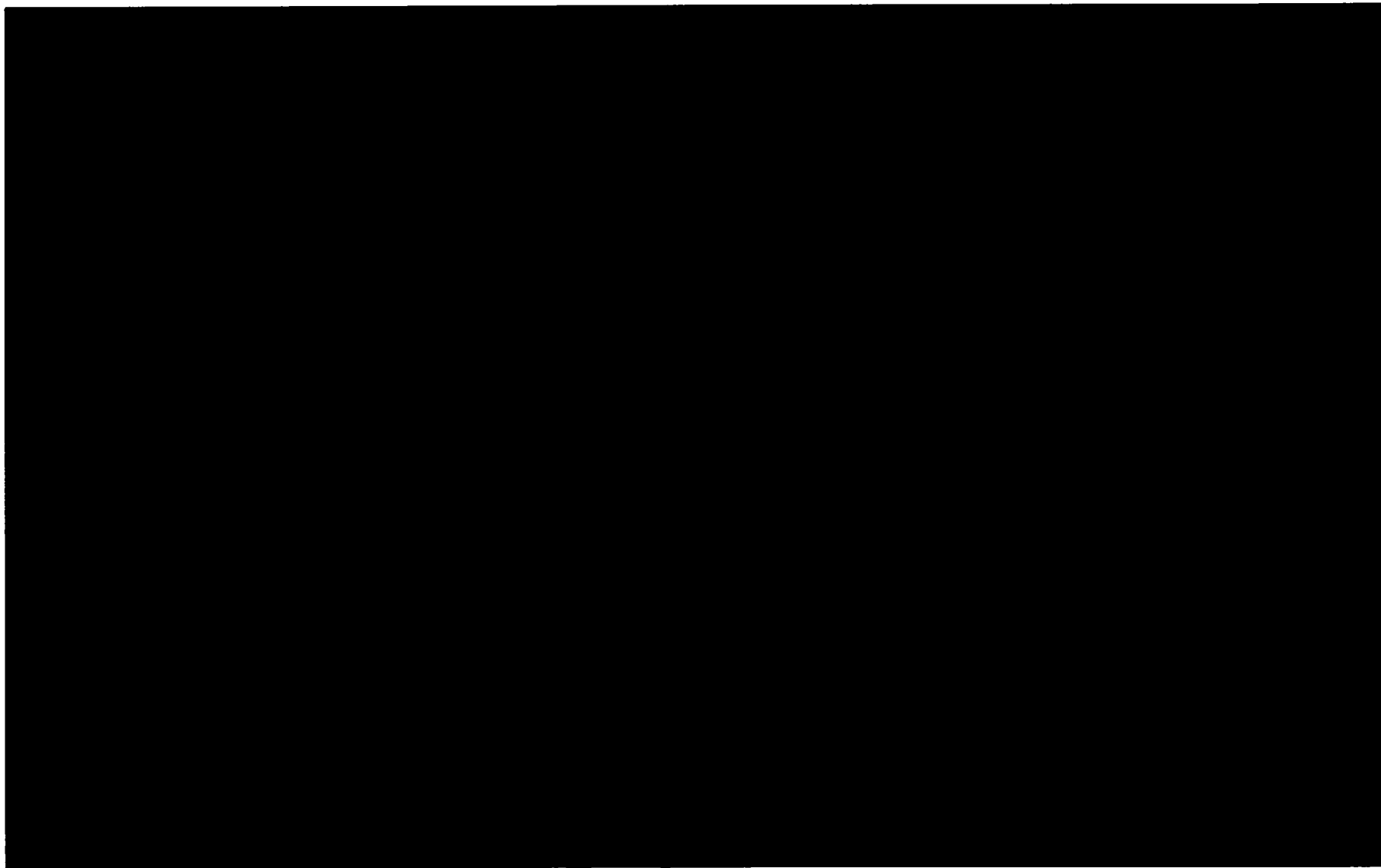


Table 3.7-4 External Events and Fire Accident Descriptions
Page 27 of 35

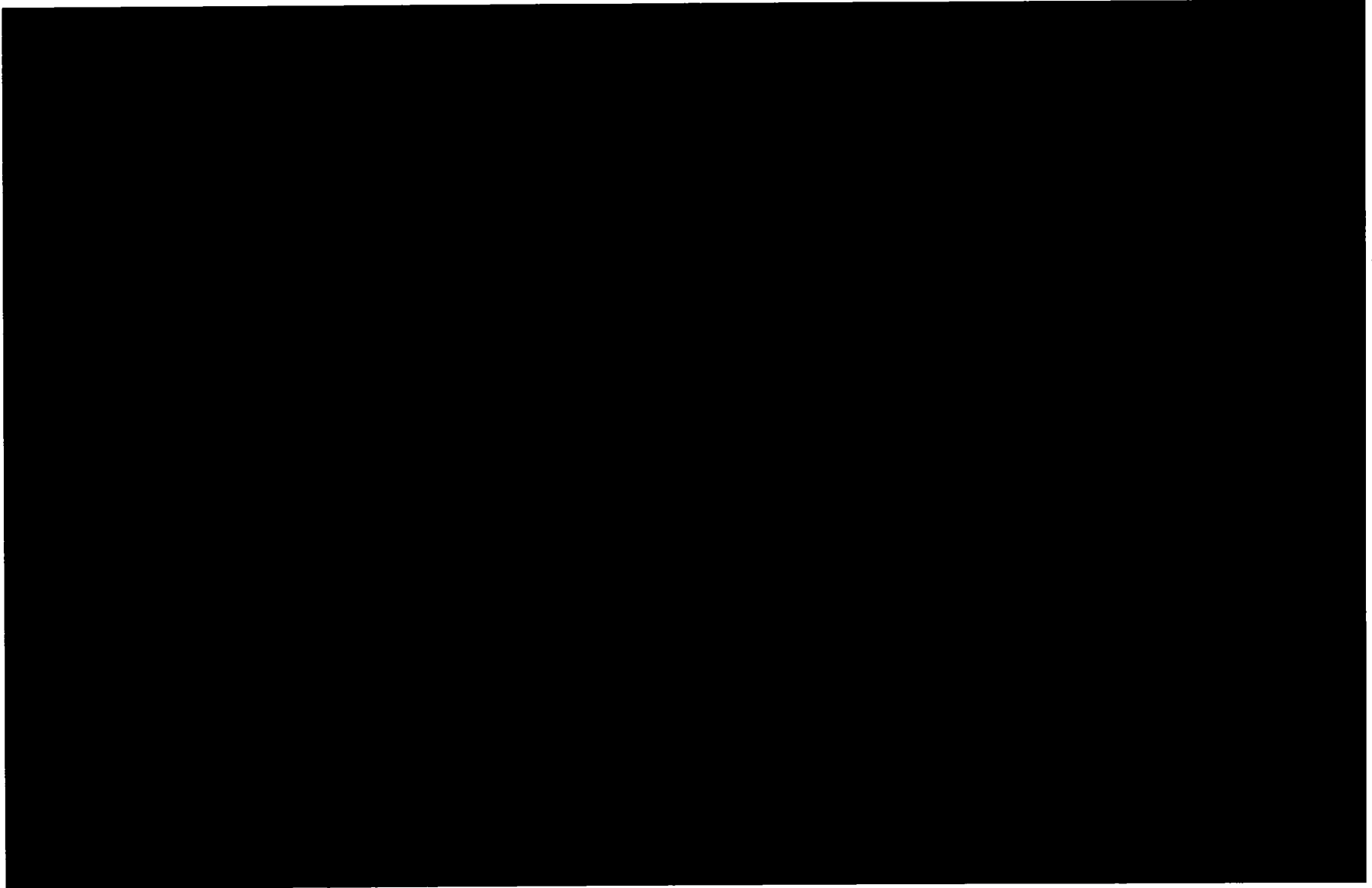


Table 3.7-4 External Events and Fire Accident Descriptions
Page 28 of 35

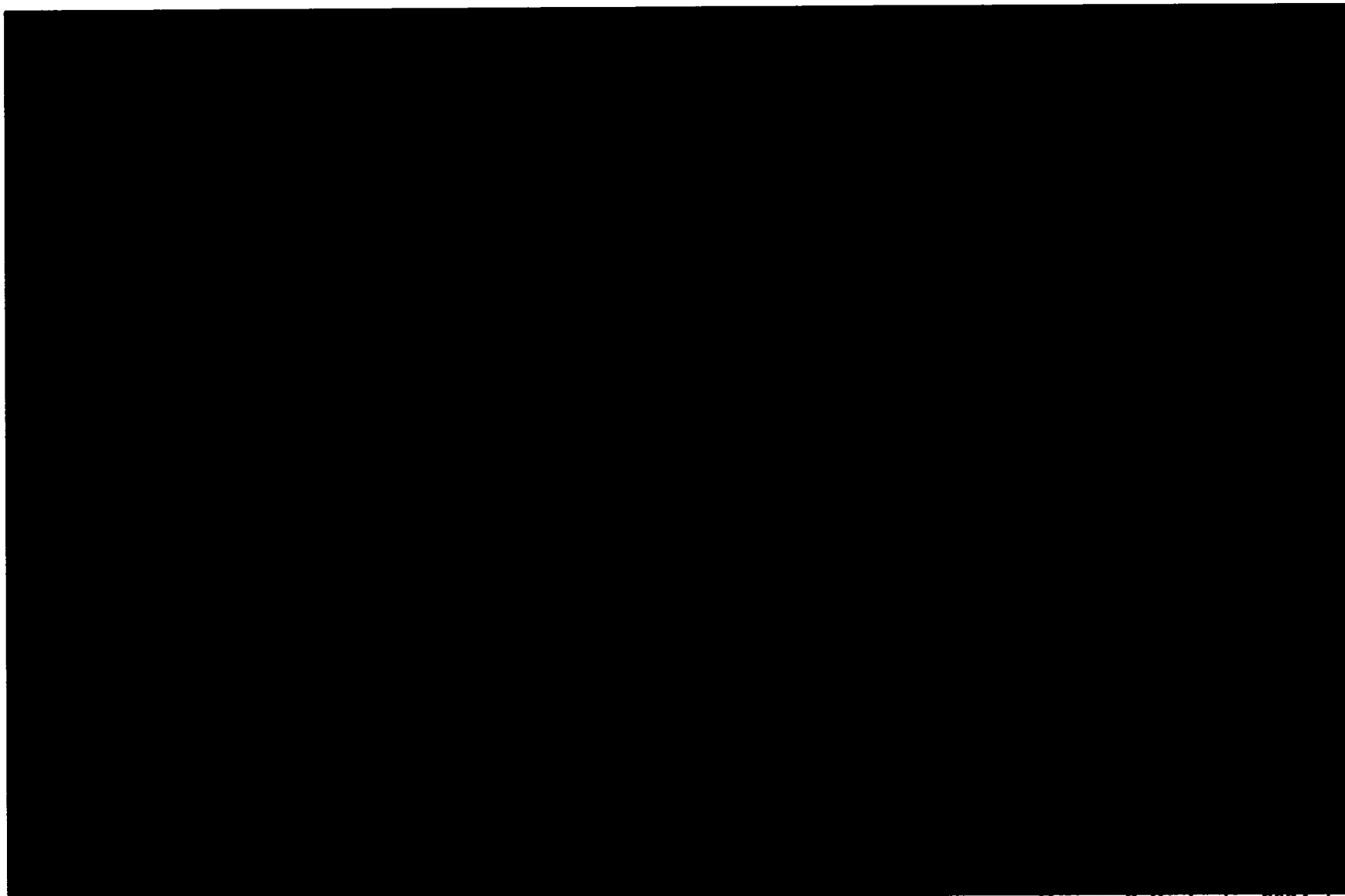


Table 3.7-4 External Events and Fire Accident Descriptions
Page 29 of 35

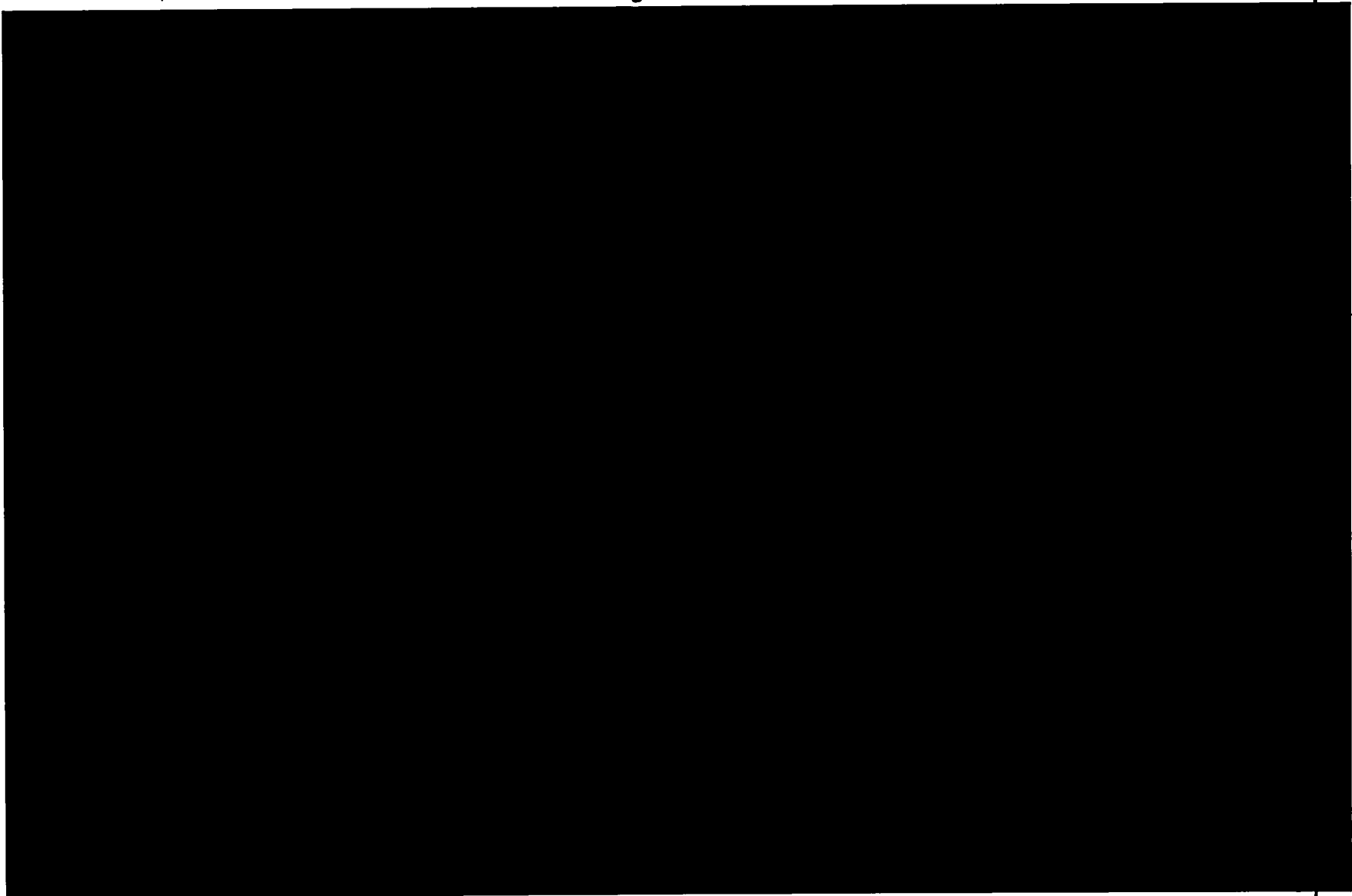


Table 3.7-4 External Events and Fire Accident Descriptions
Page 30 of 35

|



|

Table 3.7-4 External Events and Fire Accident Descriptions
Page 31 of 35

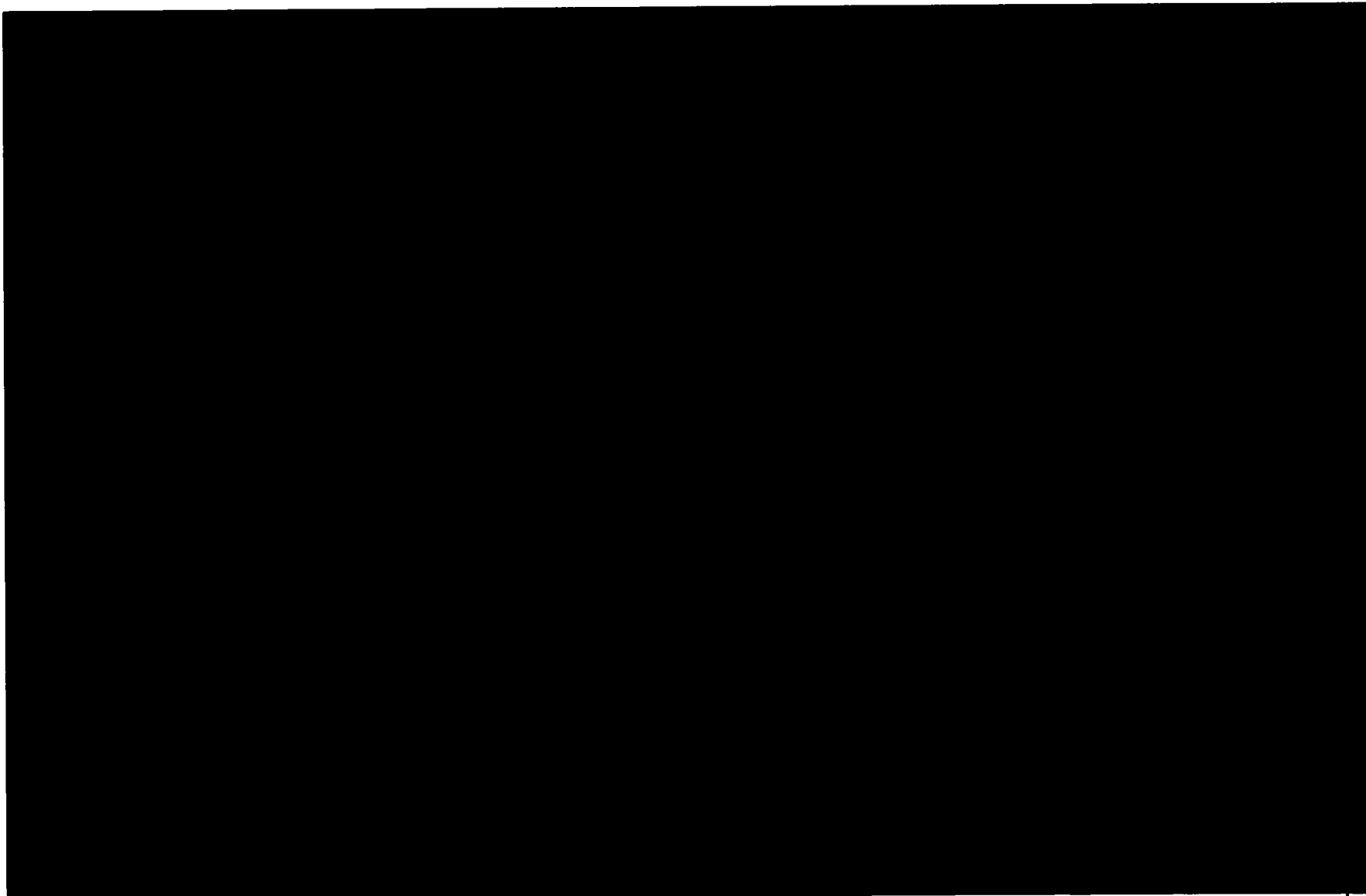


Table 3.7-4 External Events and Fire Accident Descriptions
Page 32 of 35

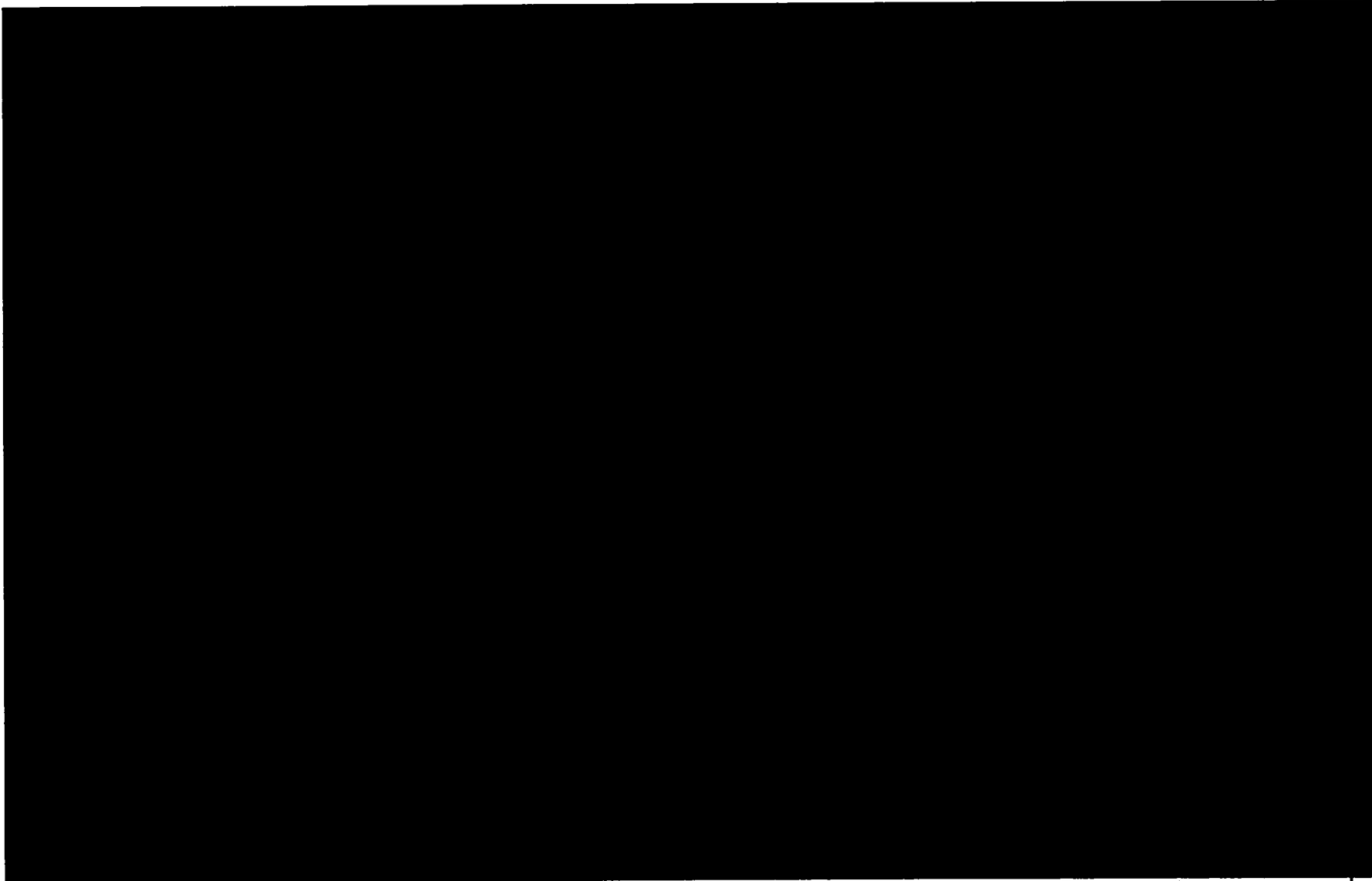


Table 3.7-4 External Events and Fire Accident Descriptions
Page 33 of 35

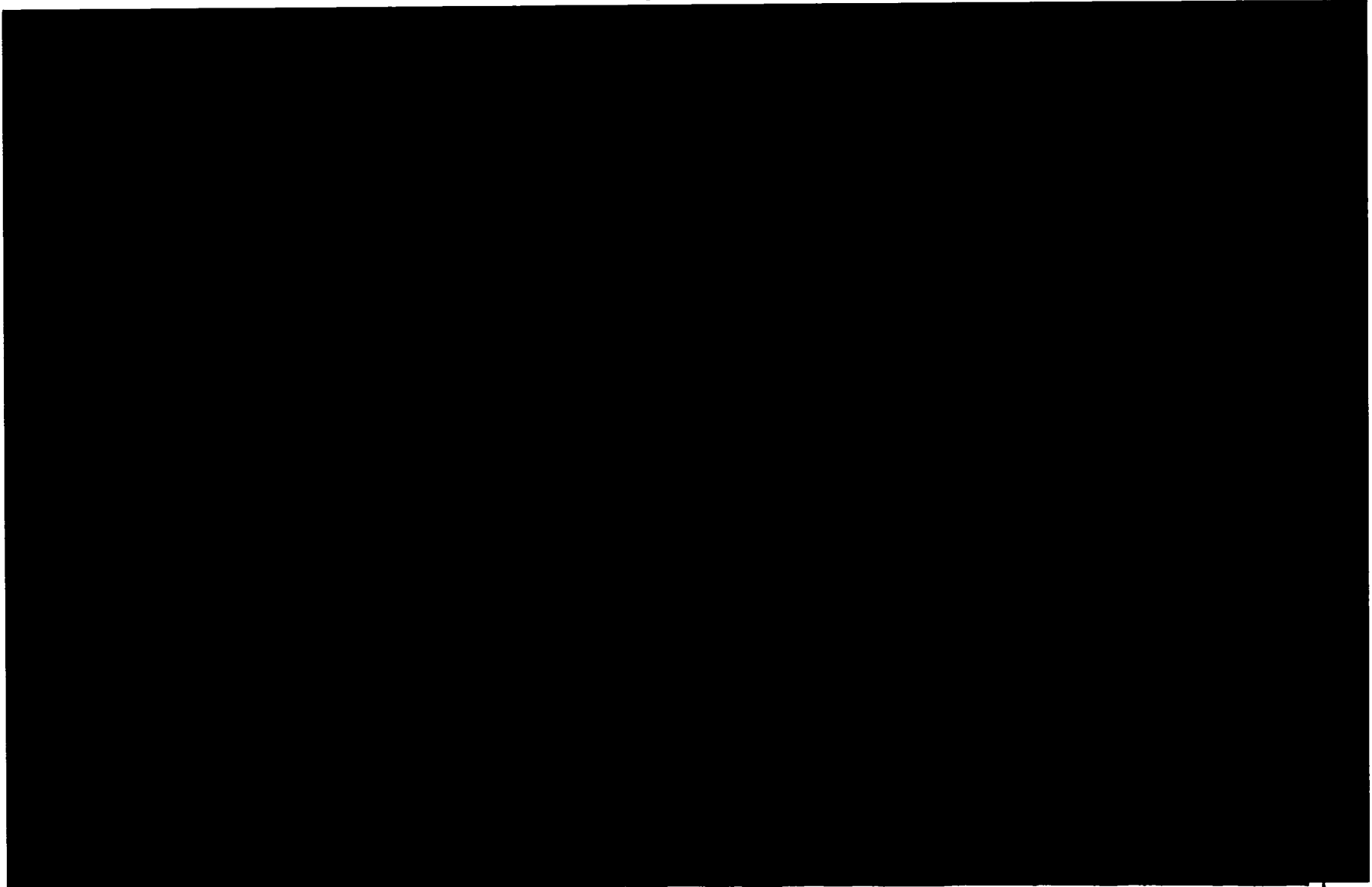


Table 3.7-4 External Events and Fire Accident Descriptions

Page 34 of 35

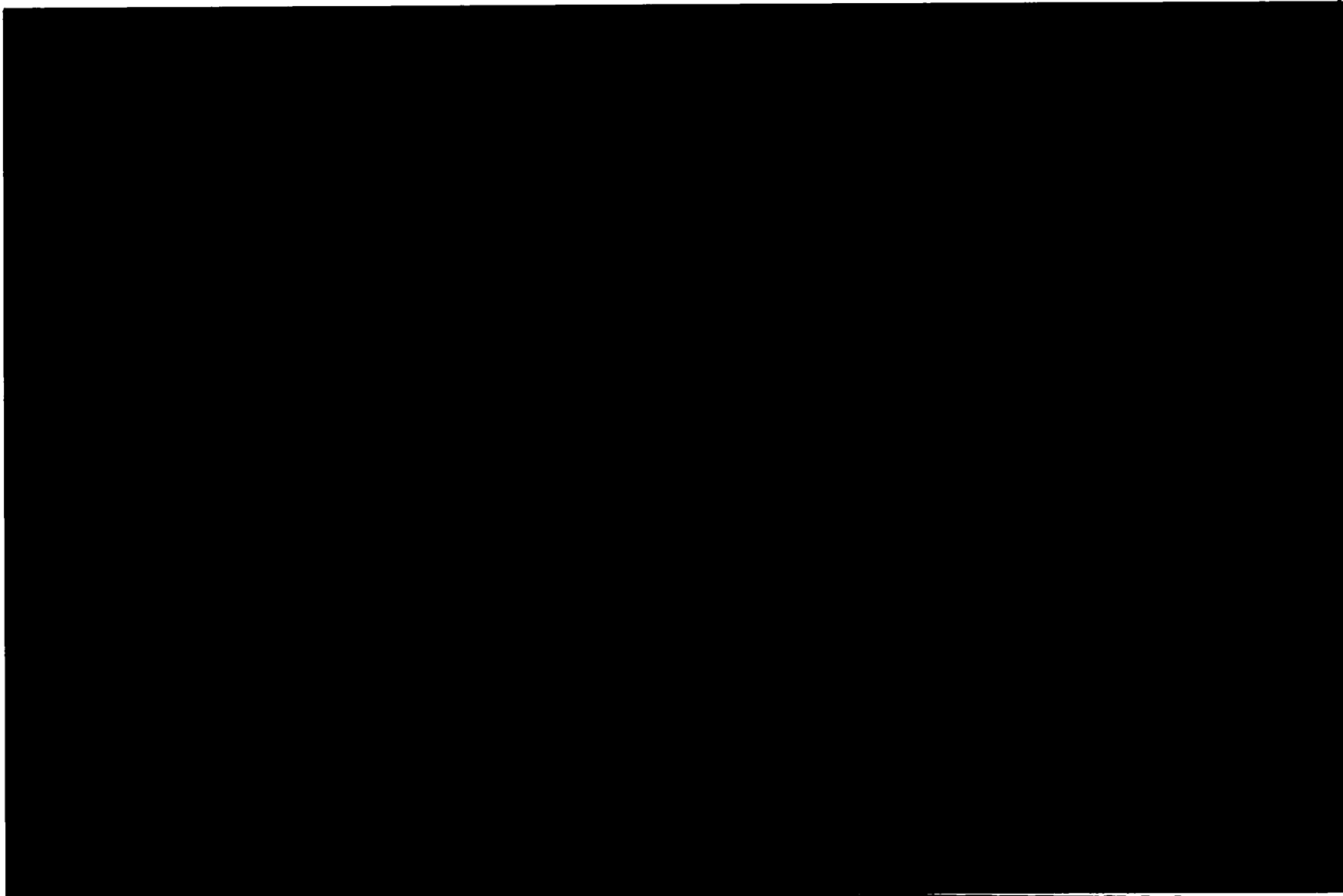


Table 3.7-4 External Events and Fire Accident Descriptions

Page 25 of 25

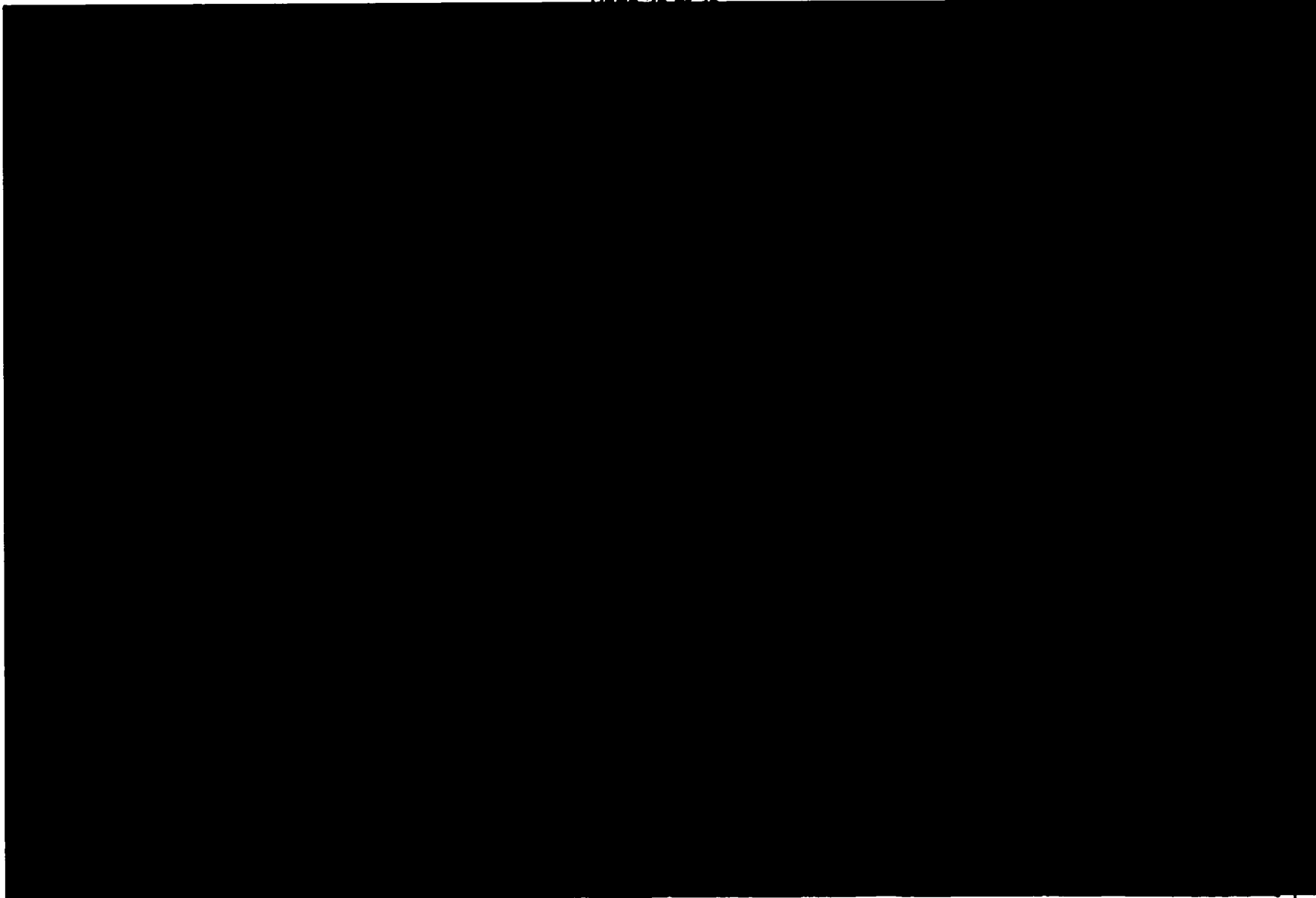
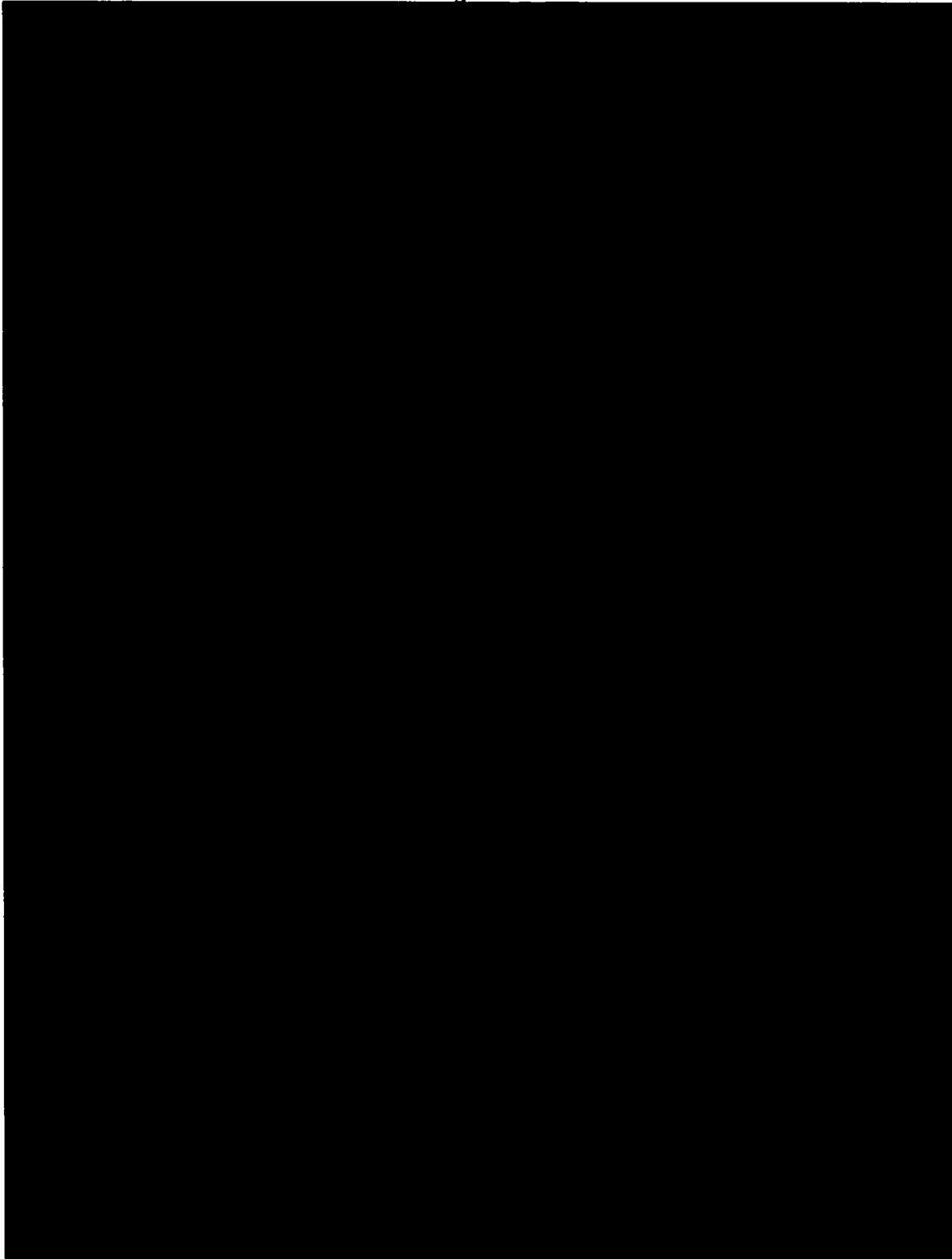
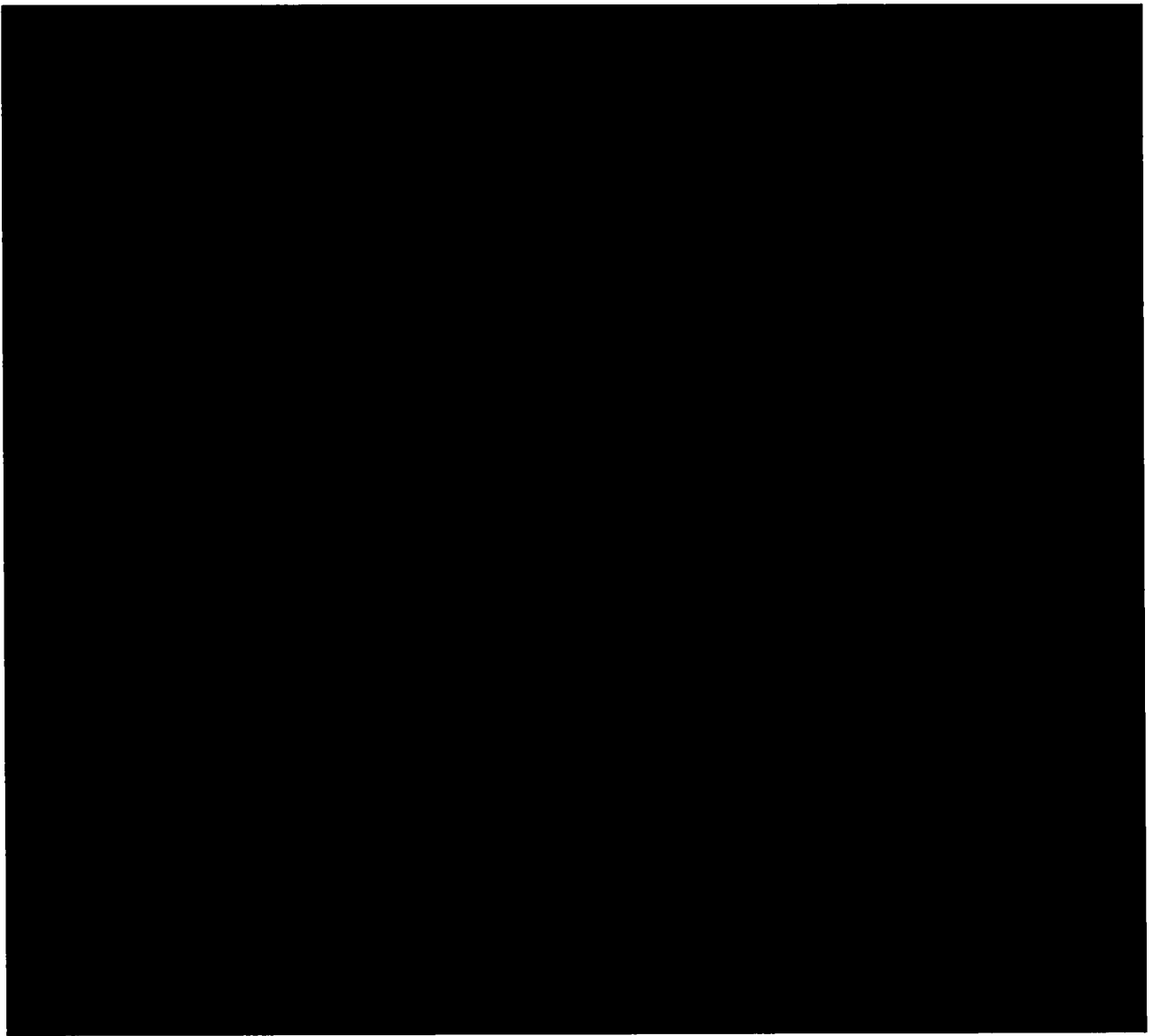
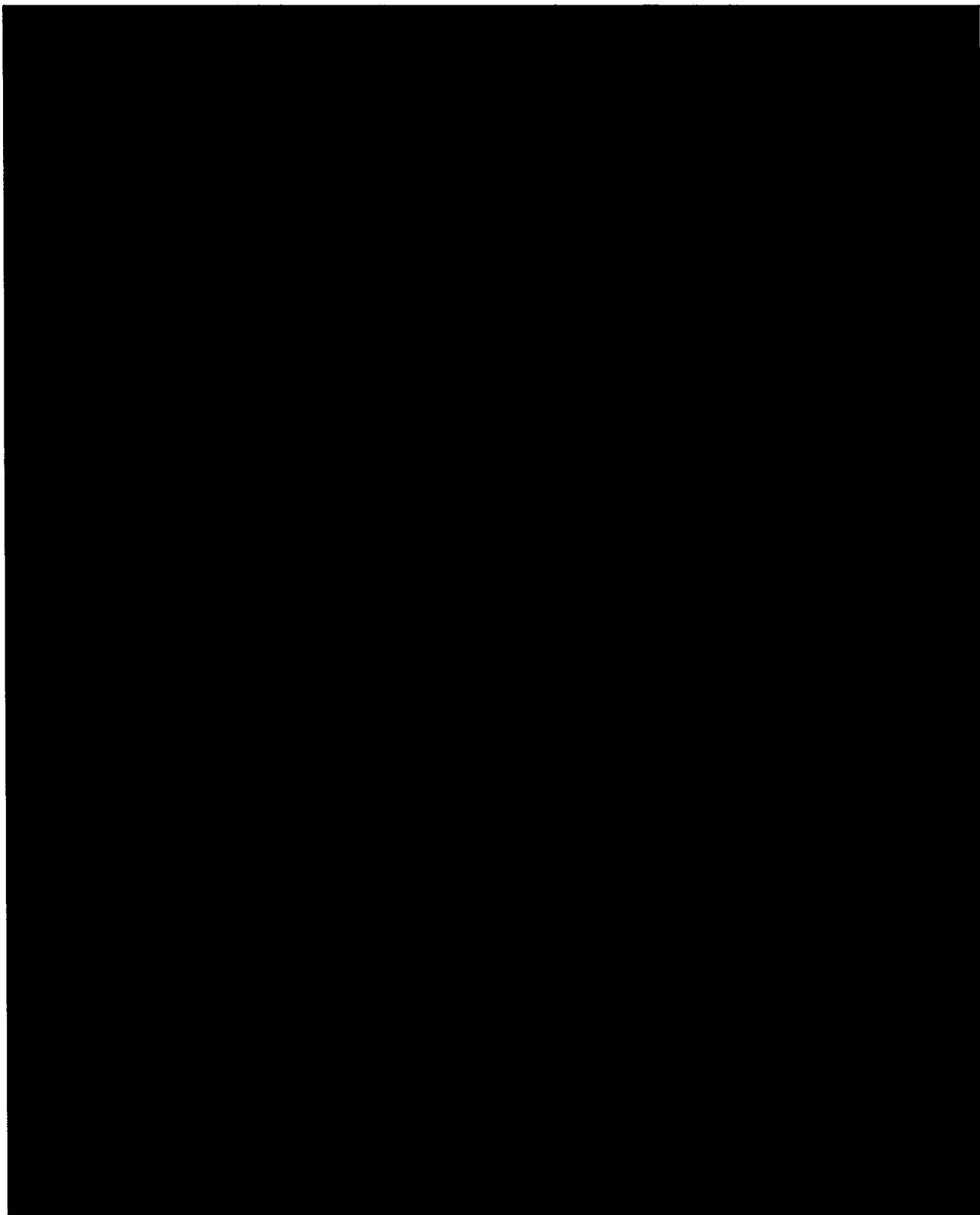


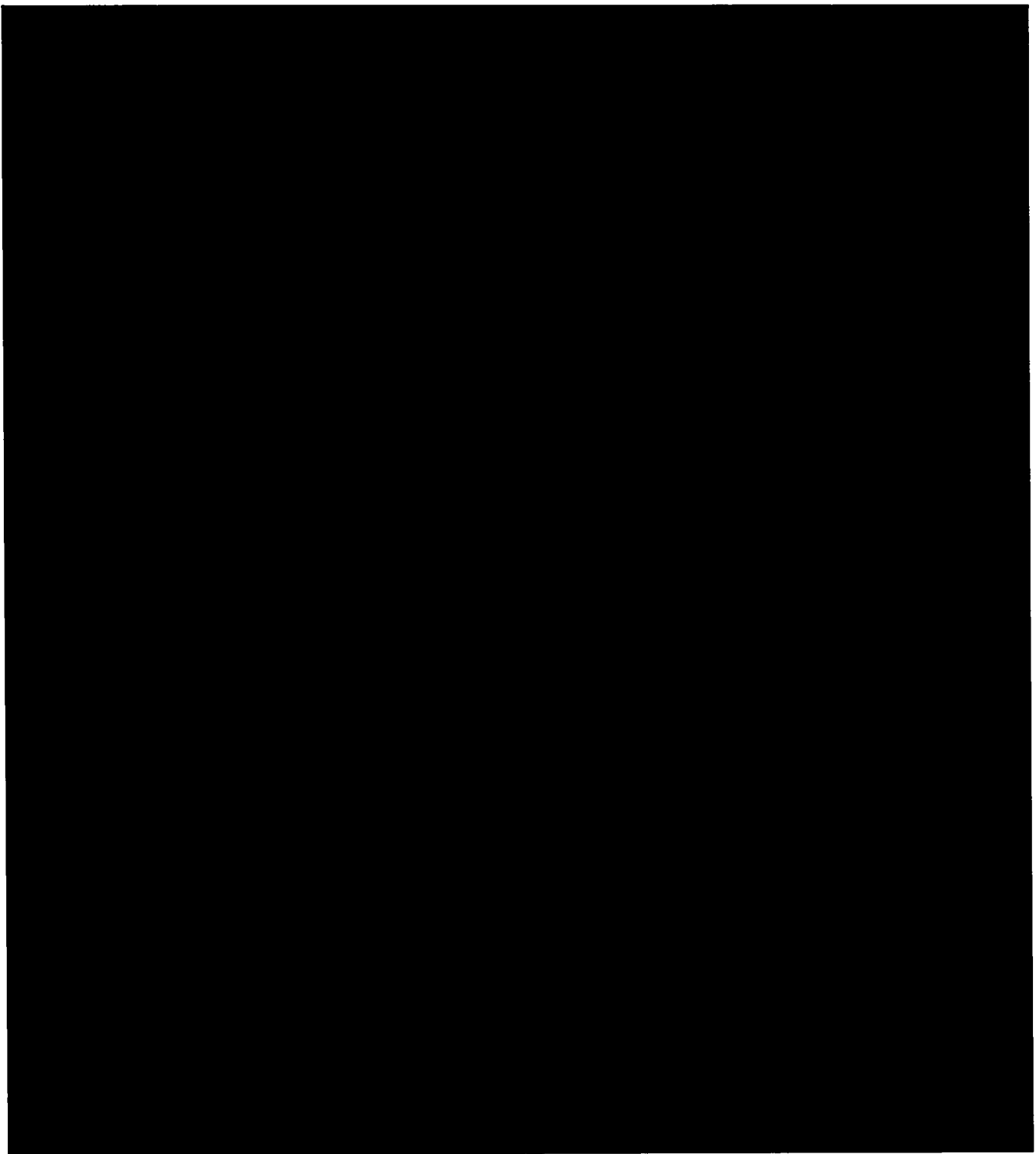
Table 3.7-5 Uranic Material Assumptions for Criticality Accident Sequences

Page 1 of 2









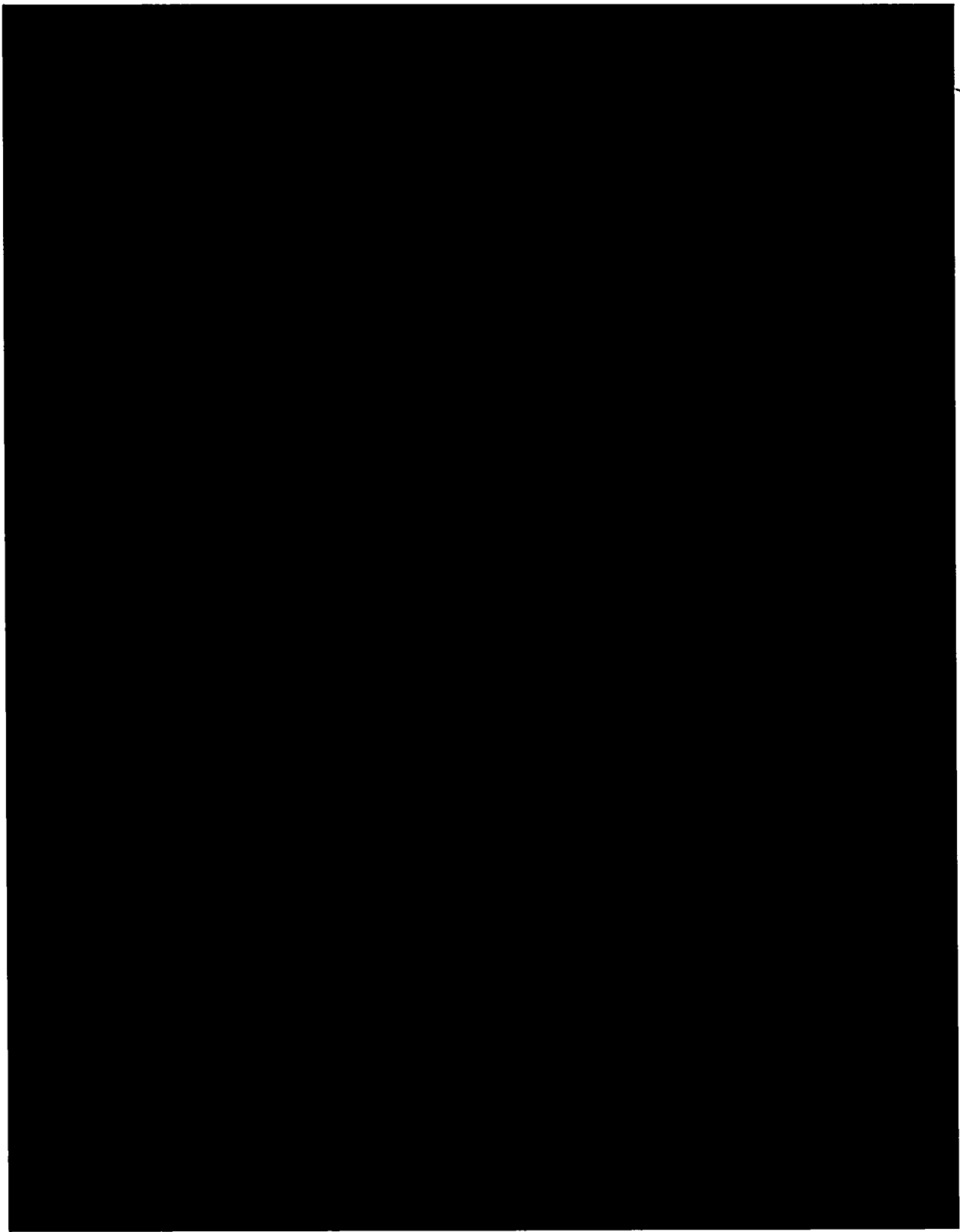


Table 3.7-7 Product System

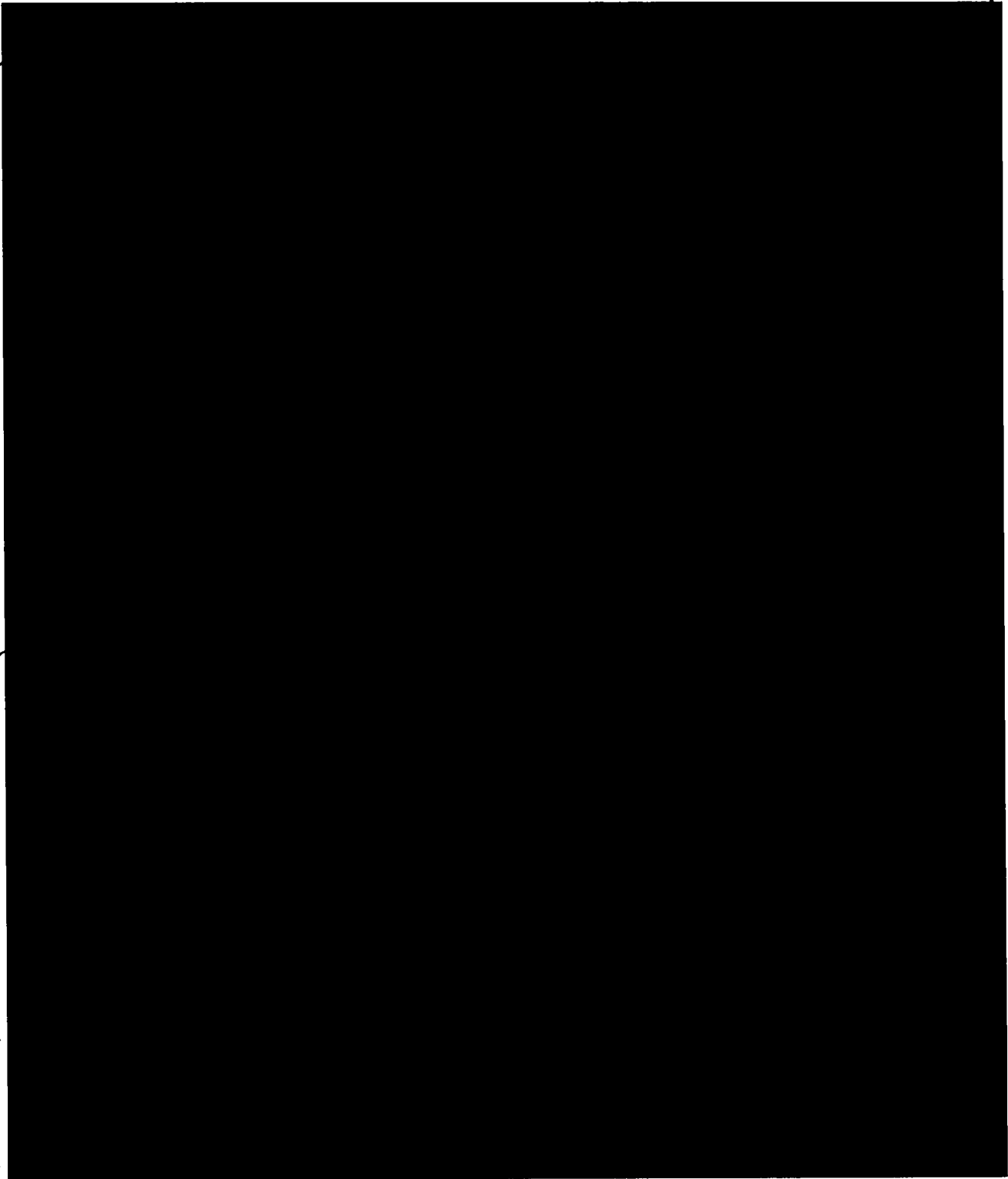


Table 3.7-7 Product System

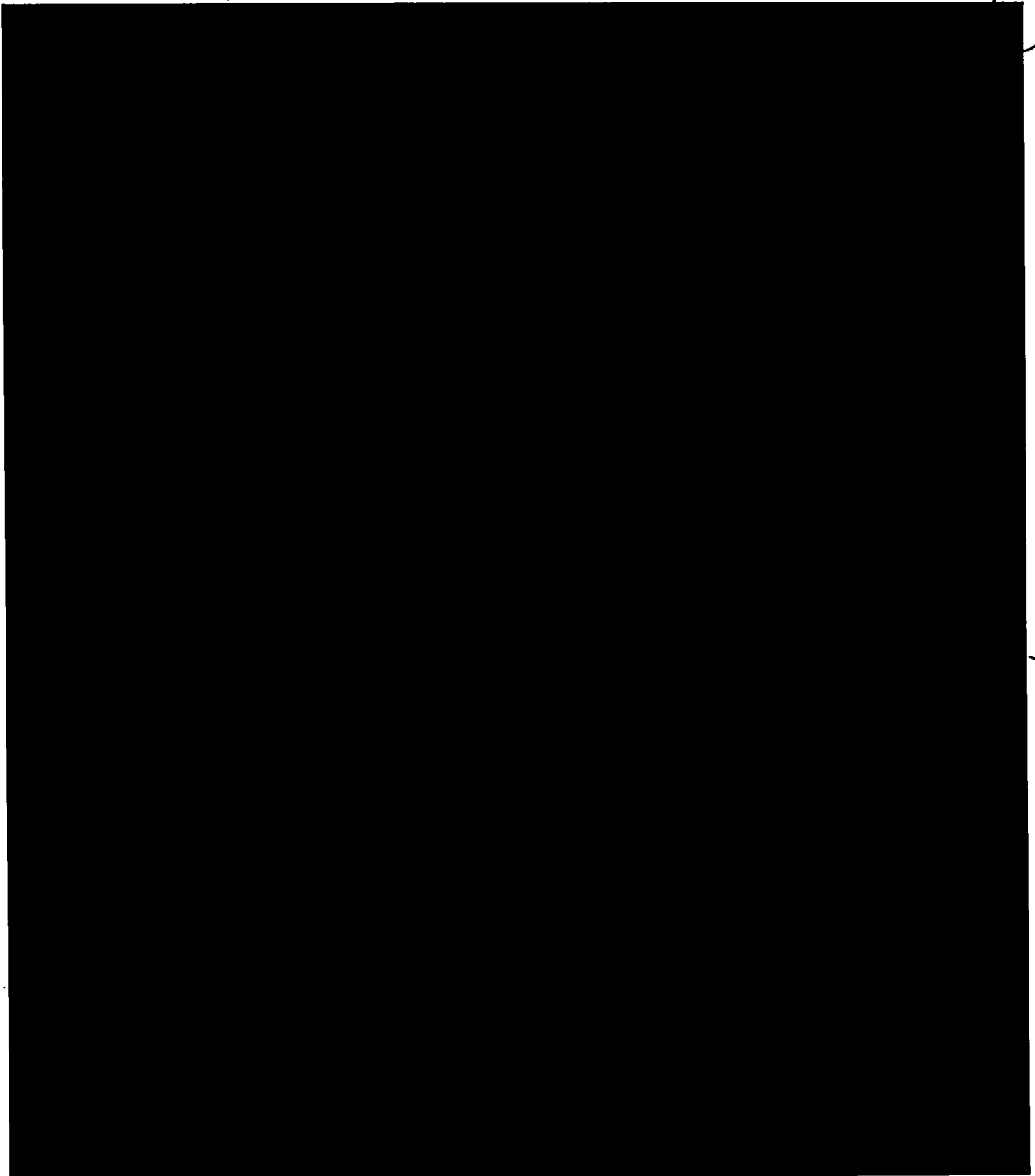


Table 3.7-7 Product System

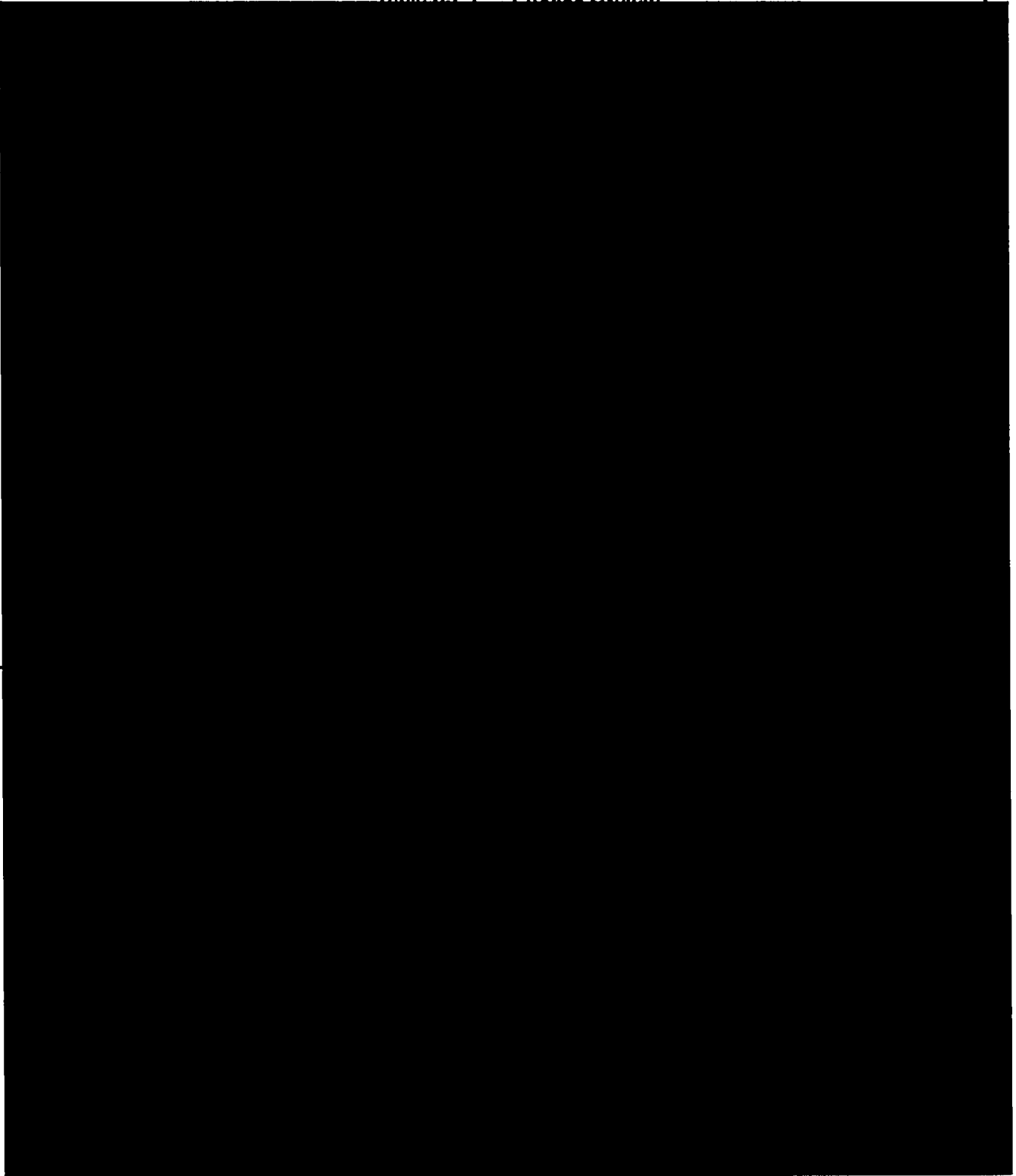


Table 3.7-7 Product System

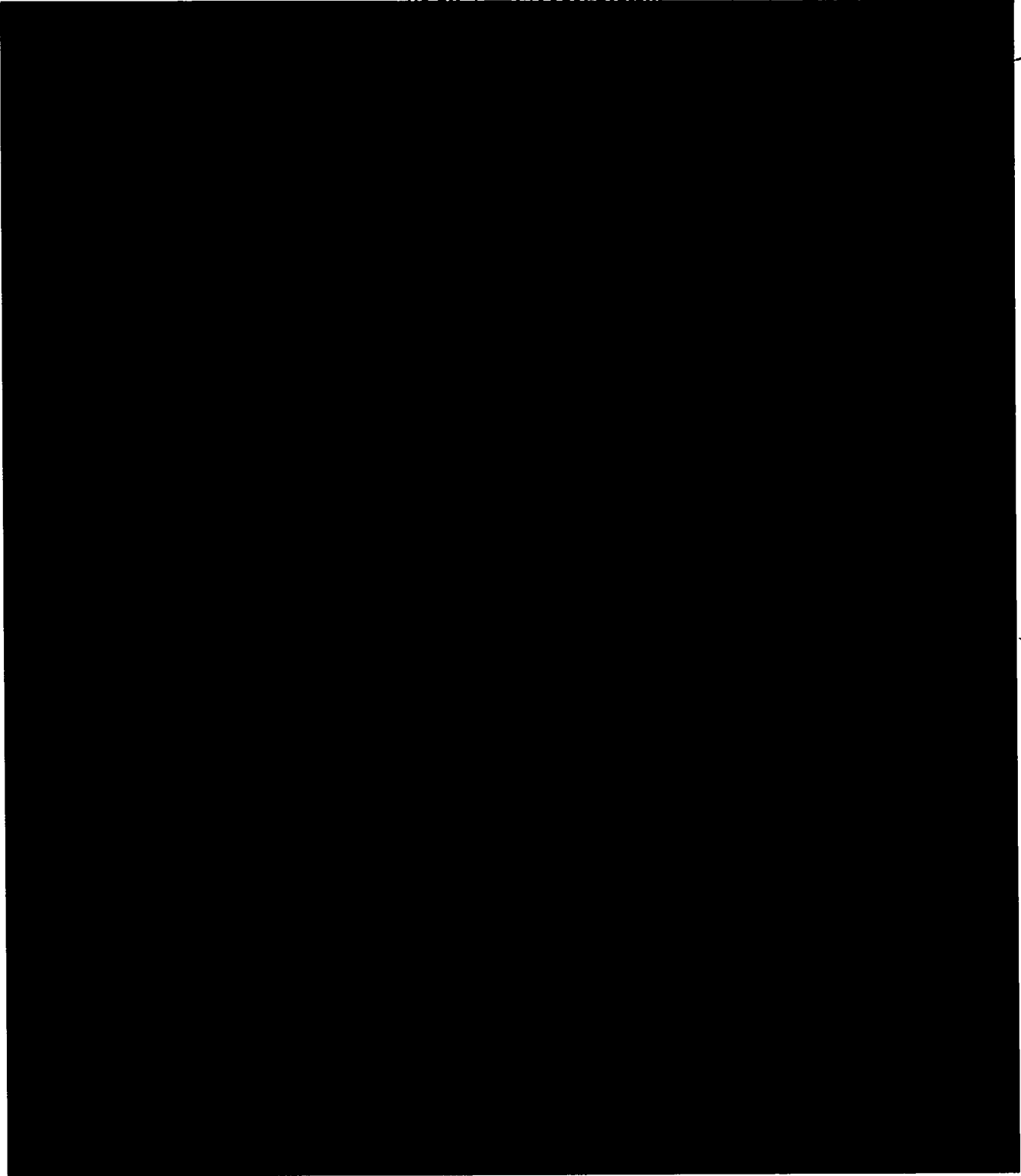


Table 3.7-7 Product System

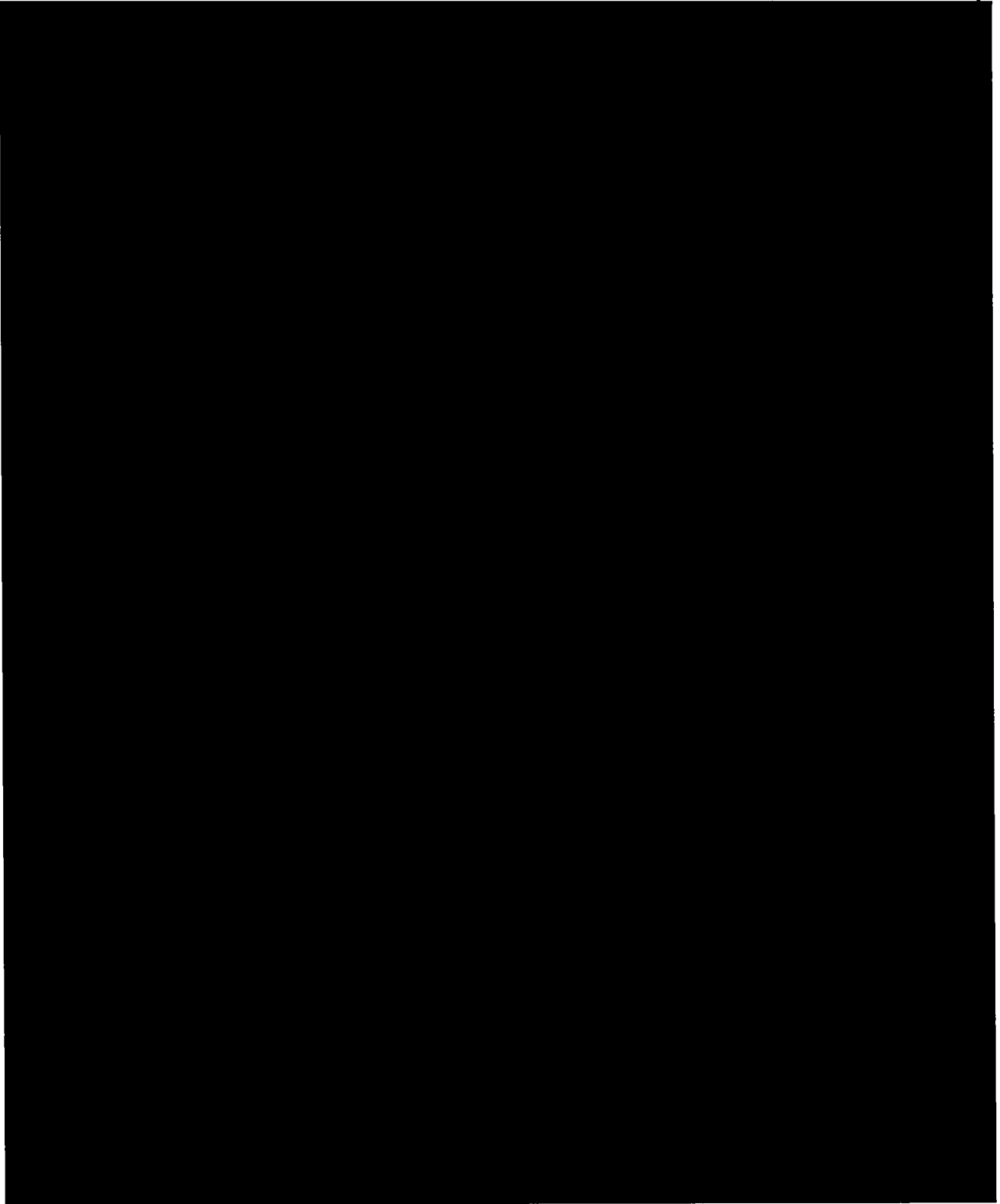


Table 3.7-7 Product System

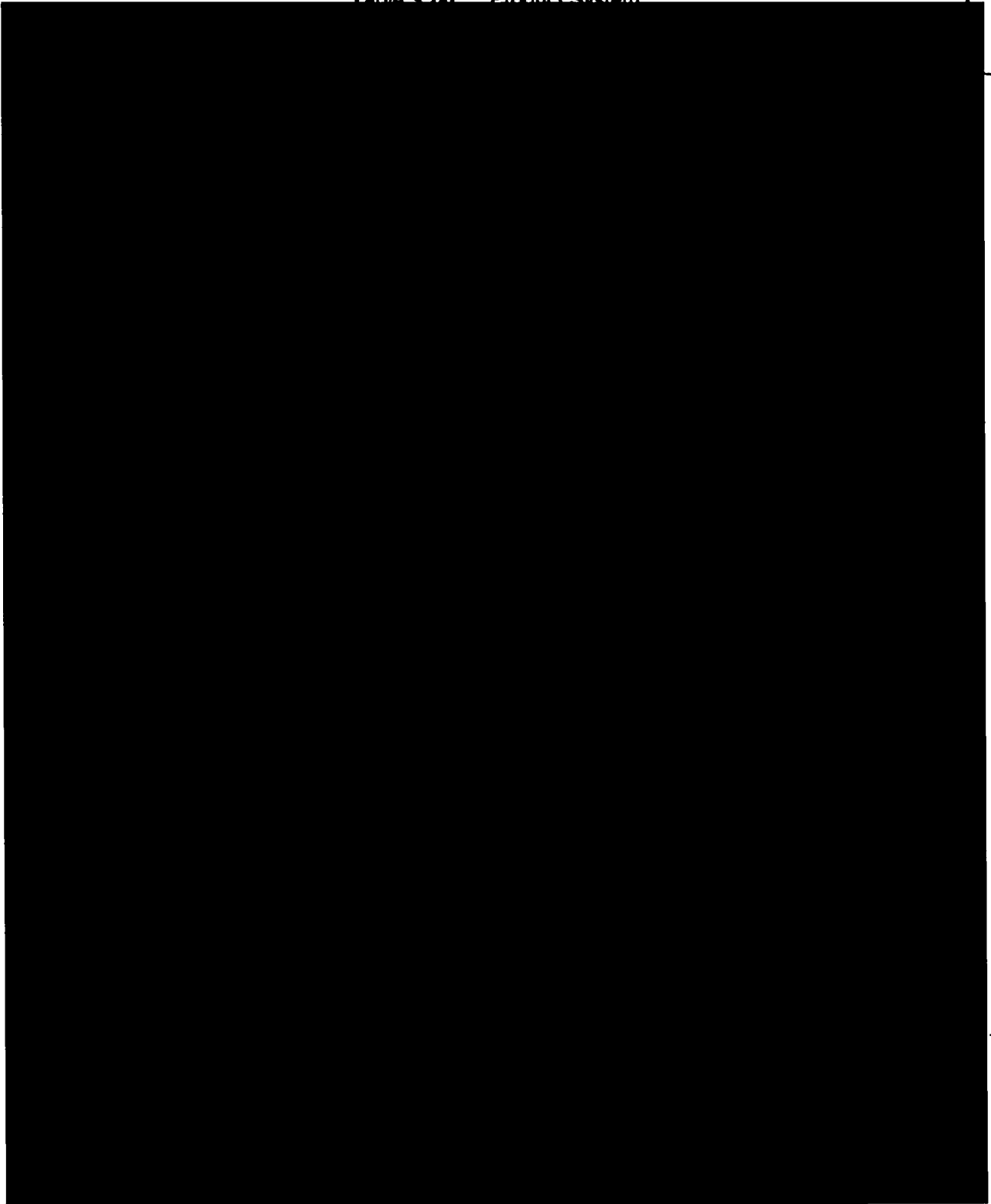


Table 3.7-7 Product System

Page 8 of 22

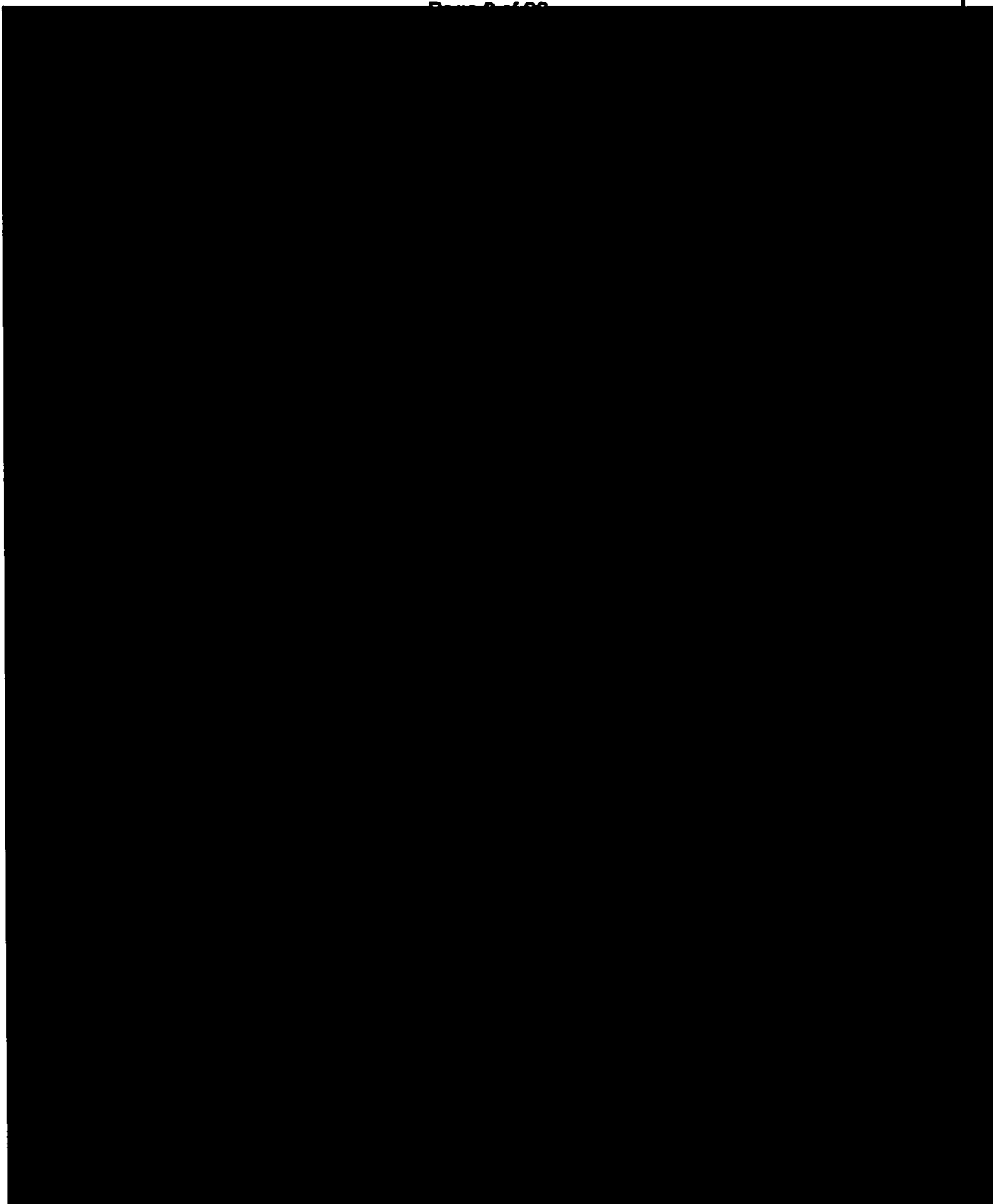


Table 3.7-7 Product System

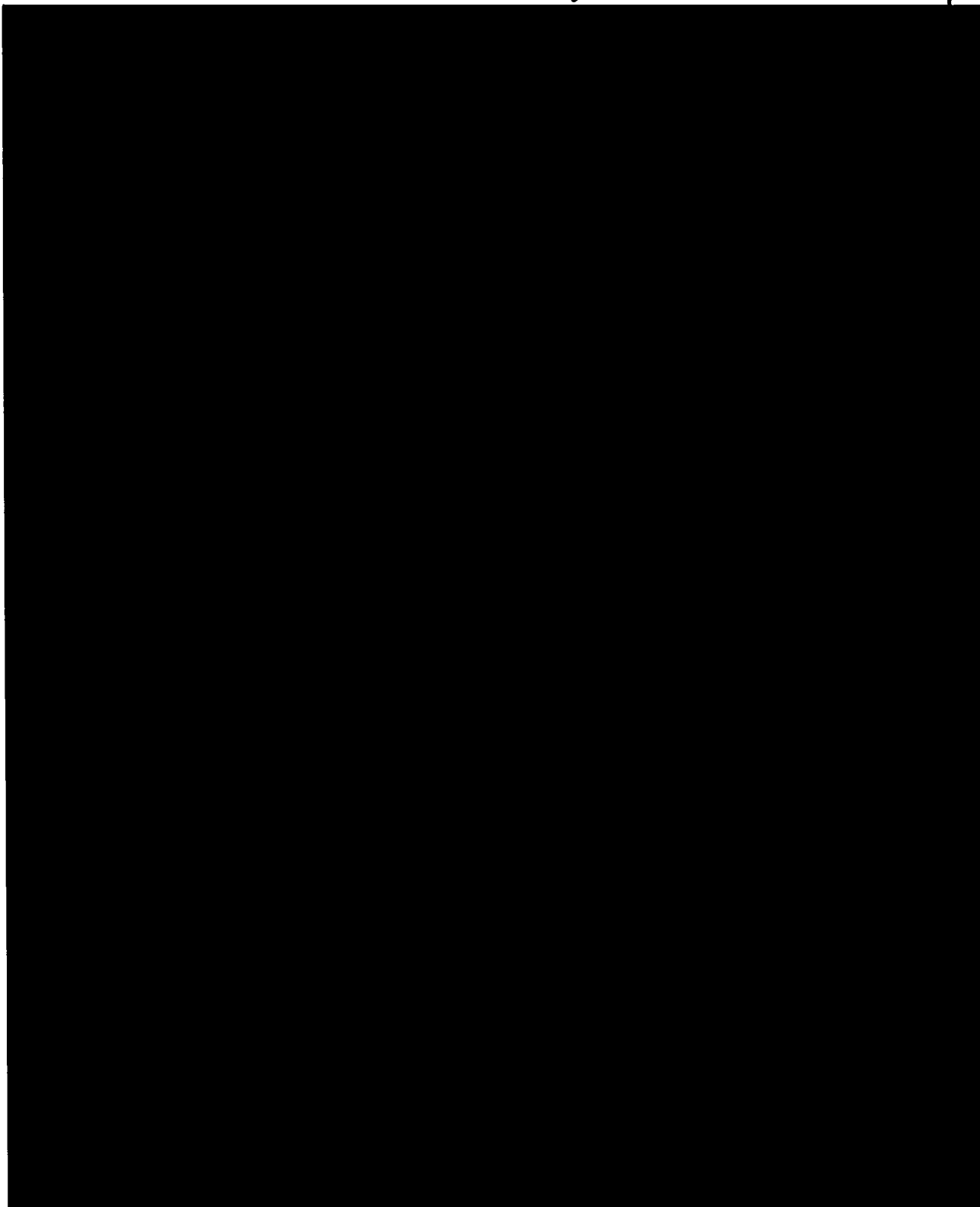


Table 3.7-7 Product System

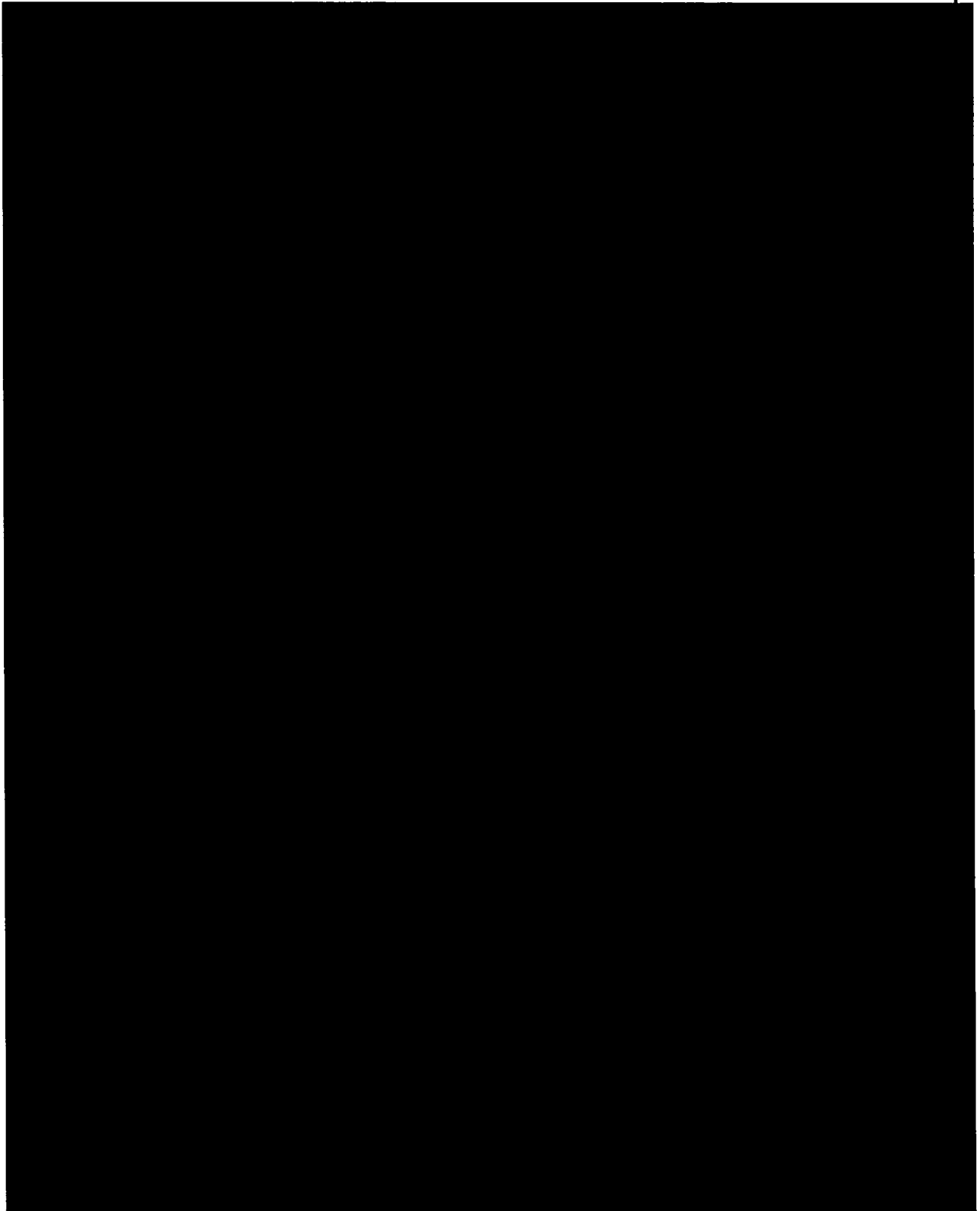


Table 3.7-7 Product System

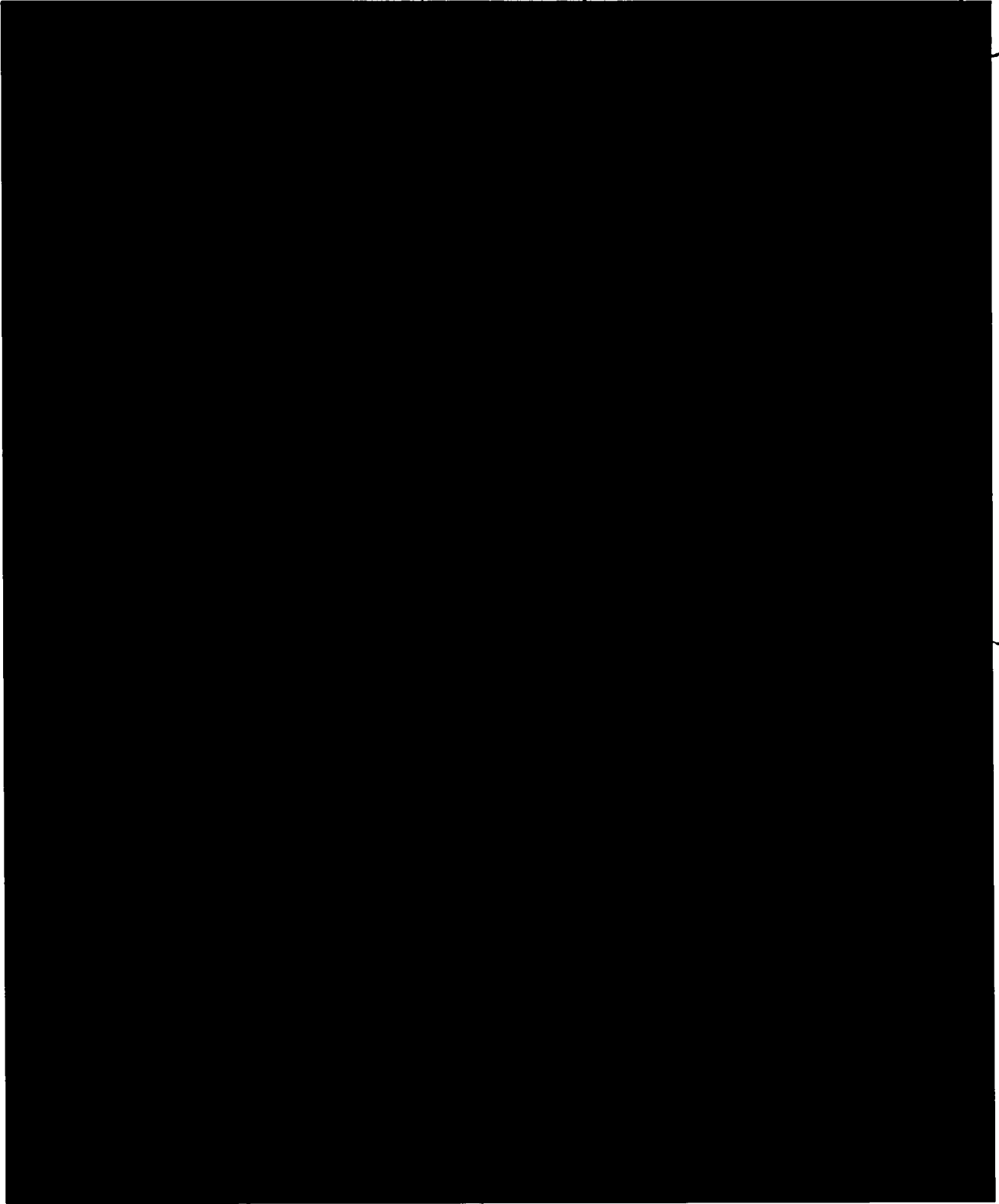


Table 3.7-7 Product System

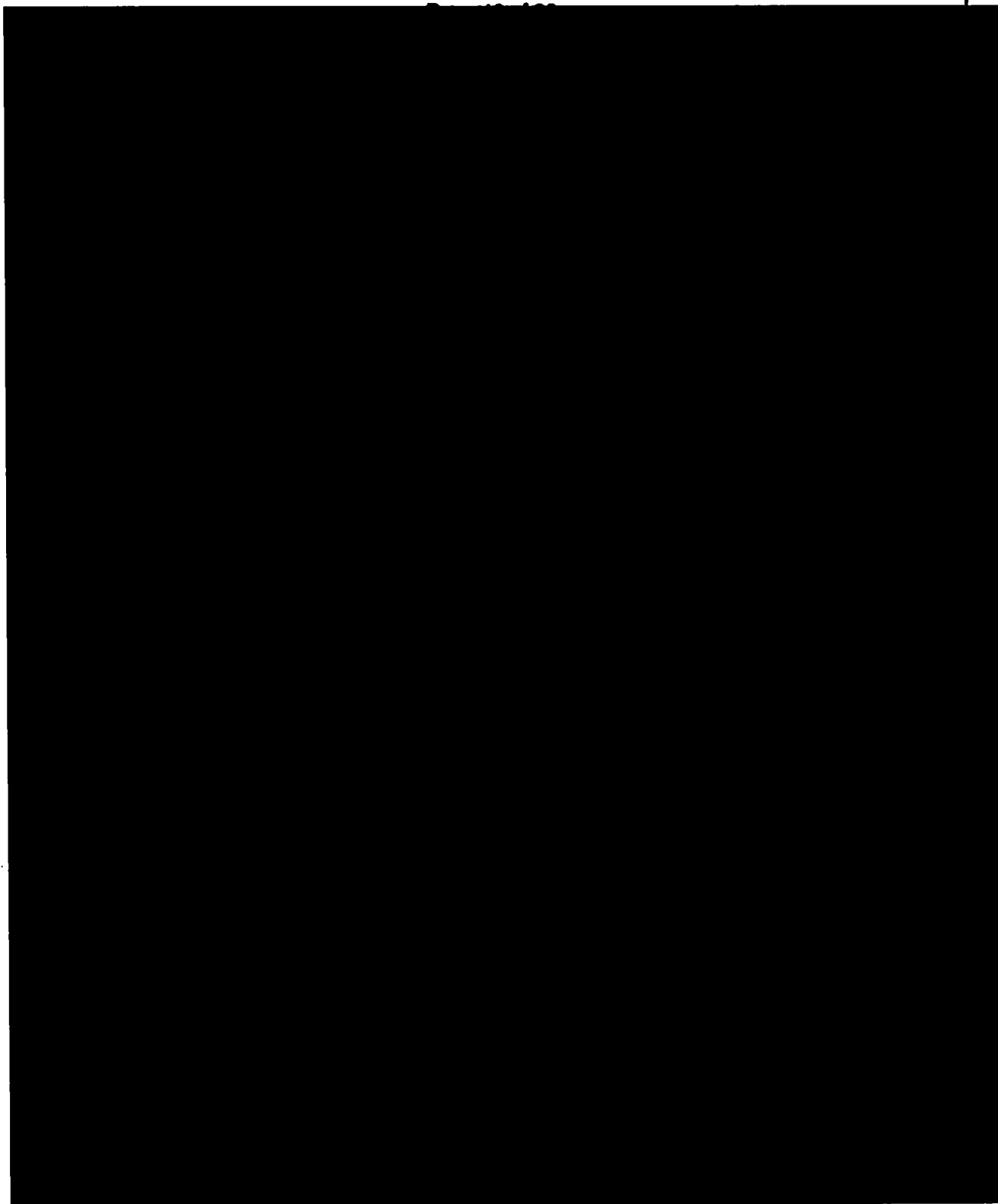


Table 3.7-7 Product System

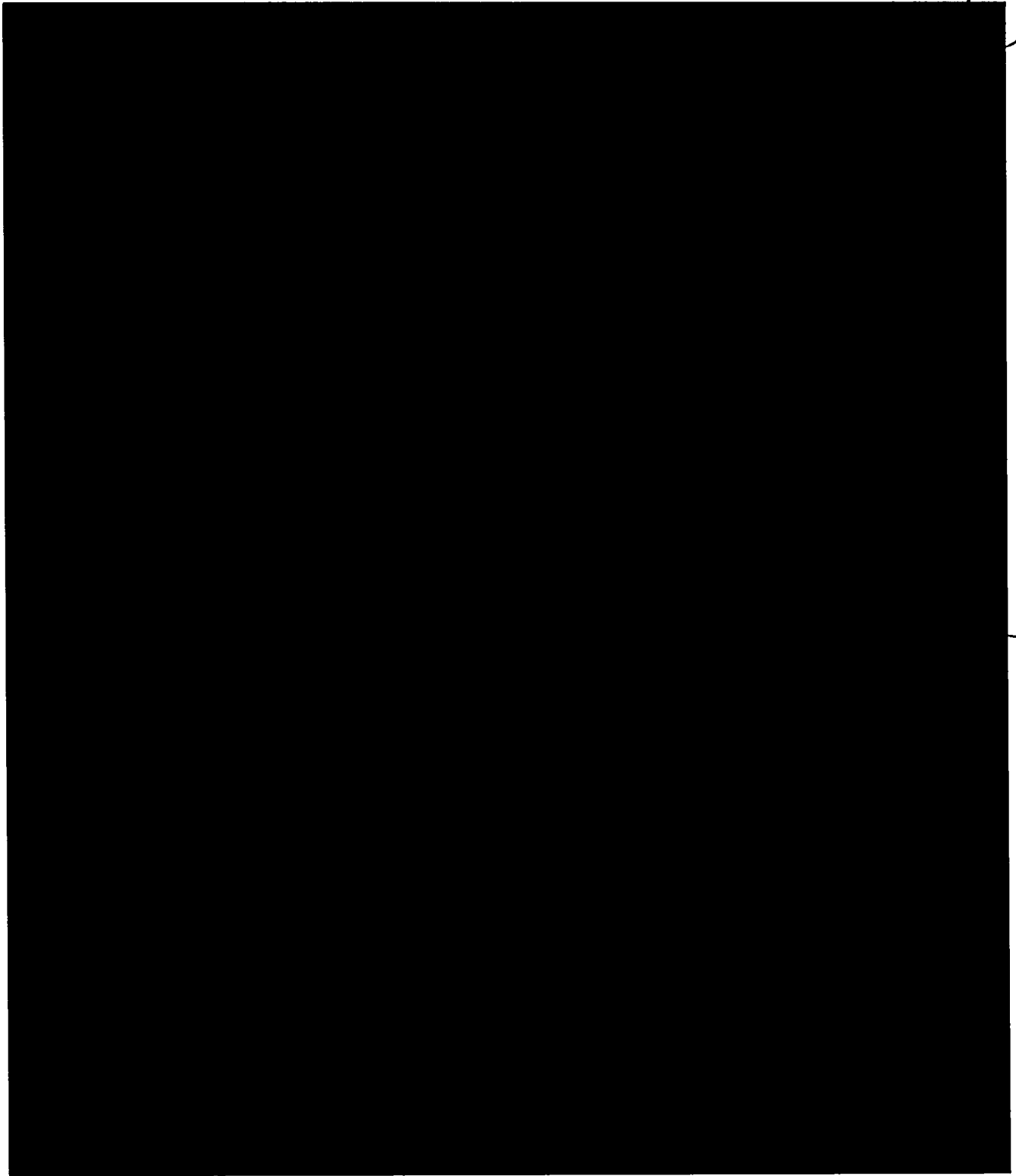


Table 3.7-7 Product System

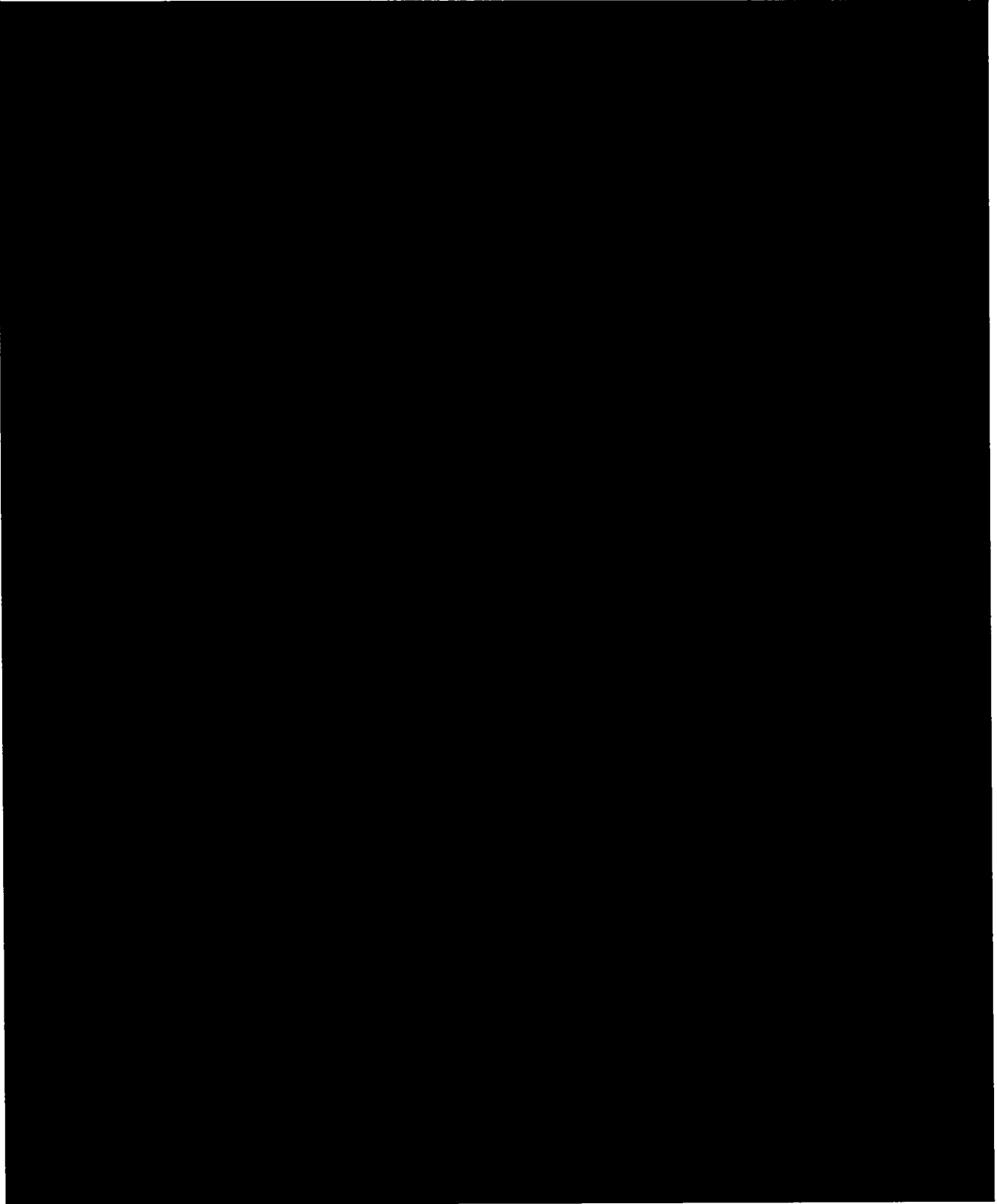


Table 3.7-7 Product System

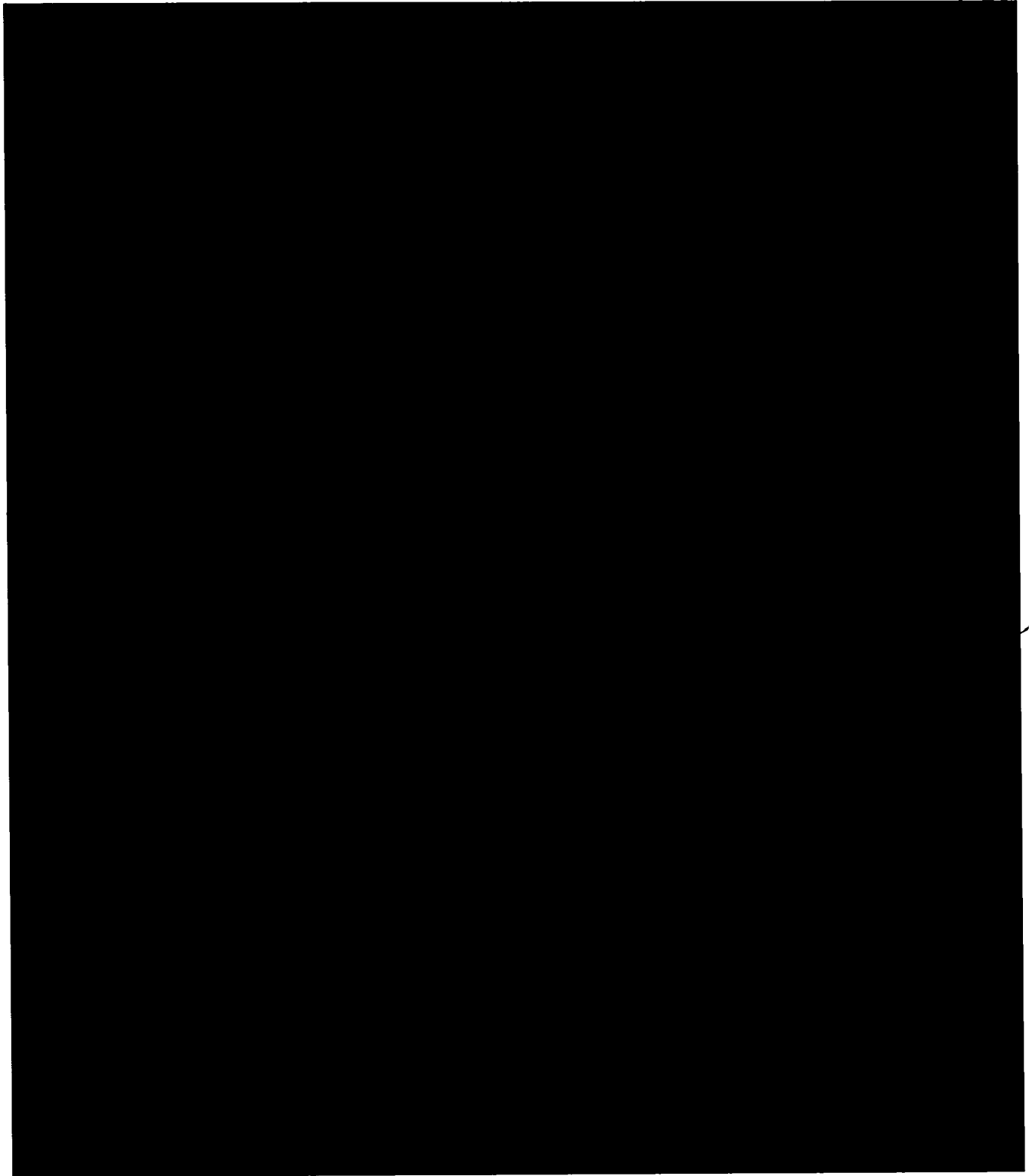


Table 3.7-7 Product System

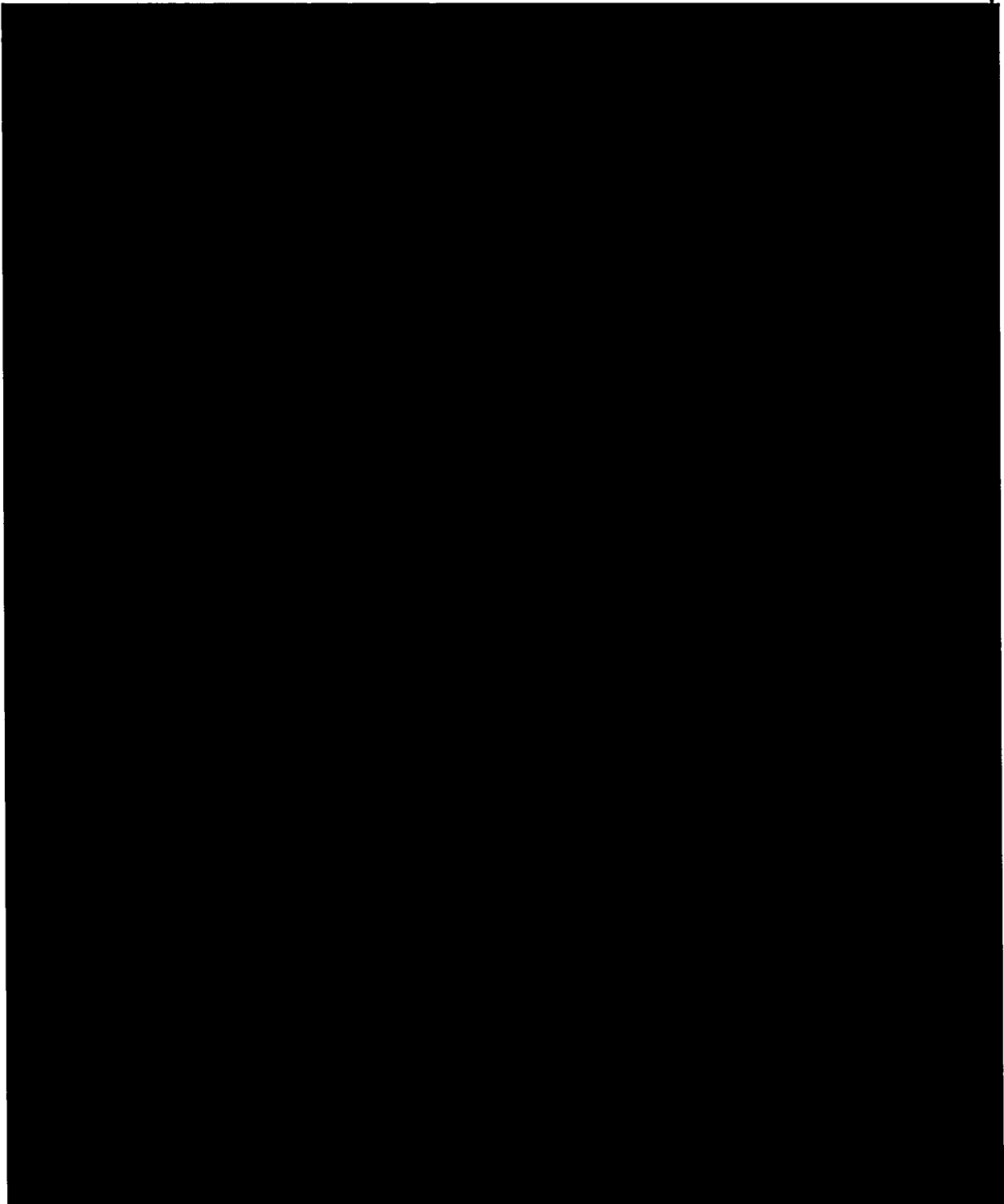


Table 3.7-7 Product System

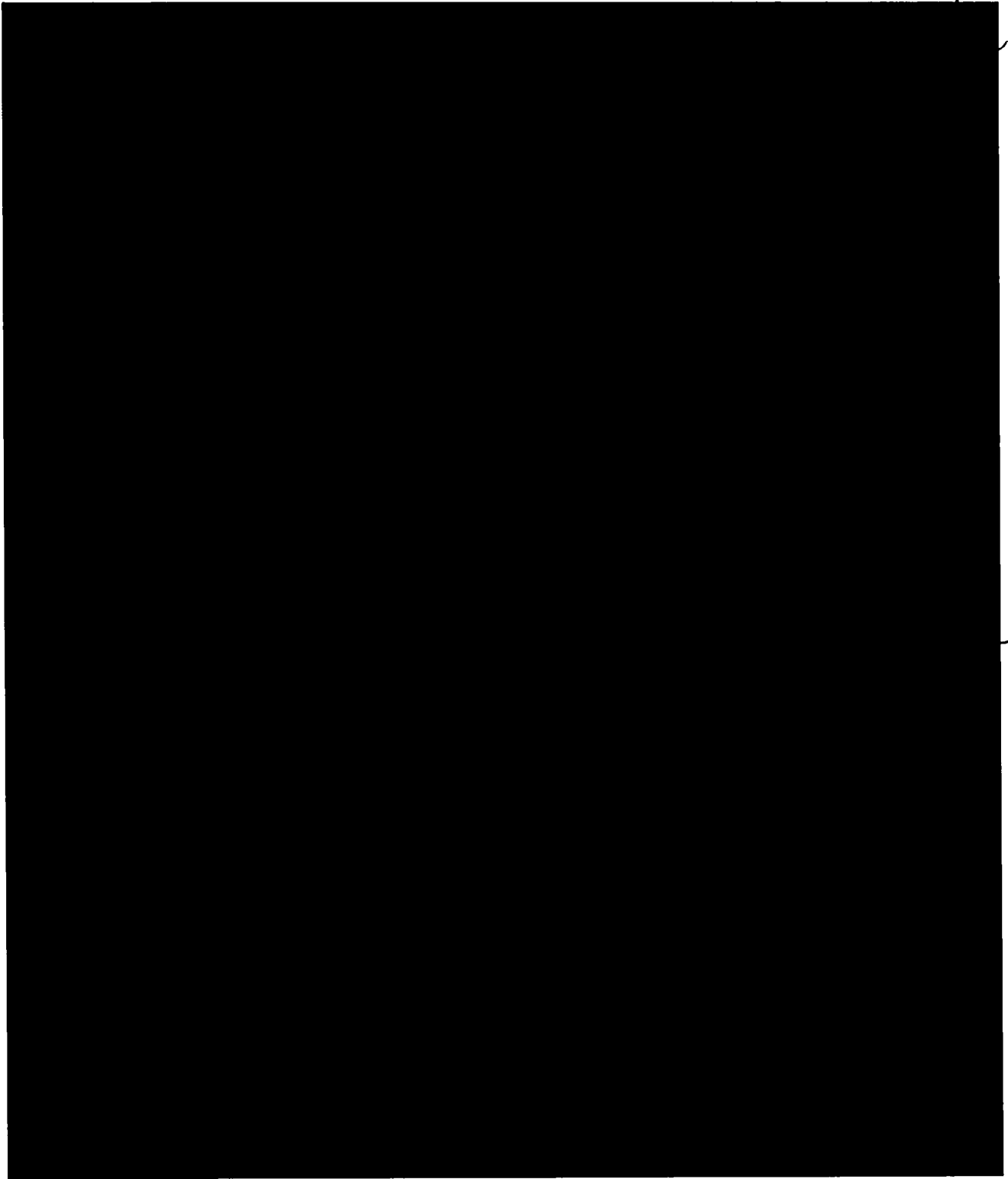


Table 3.7-7 Product System

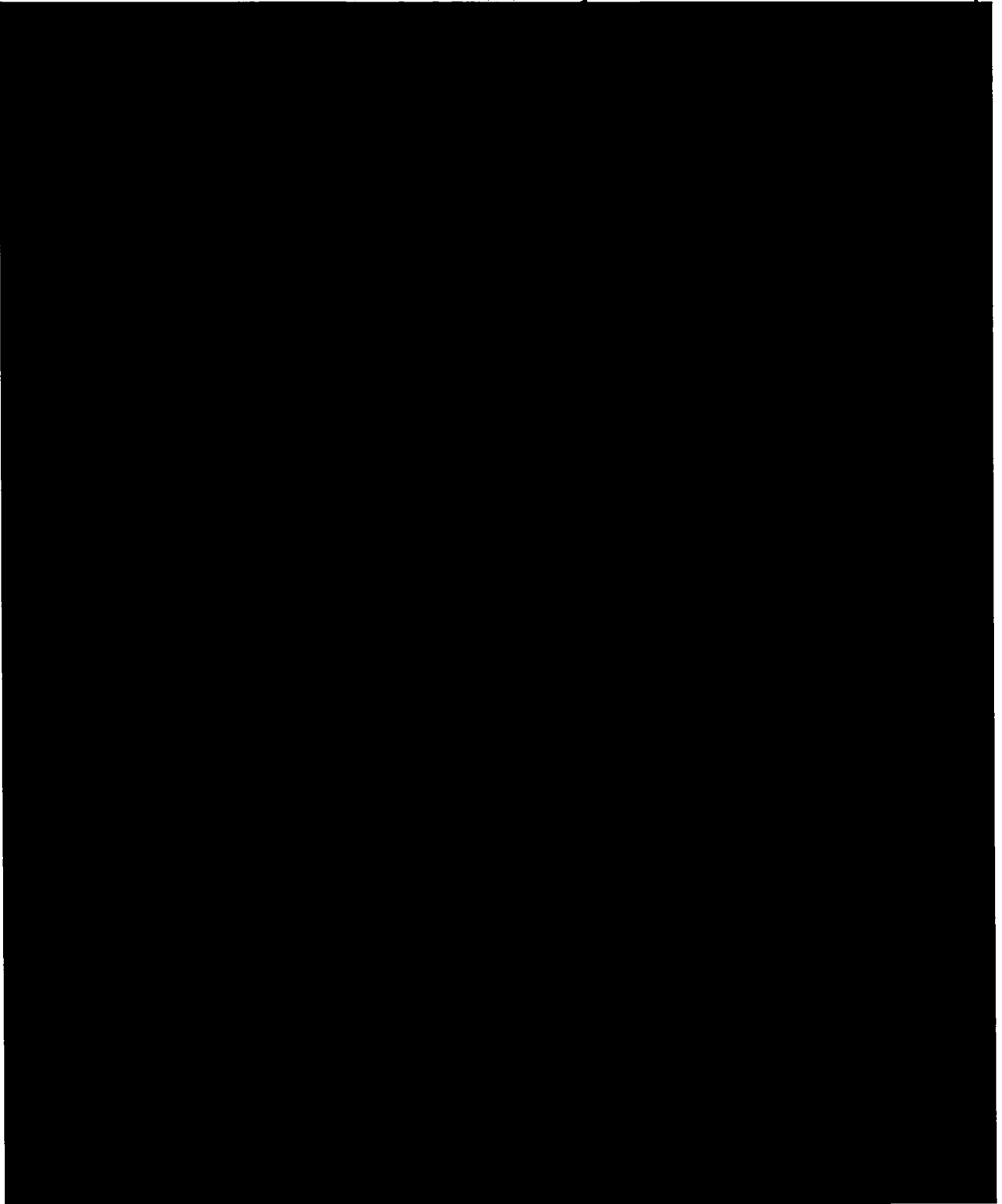


Table 3.7-7 Product System

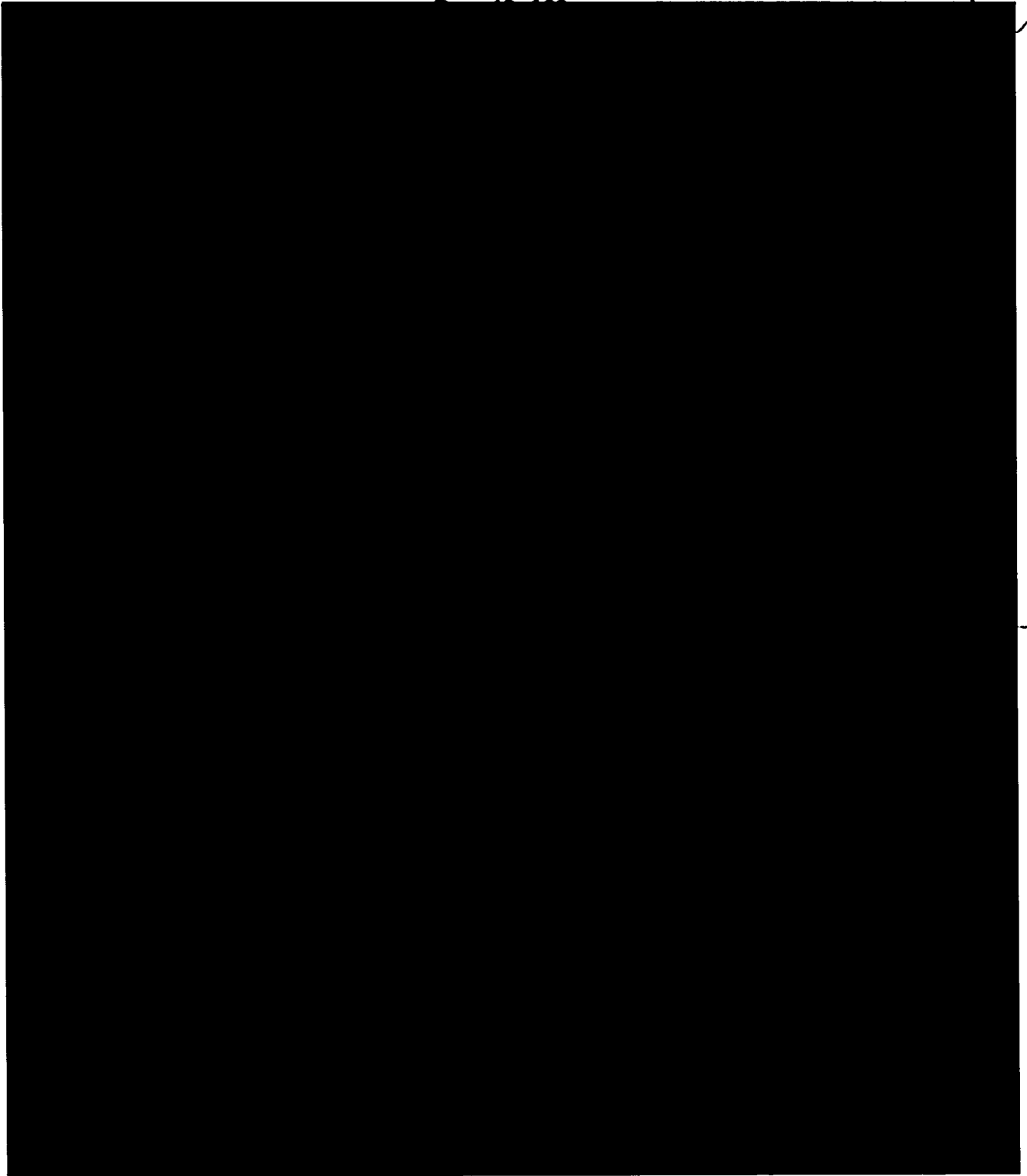


Table 3.7-7 Product System

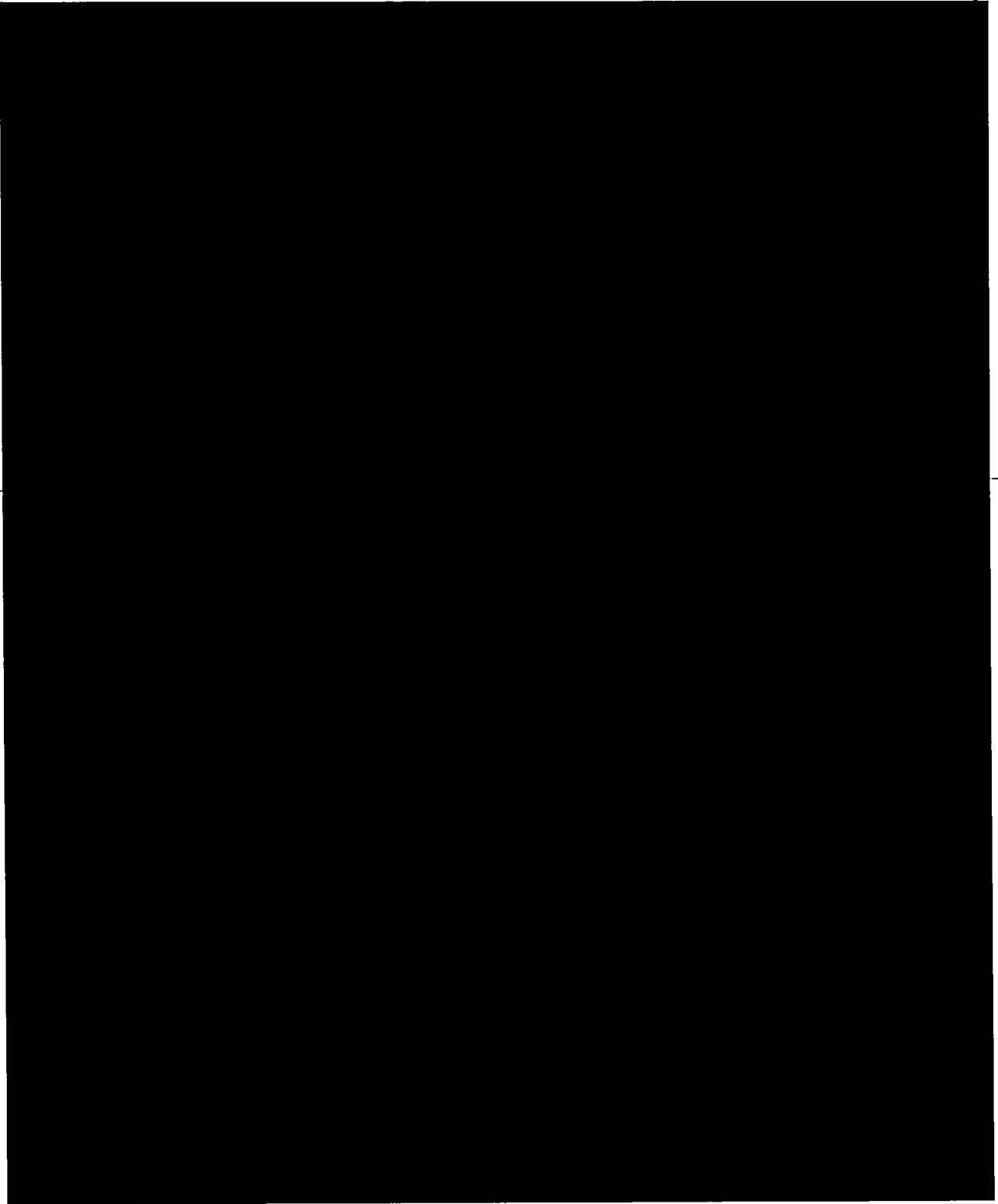


Table 3.7-7 Product System

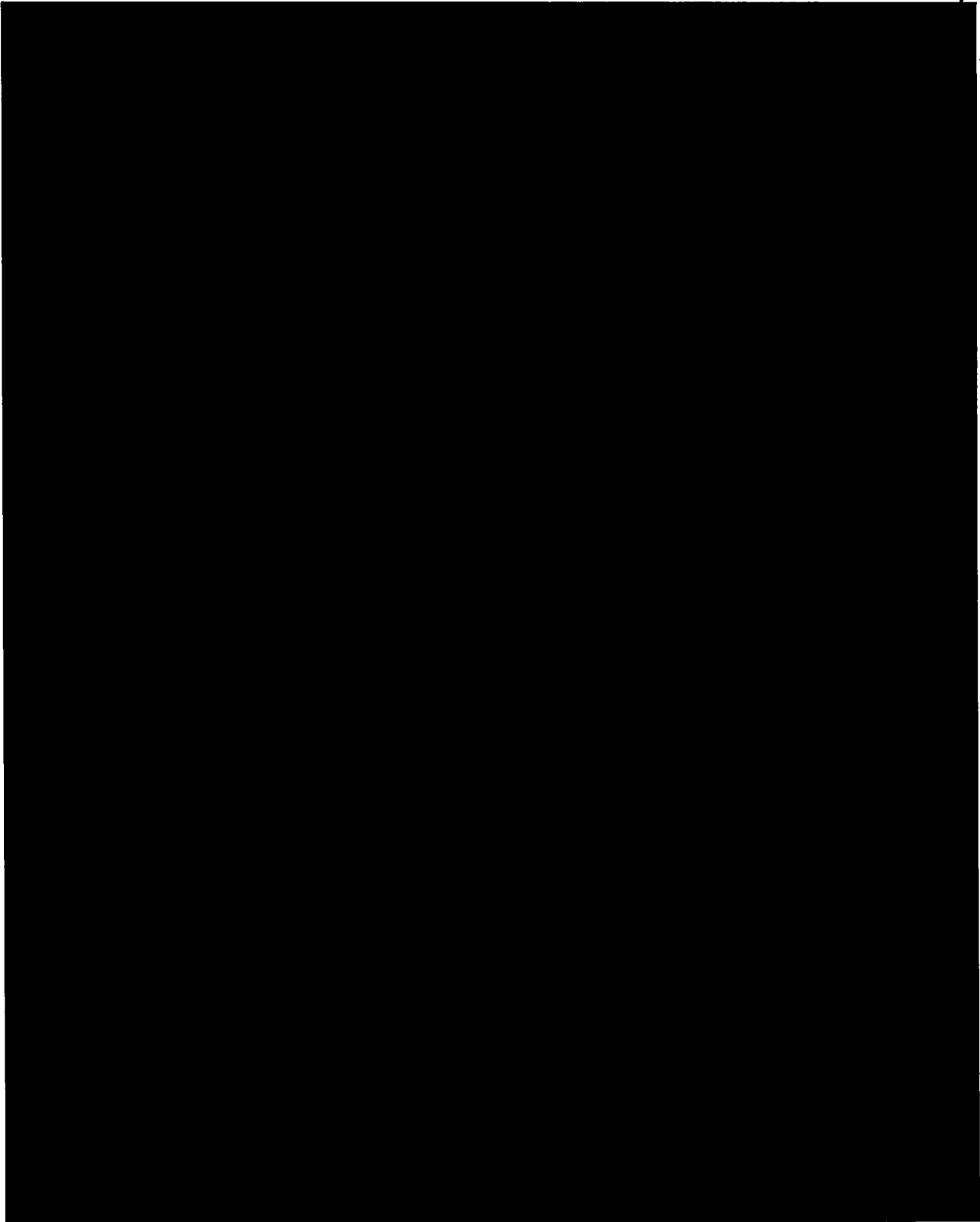


Table 3.7-7 Product System

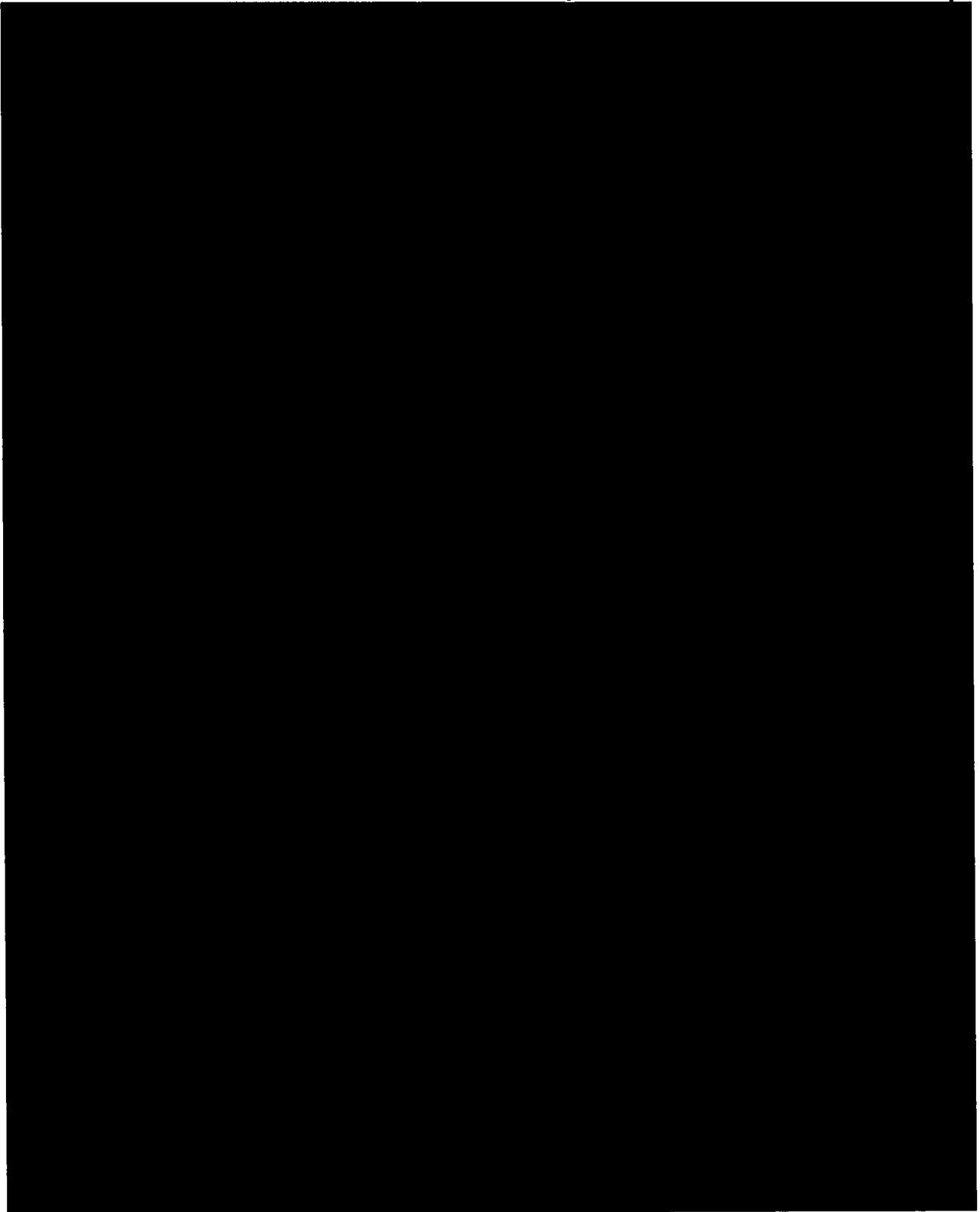


Table 3.7-7 Product System

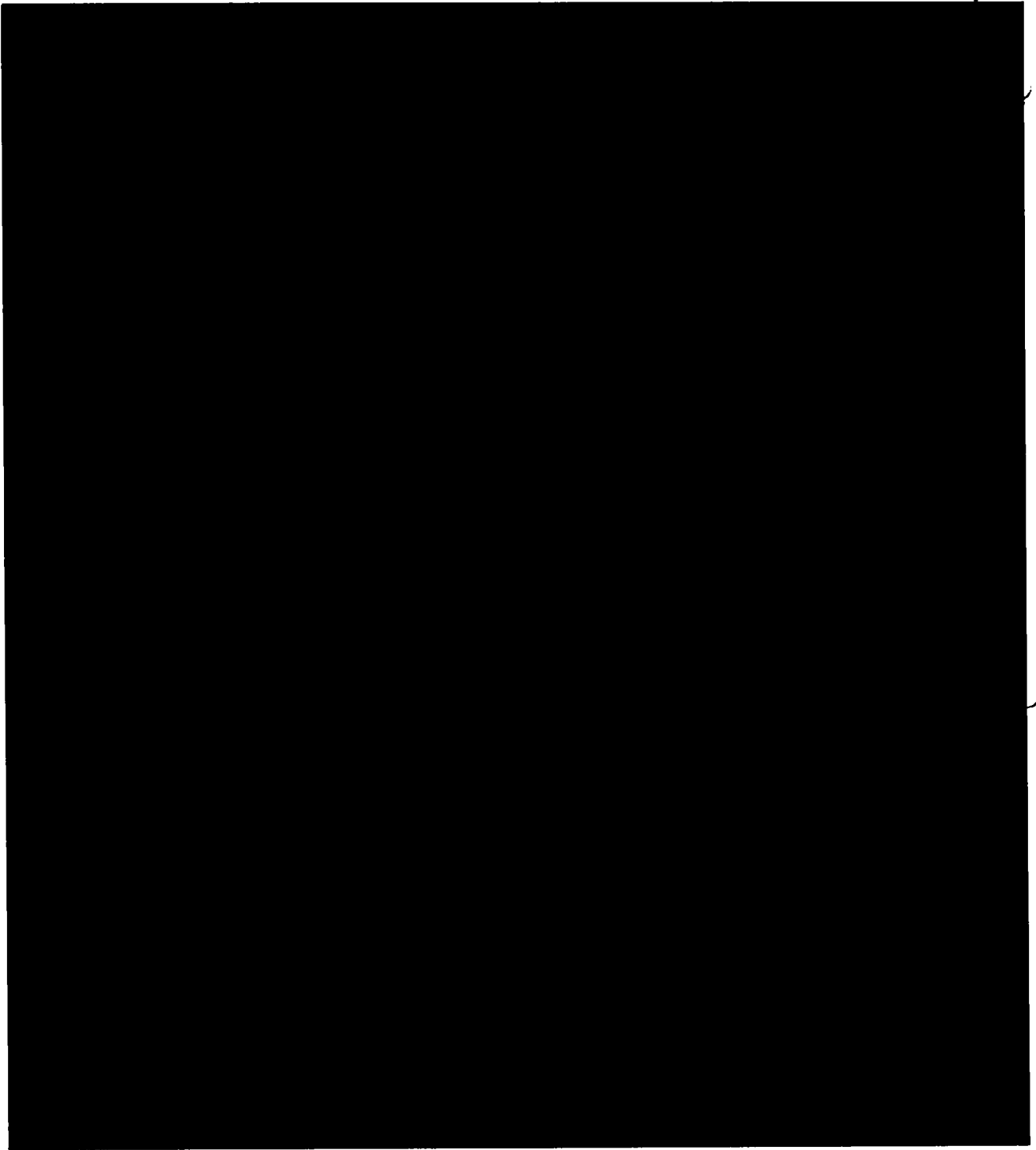


Table 3.7-7 Product System

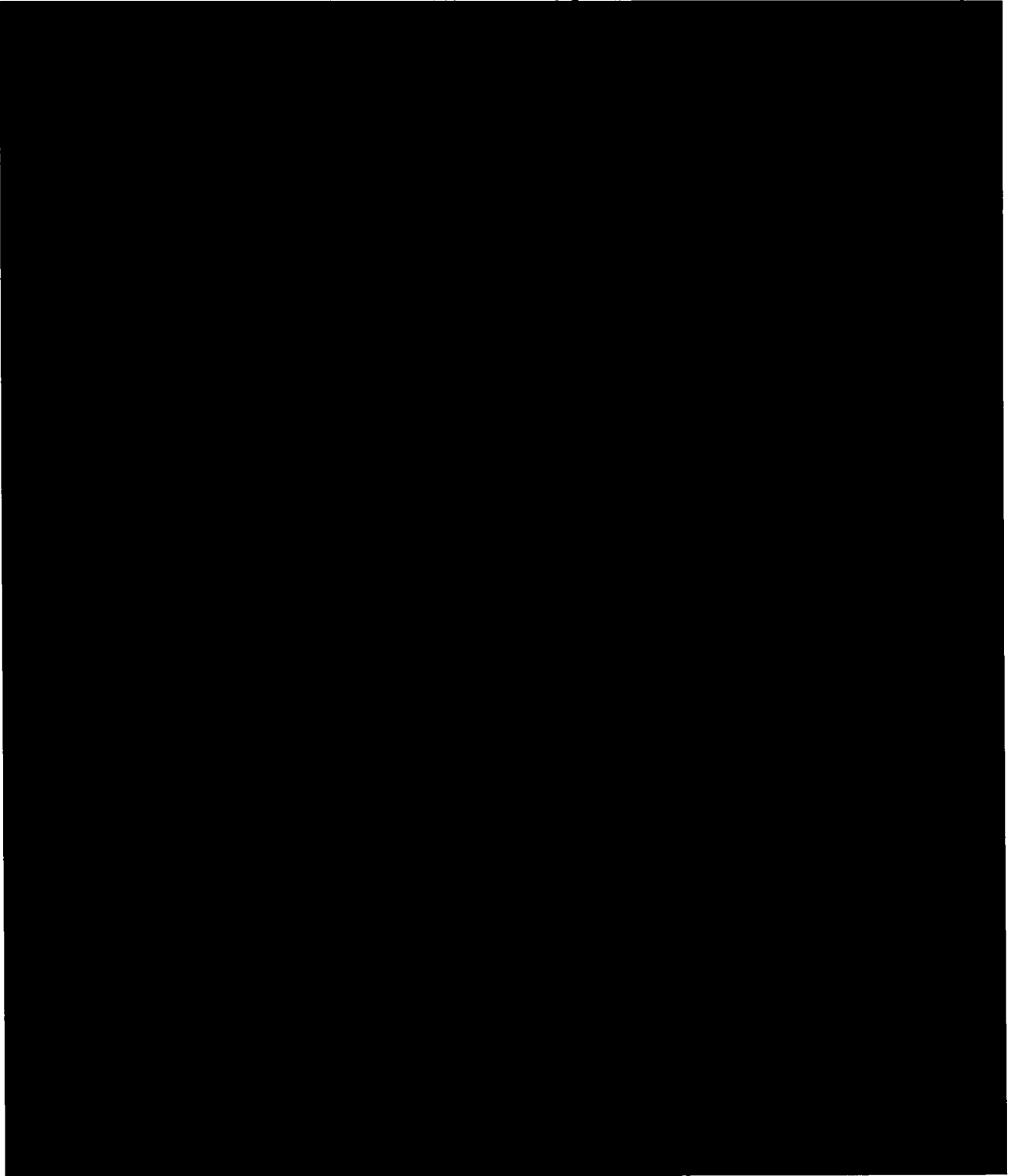


Table 3.7-7 Product System

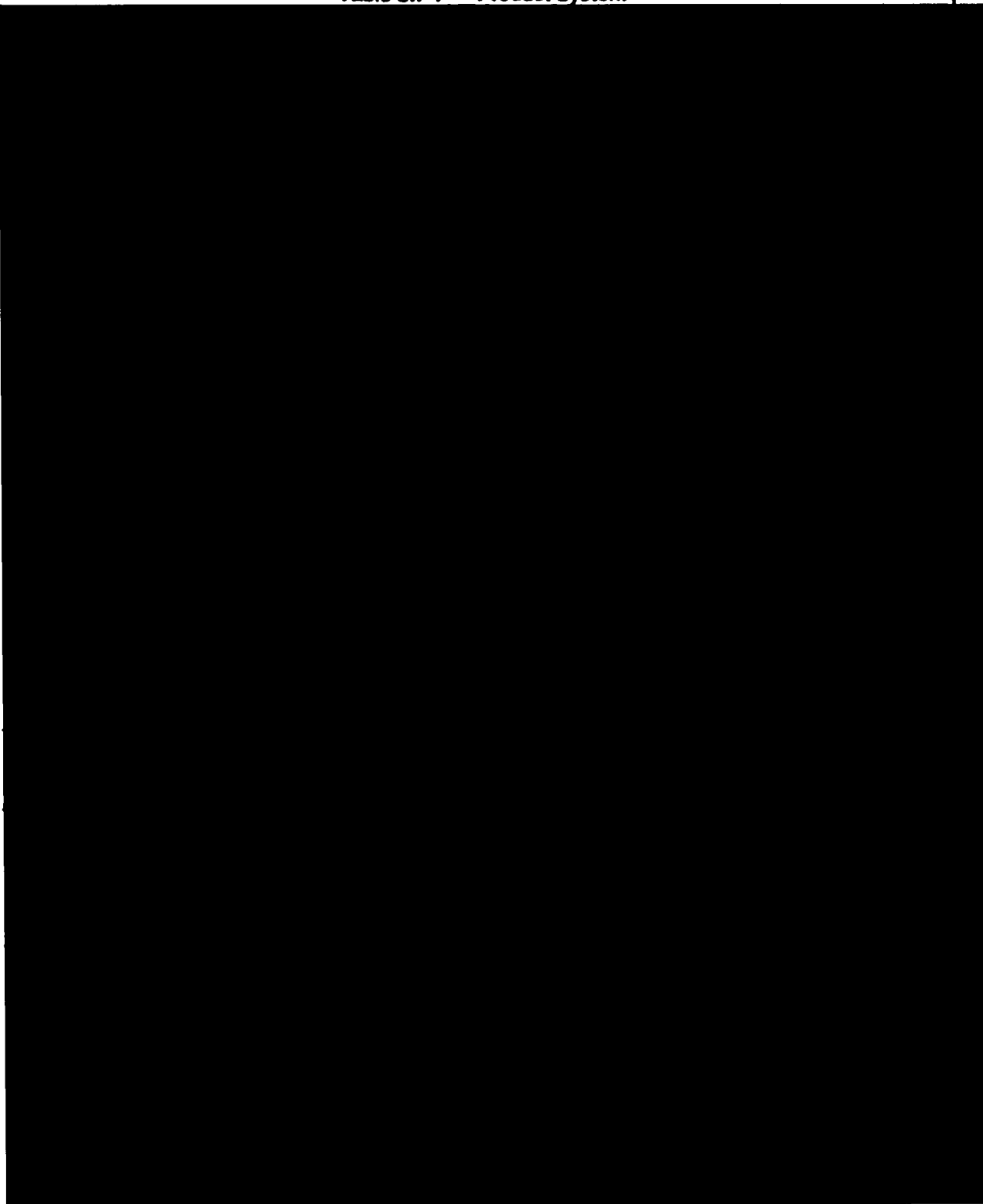


Table 3.7-7 Product System

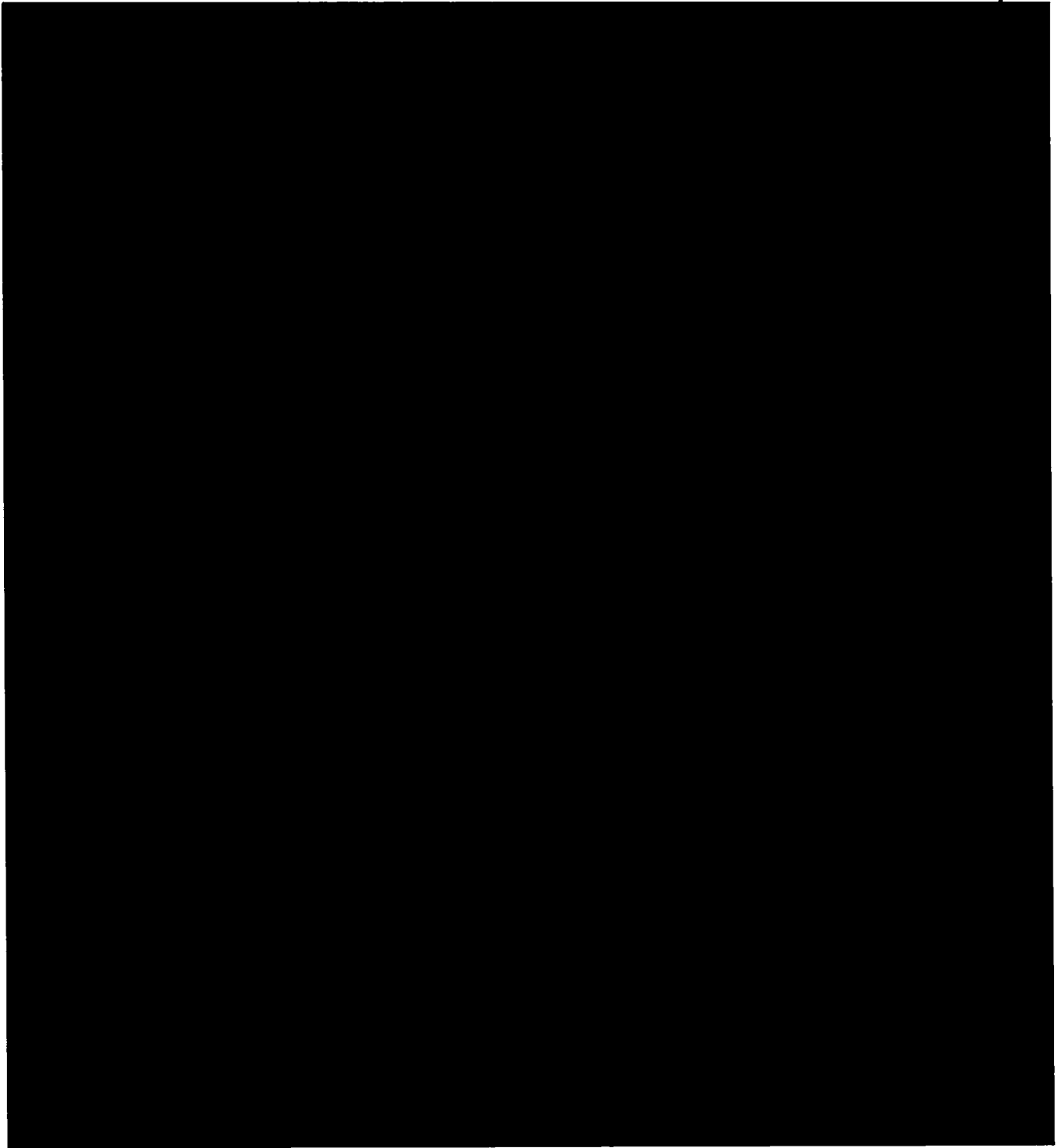


Table 3.7-7 Product System

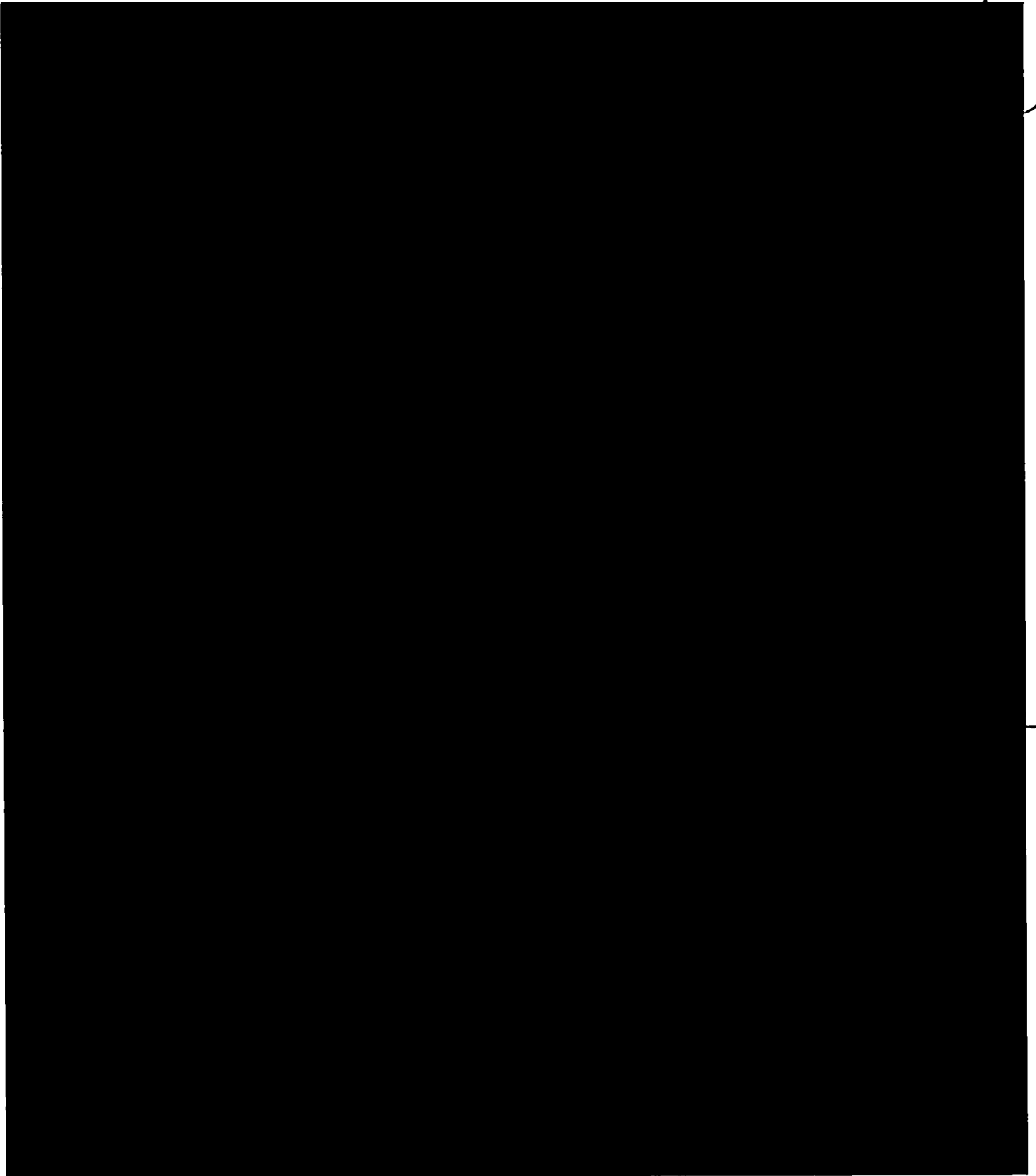


Table 3.7-7 Product System



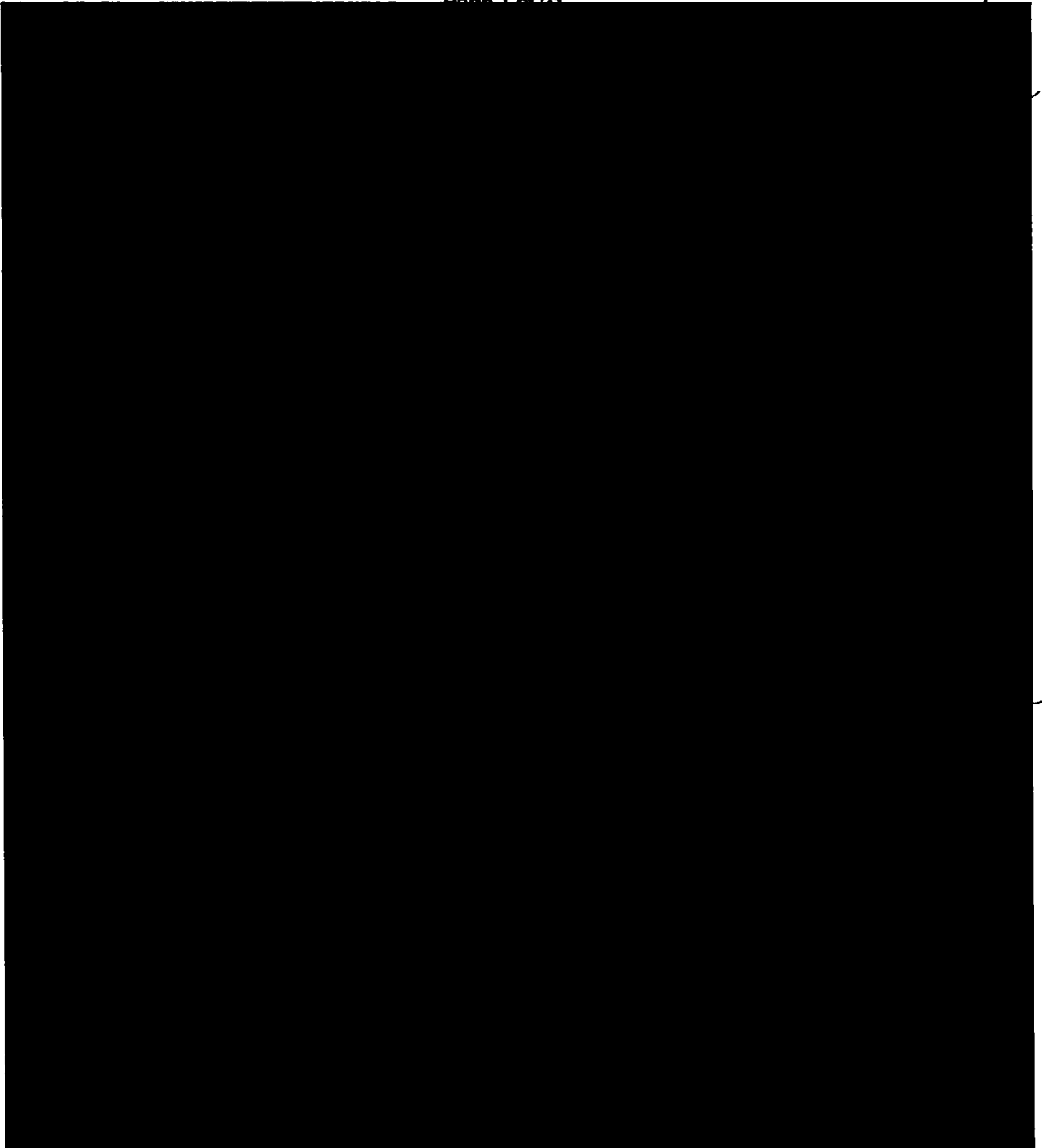


Table 3.7-8 Tails System

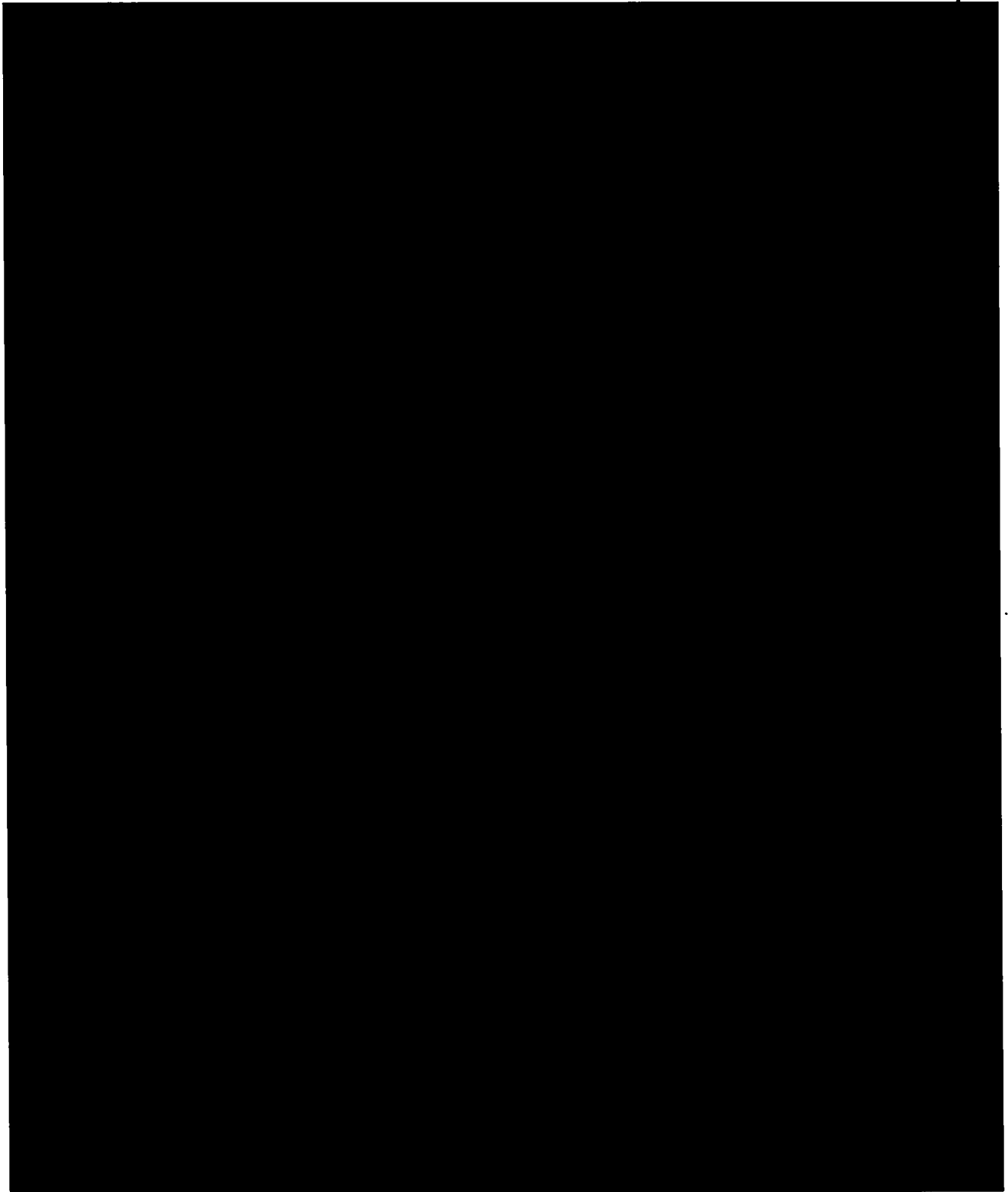


Table 3.7-8 Tails System

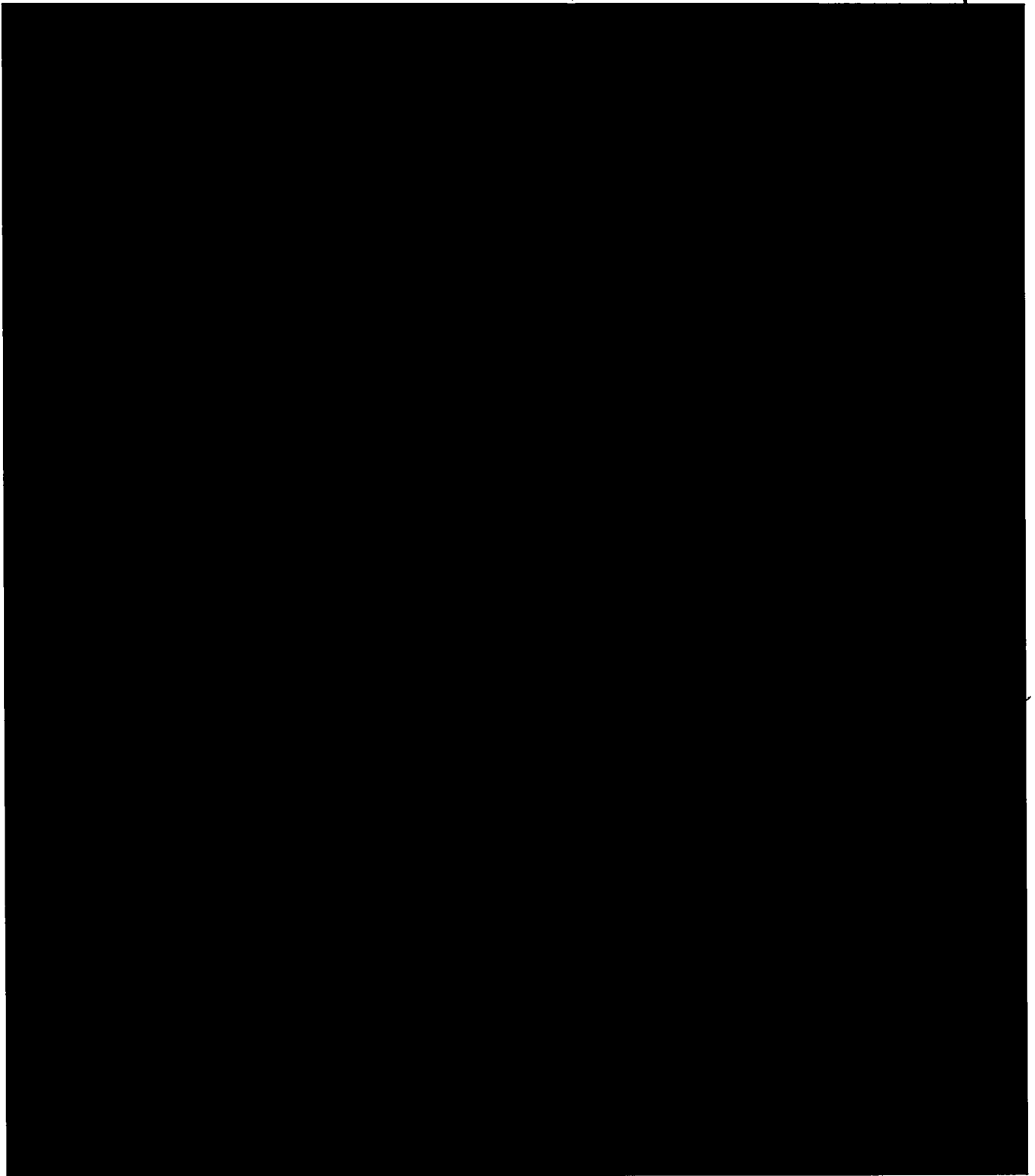


Table 3.7-8 Tails System

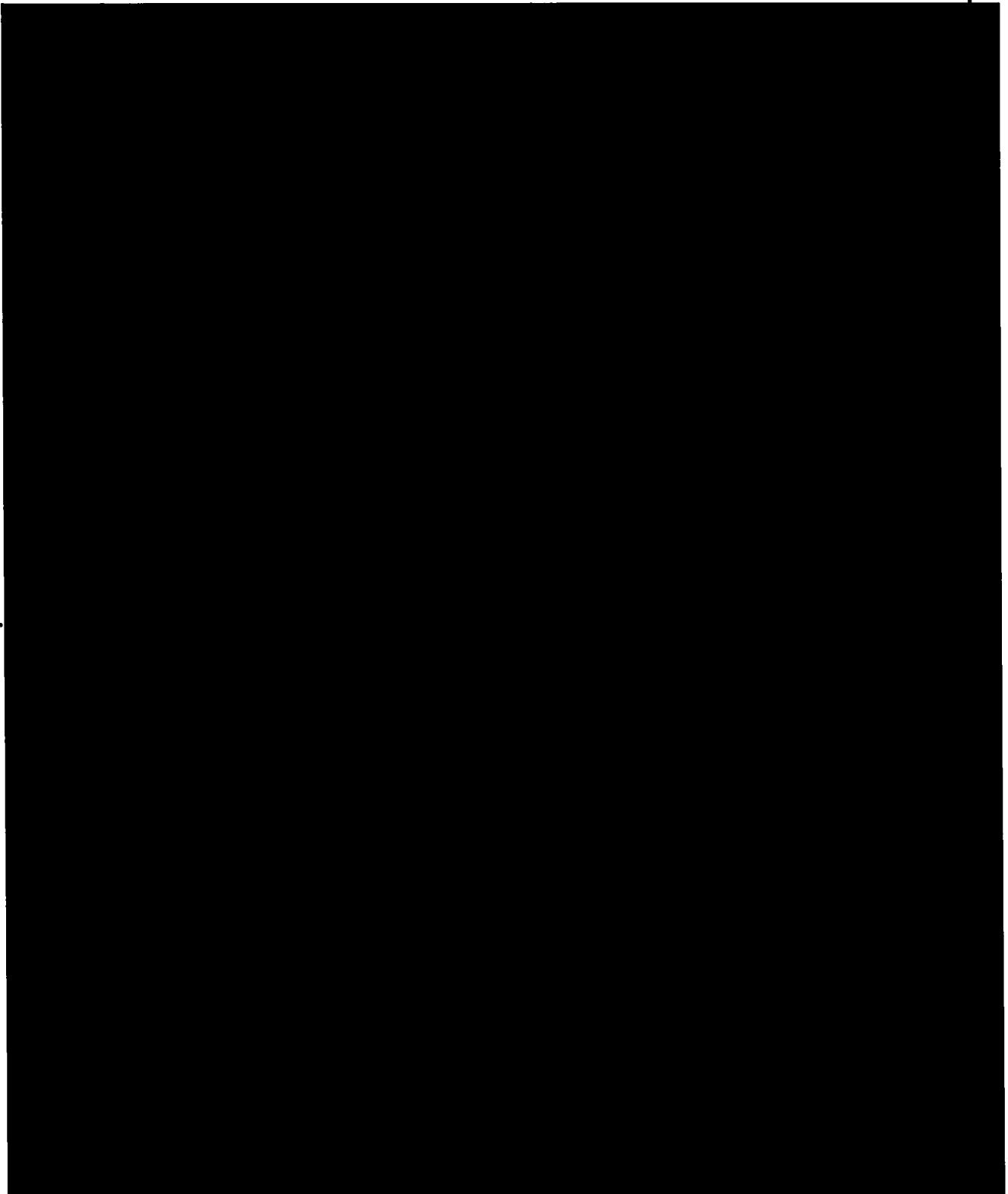


Table 3.7-8 Tails System

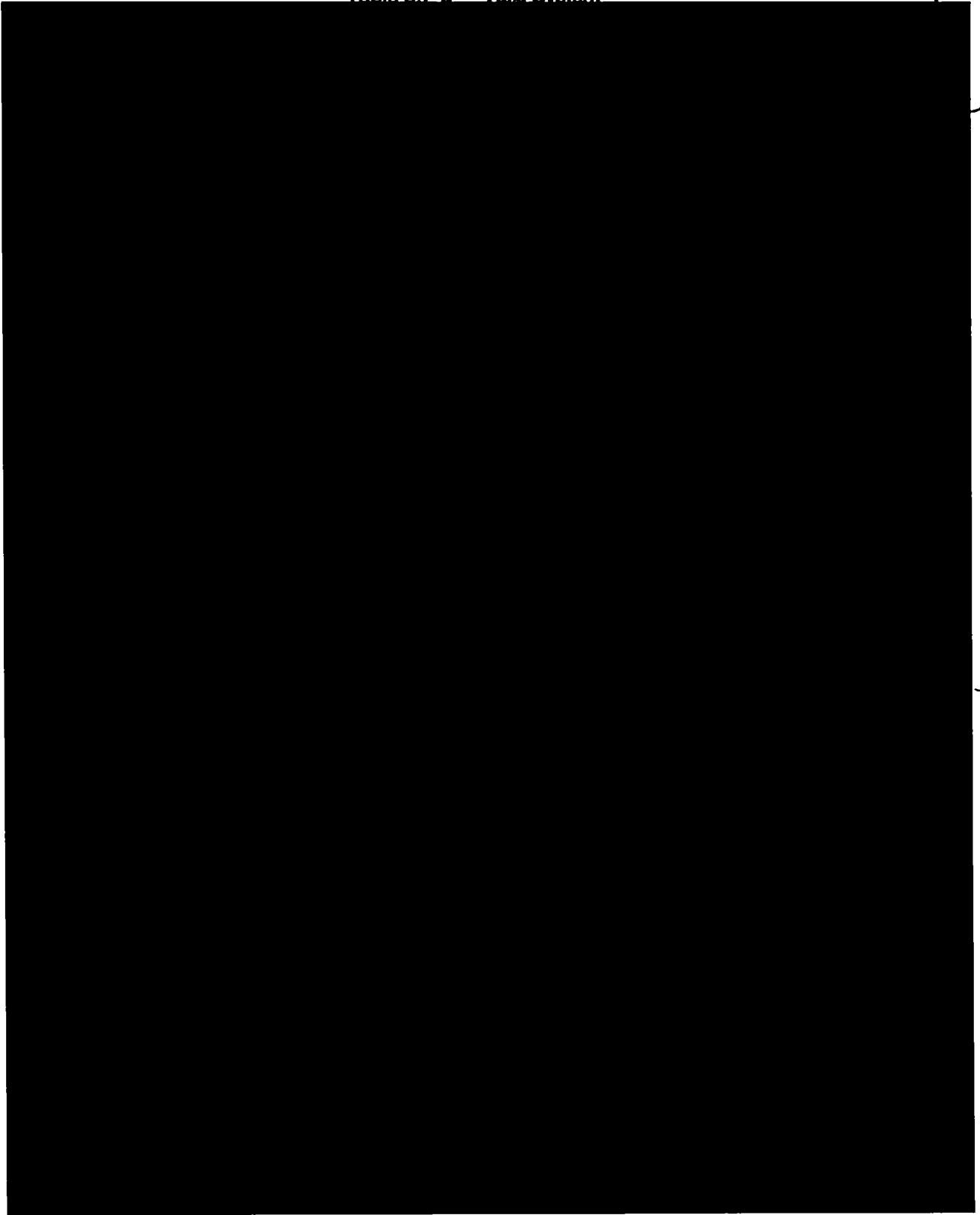


Table 3.7-8 Tails System

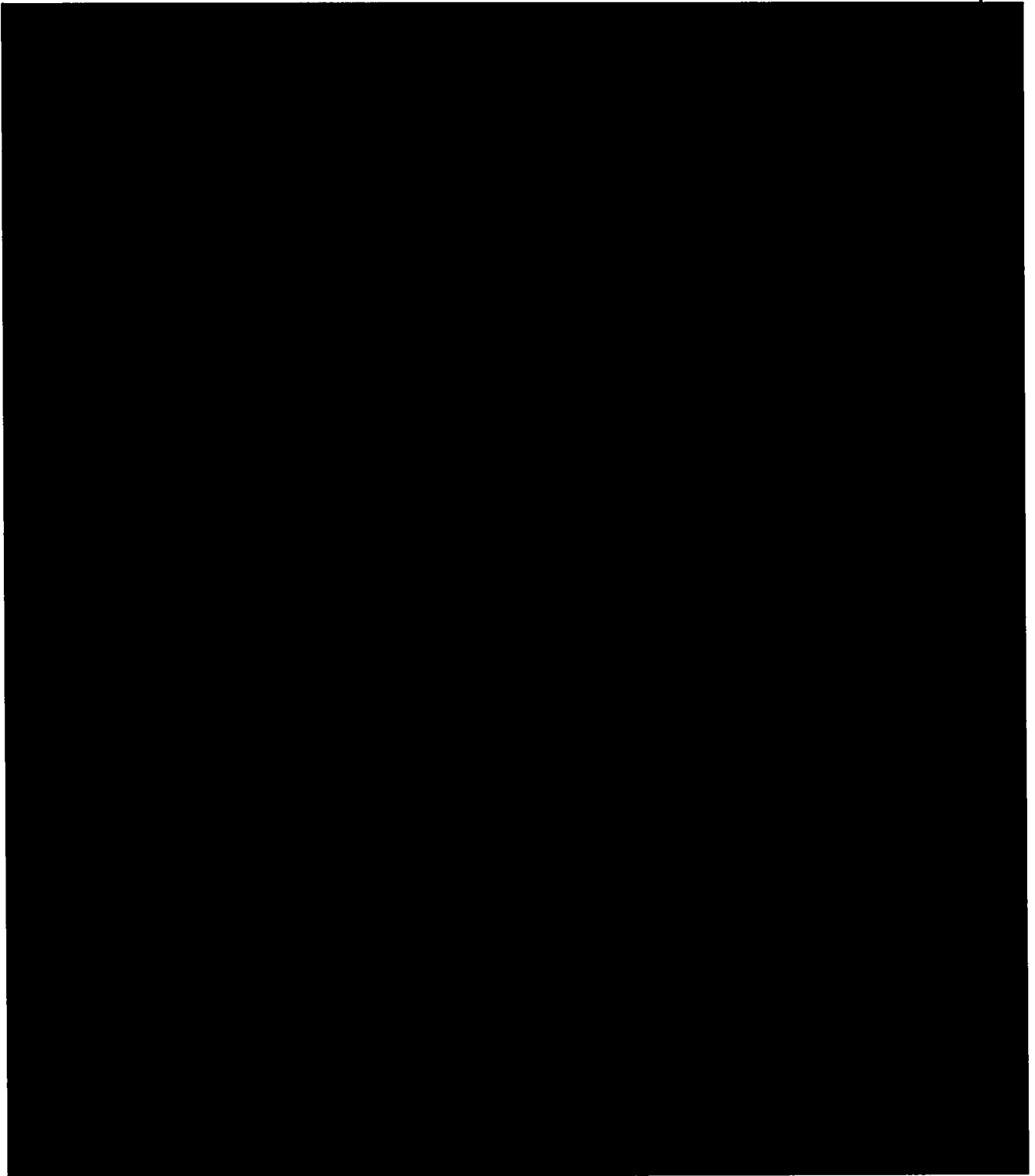


Table 3.7-8 Tails System

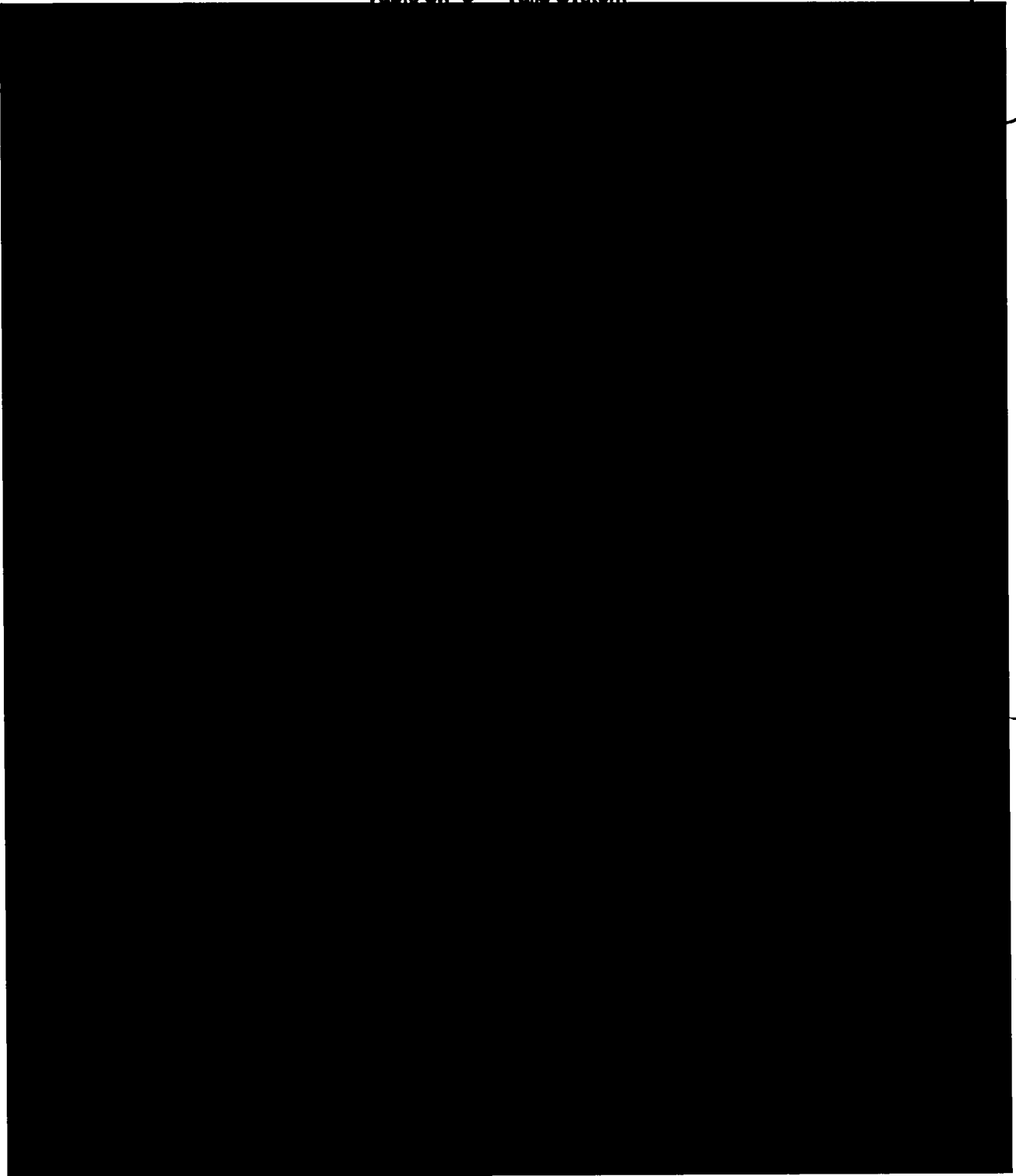


Table 3.7.8 Tails System

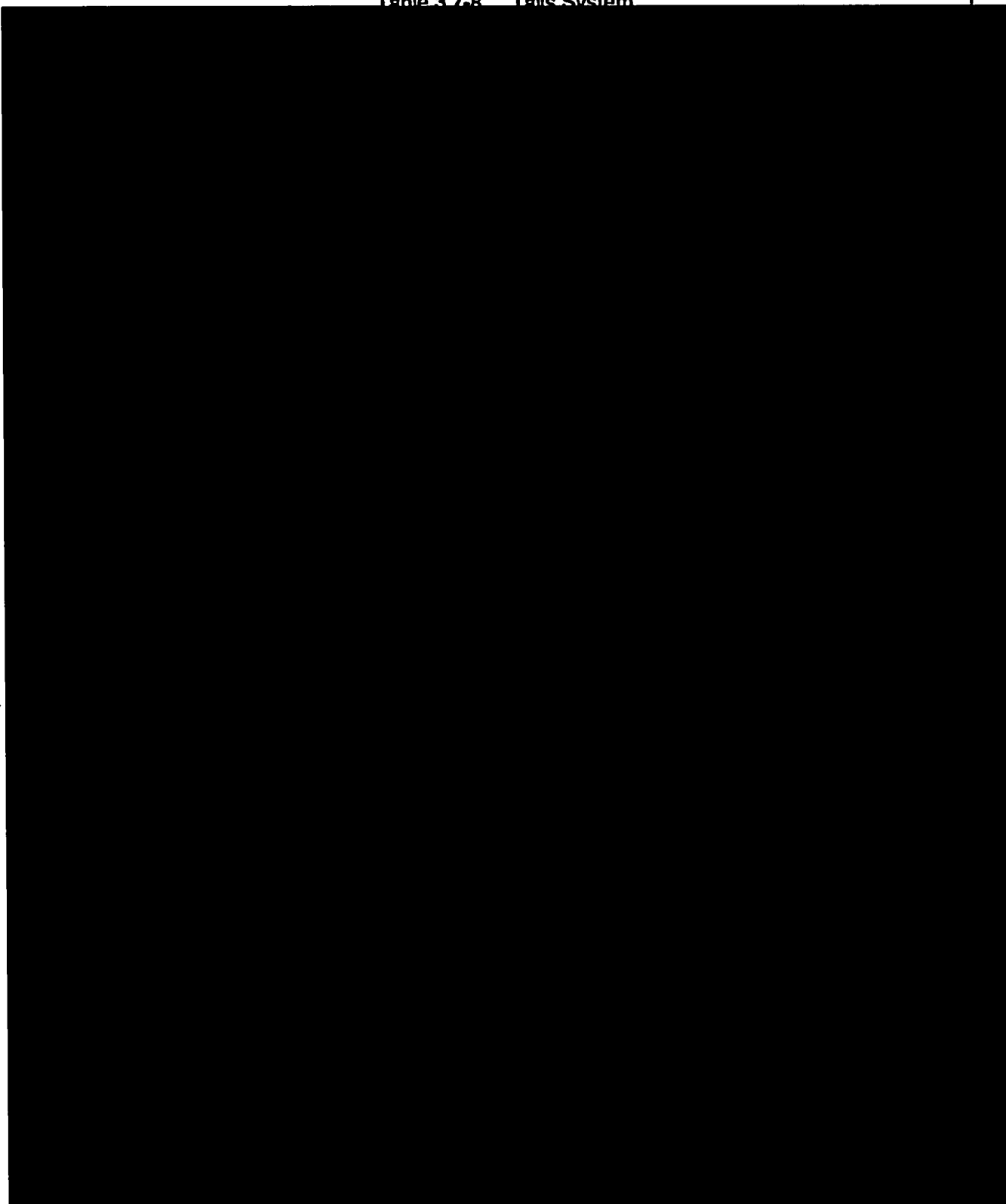


Table 3.7-8 Tails System

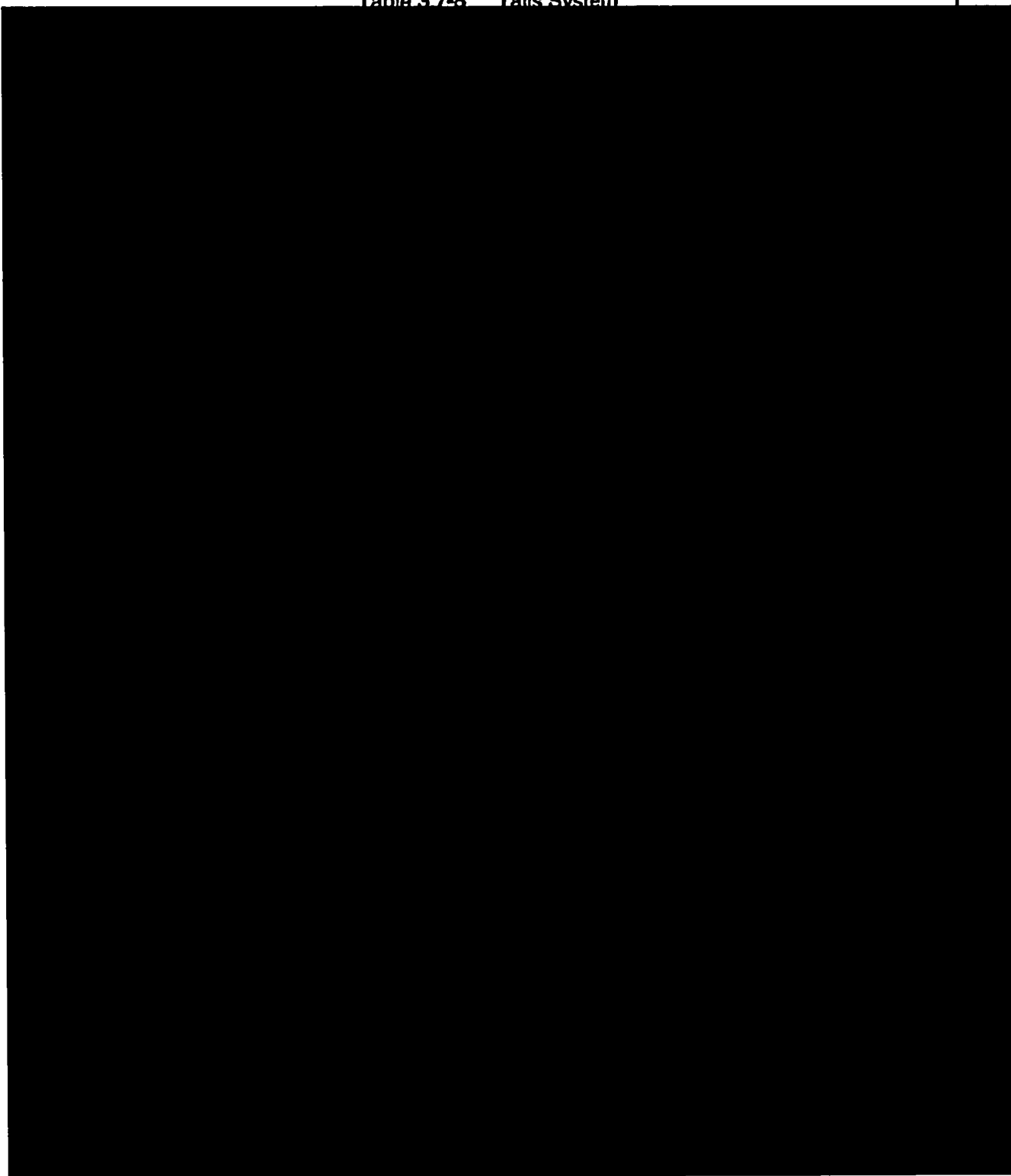


Table 3.7-8 Tails System

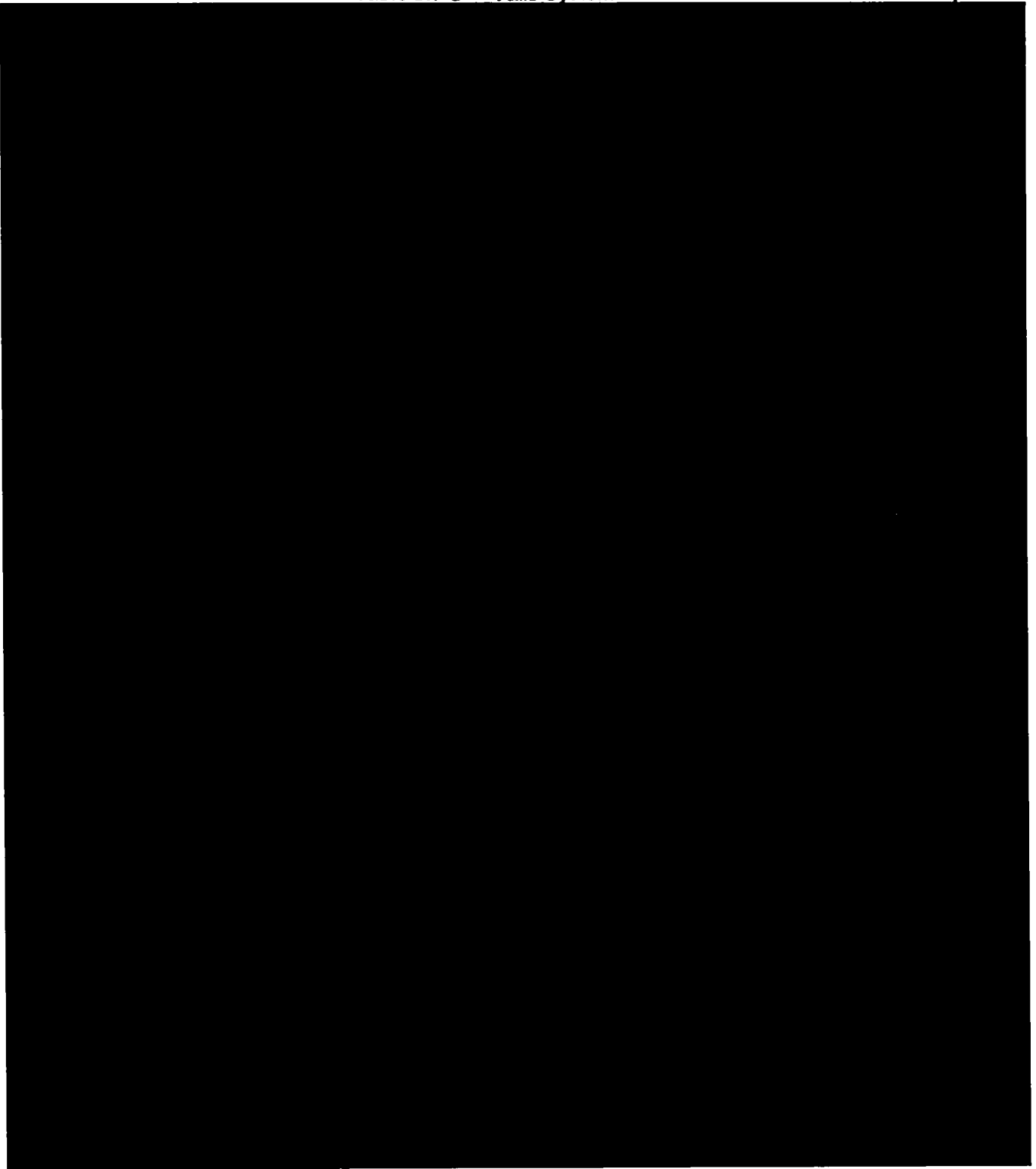


Table 3.7-8 Tails System

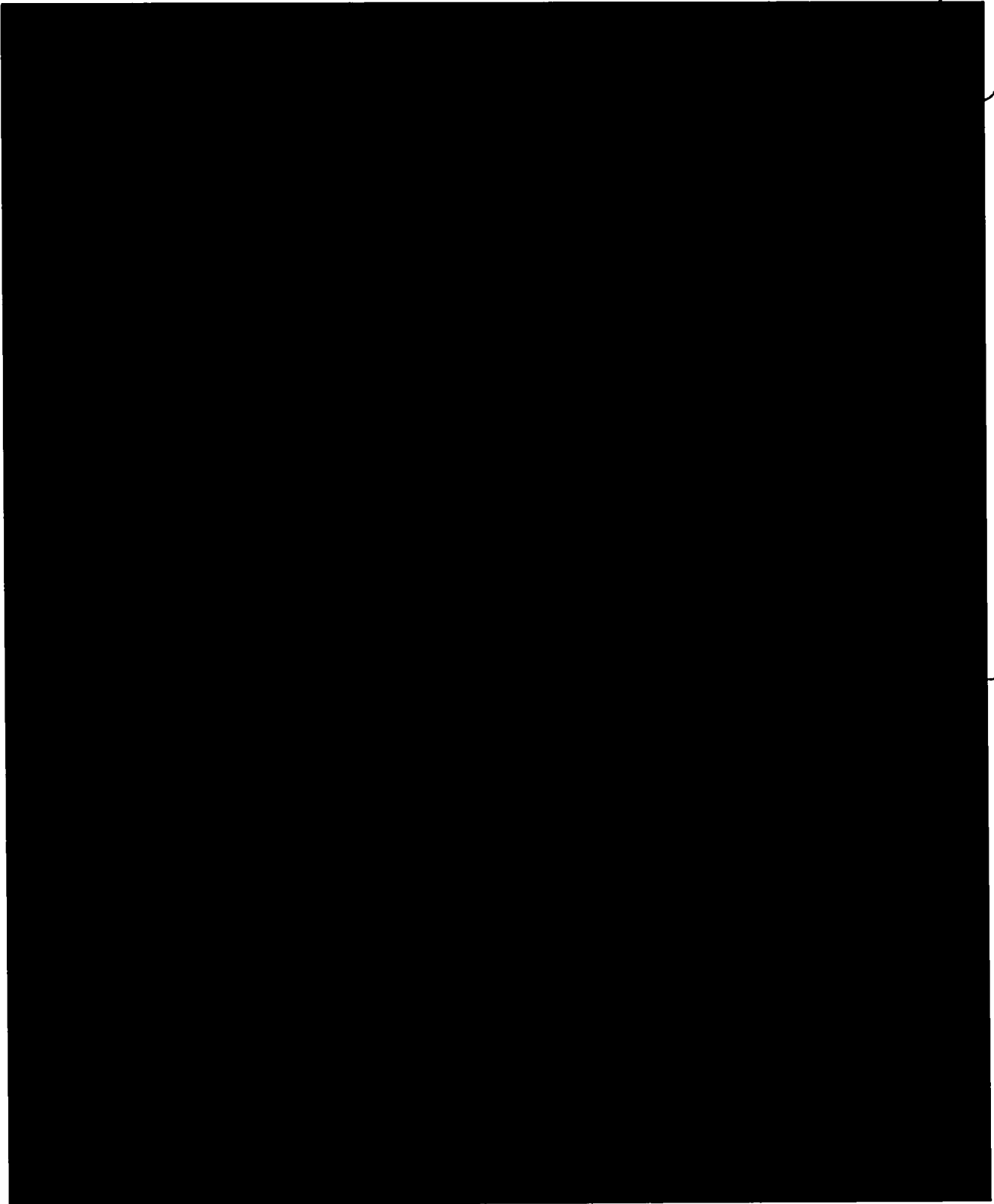


Table 3.7-8 Tails System

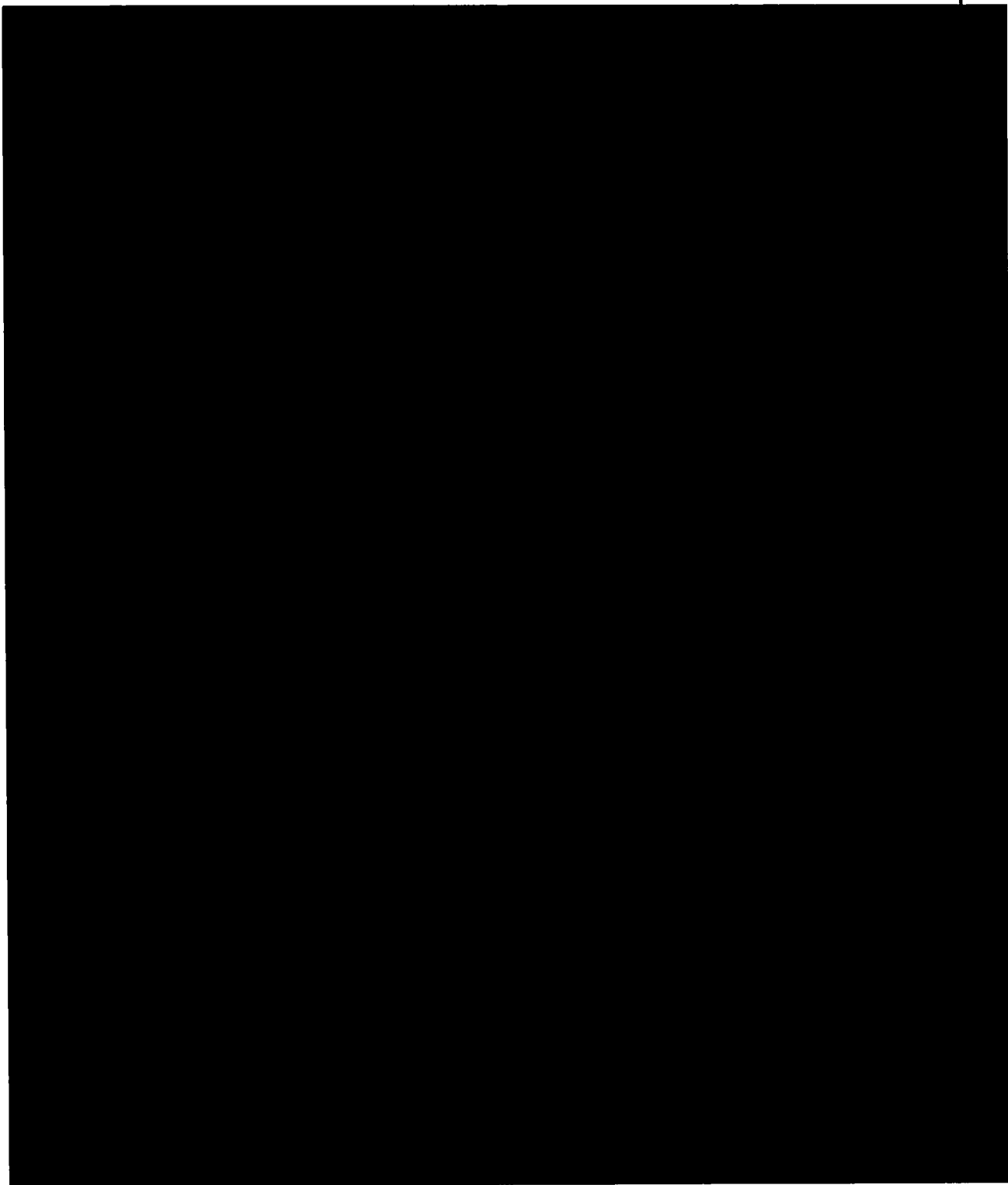


Table 3.7-8 Tails System

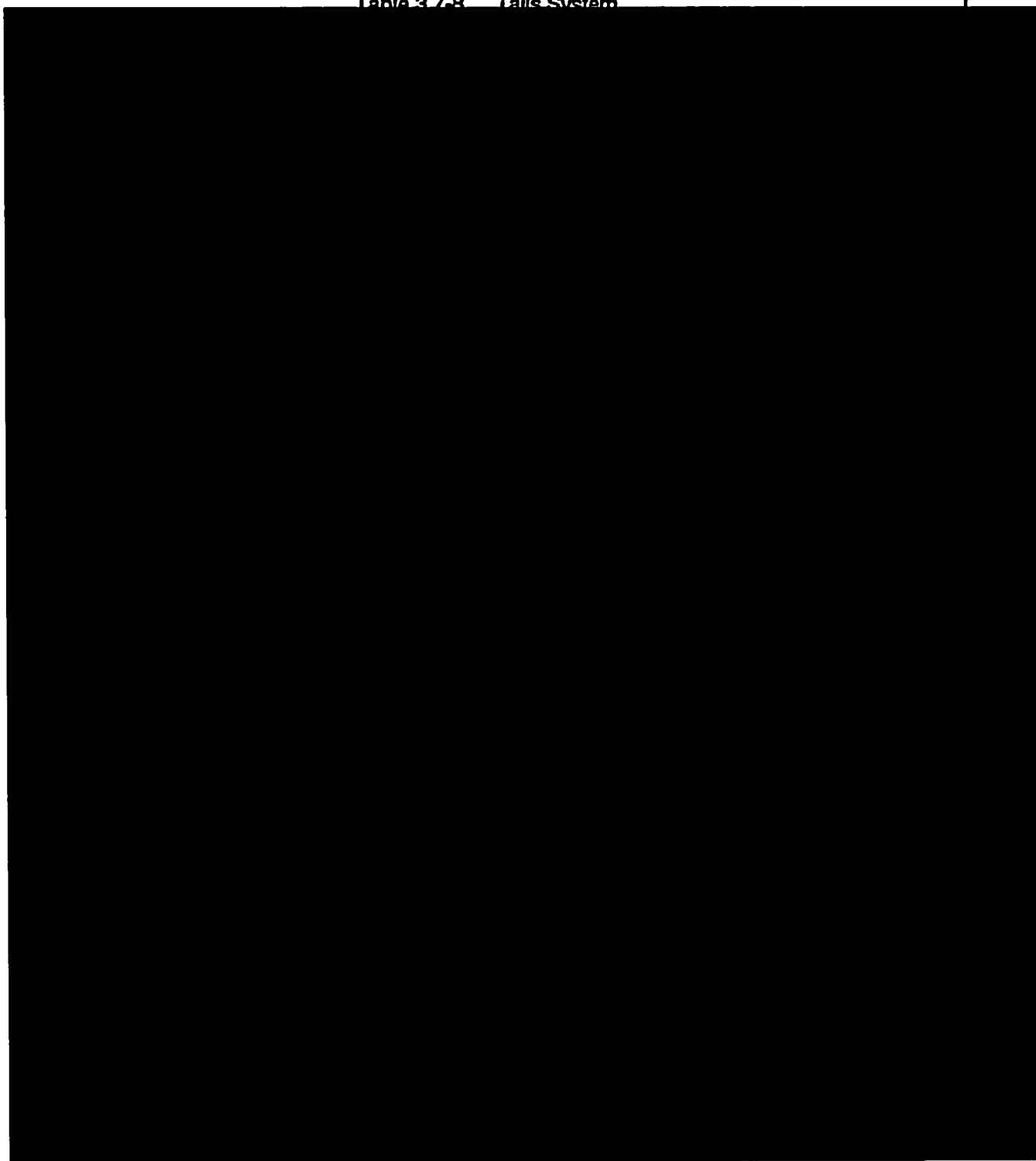


Table 3.7-8 Tails System

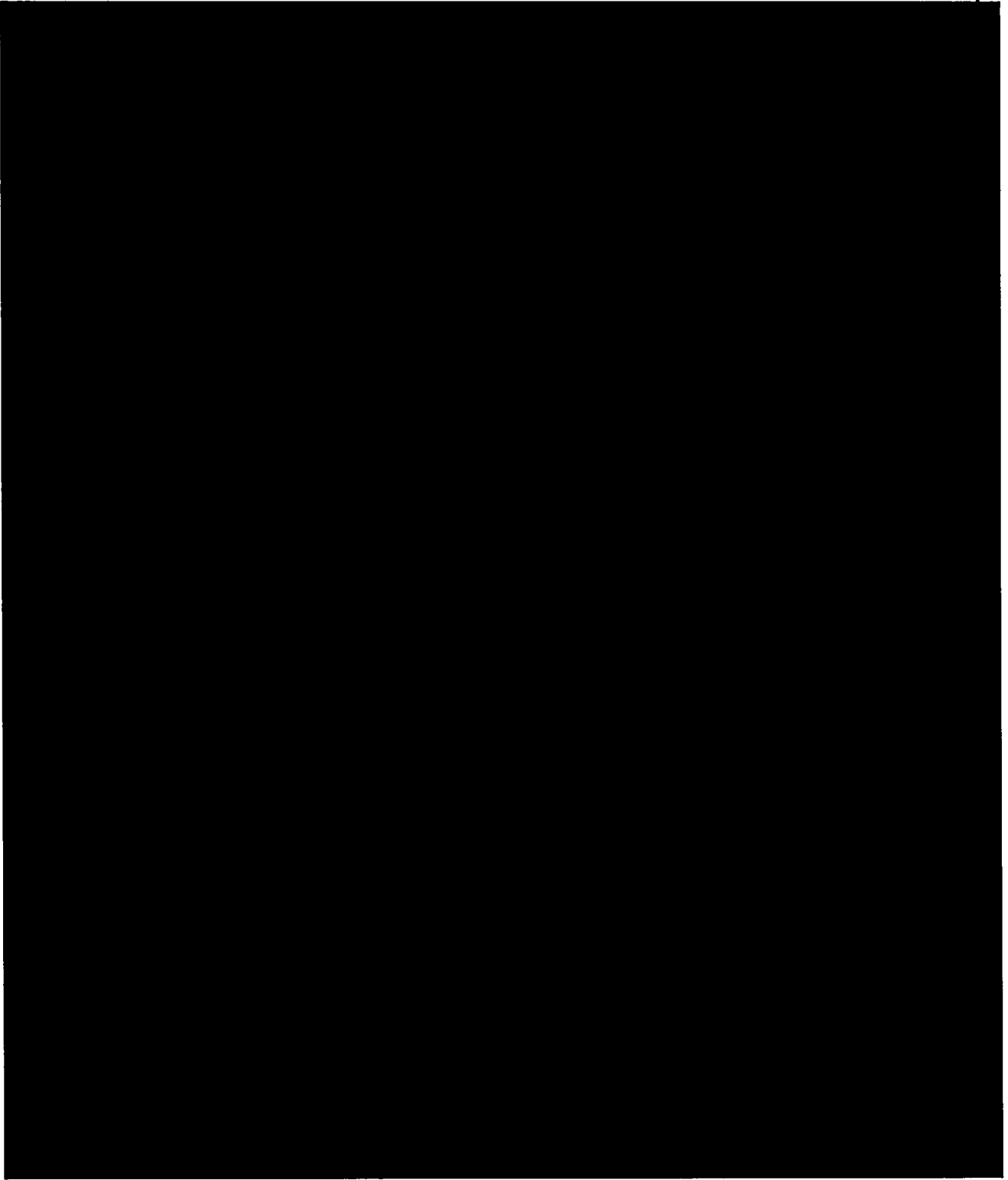


Table 3.7-8 Tails System

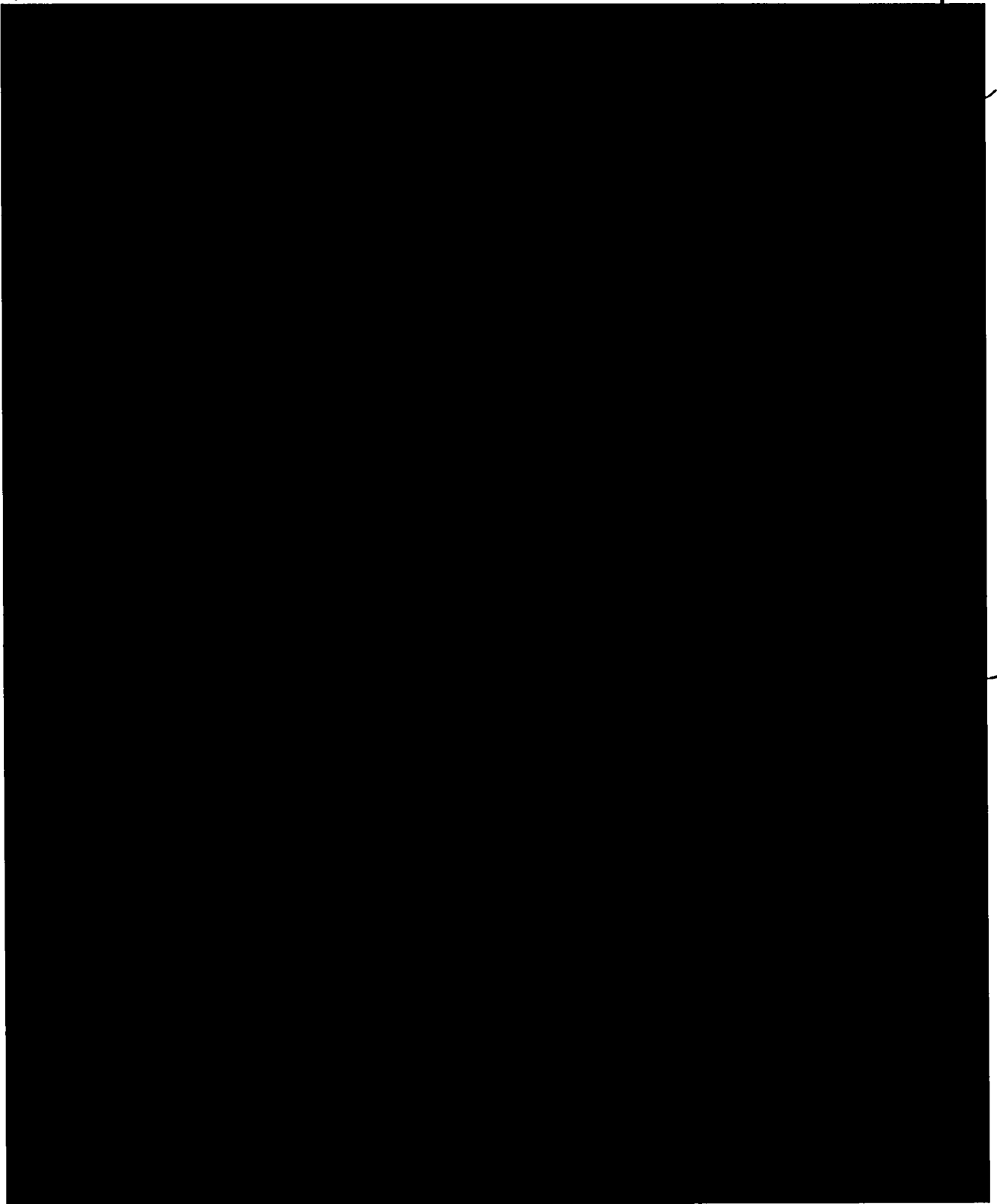


Table 3.7-8 Tails System

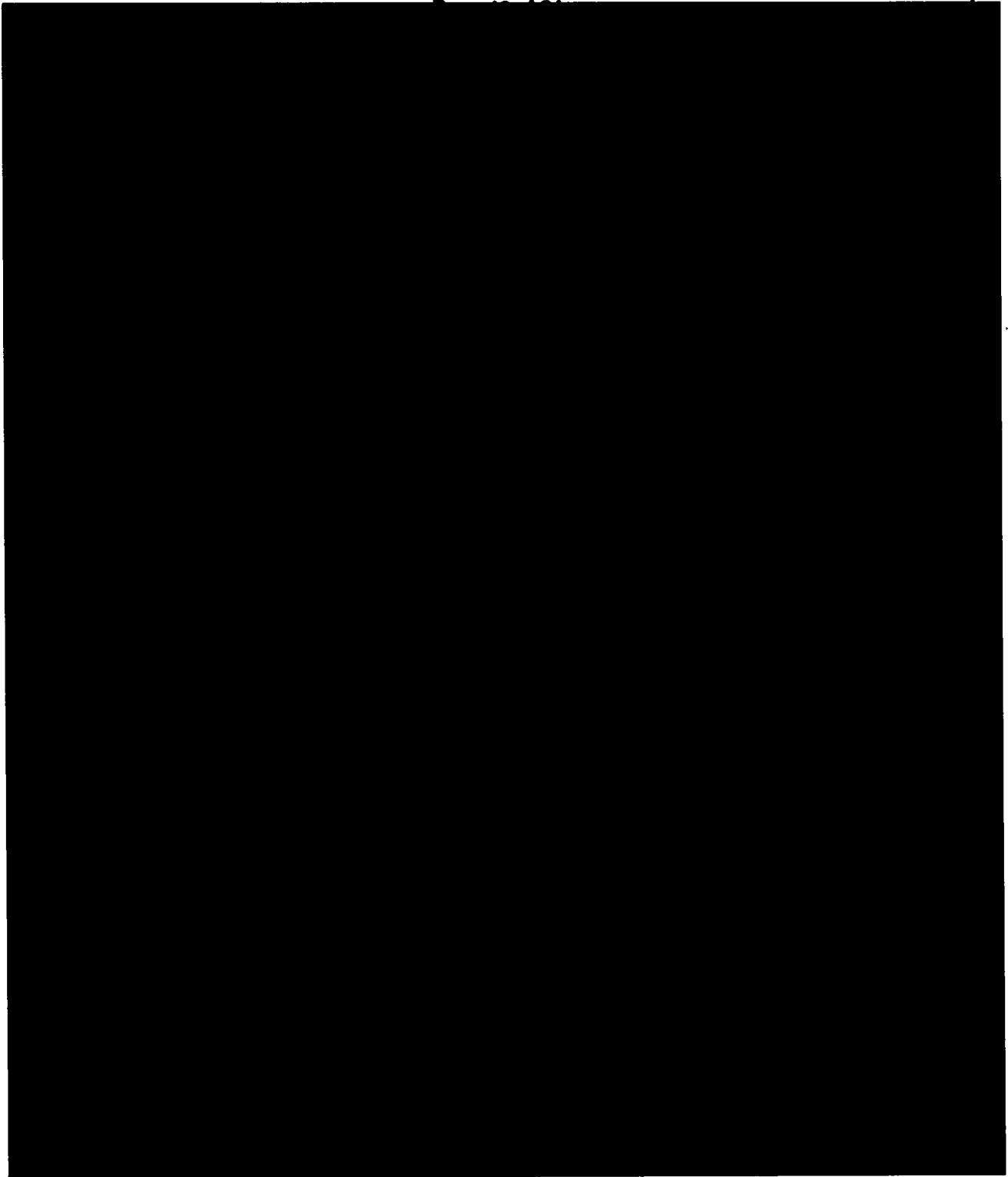


Table 3.7-8 Tails System

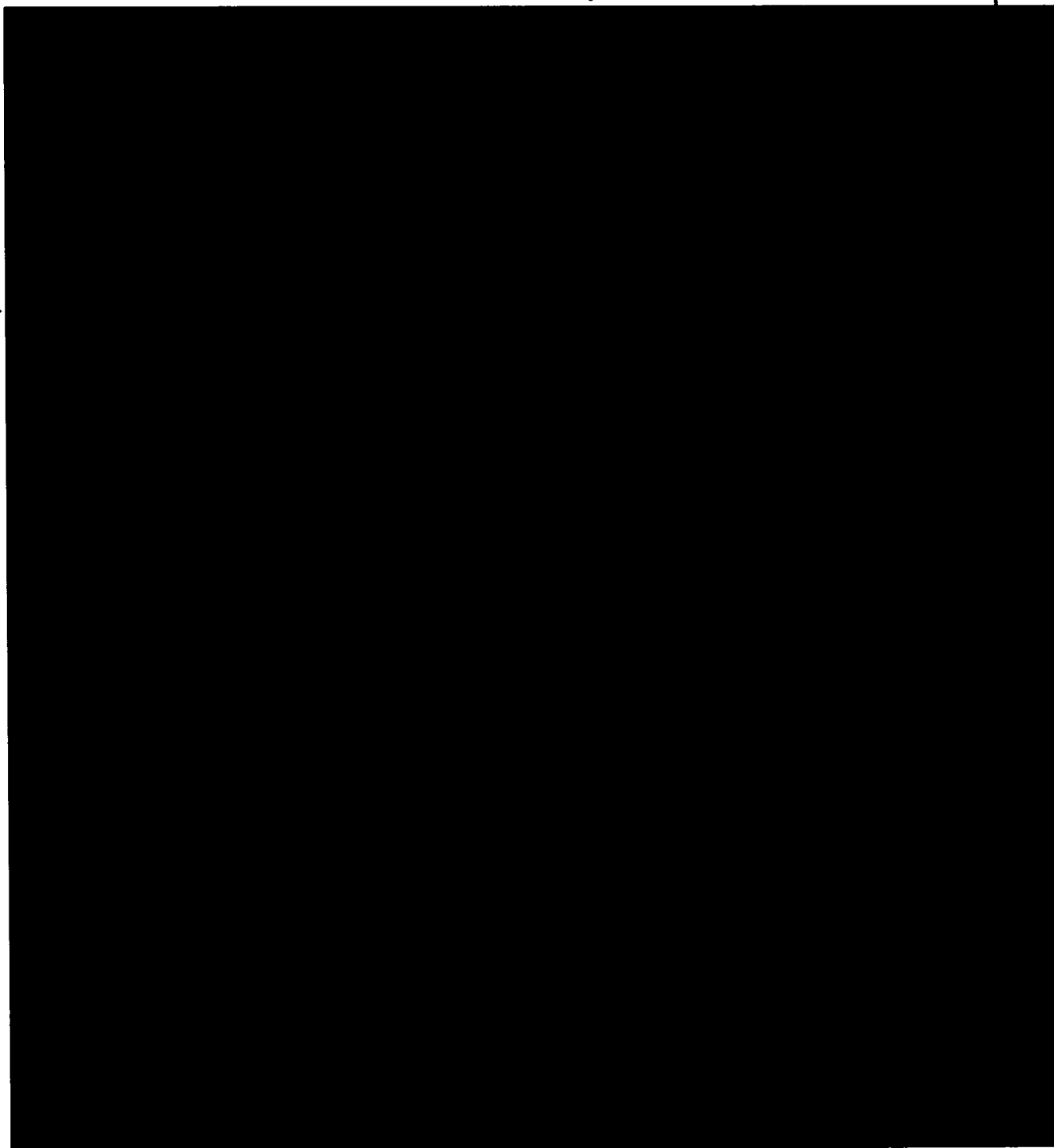


Table 3.7-8 Tails System

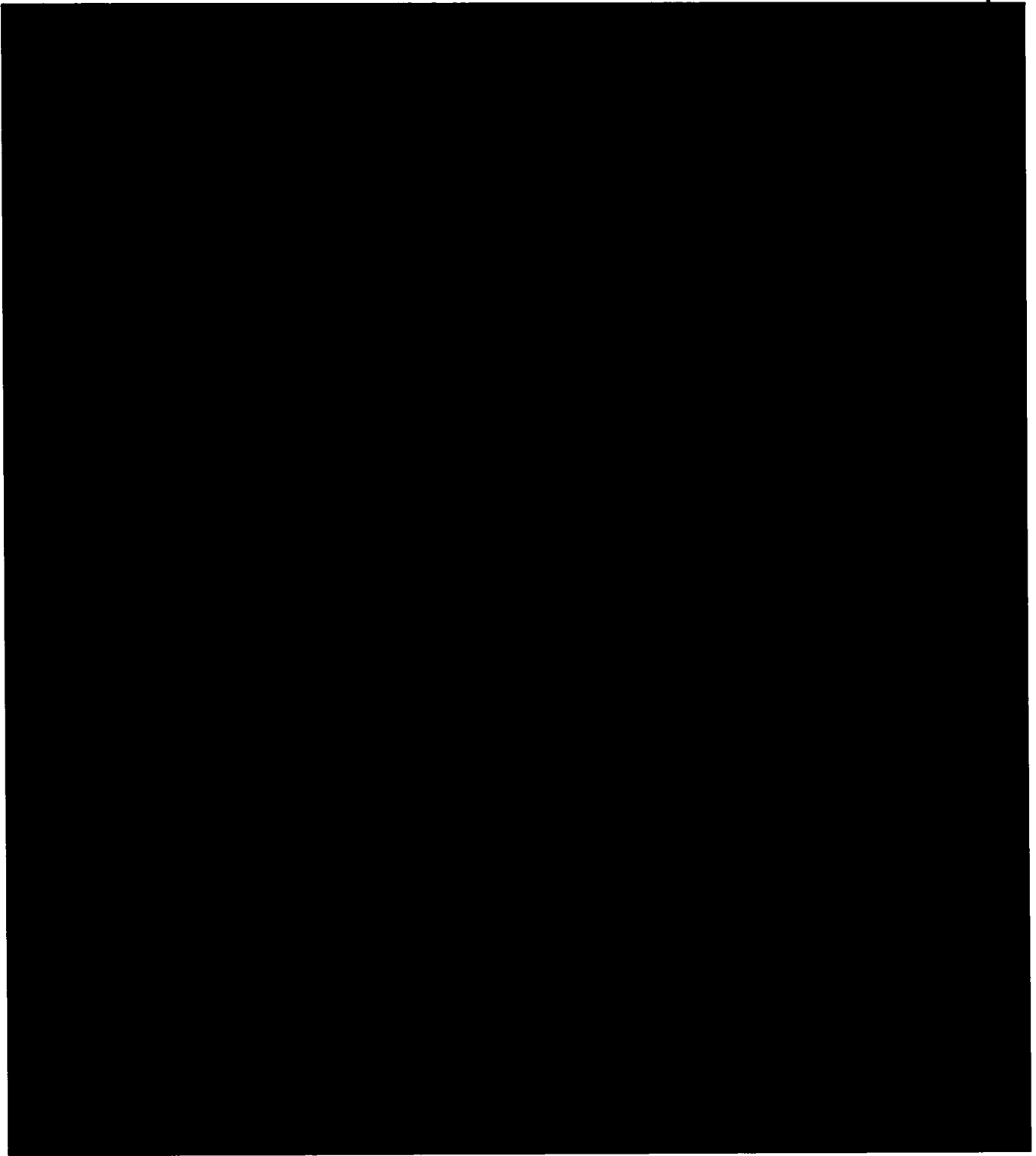


Table 3.7-8 Tails System

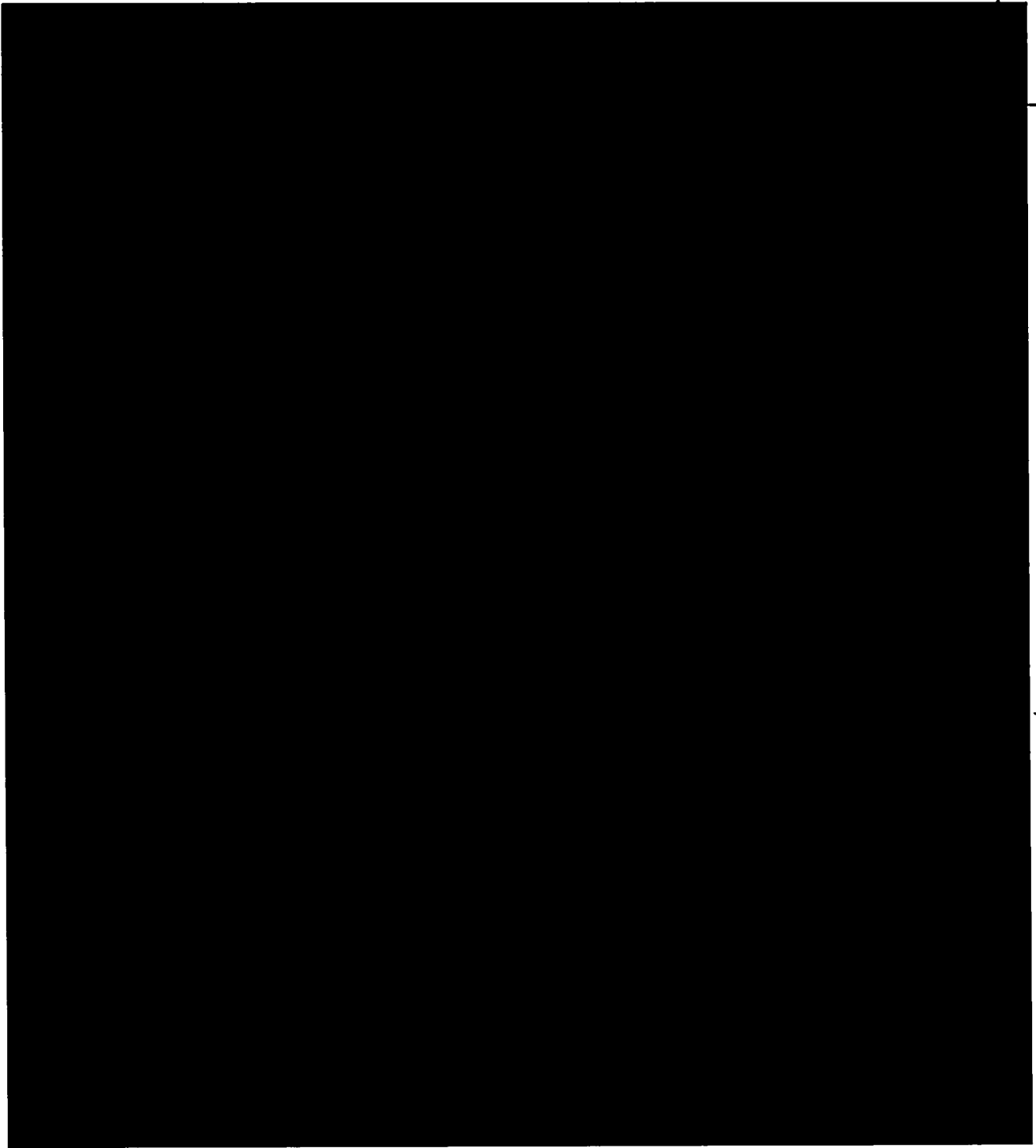


Table 3.7-8 Tails System

Page 88 of 91

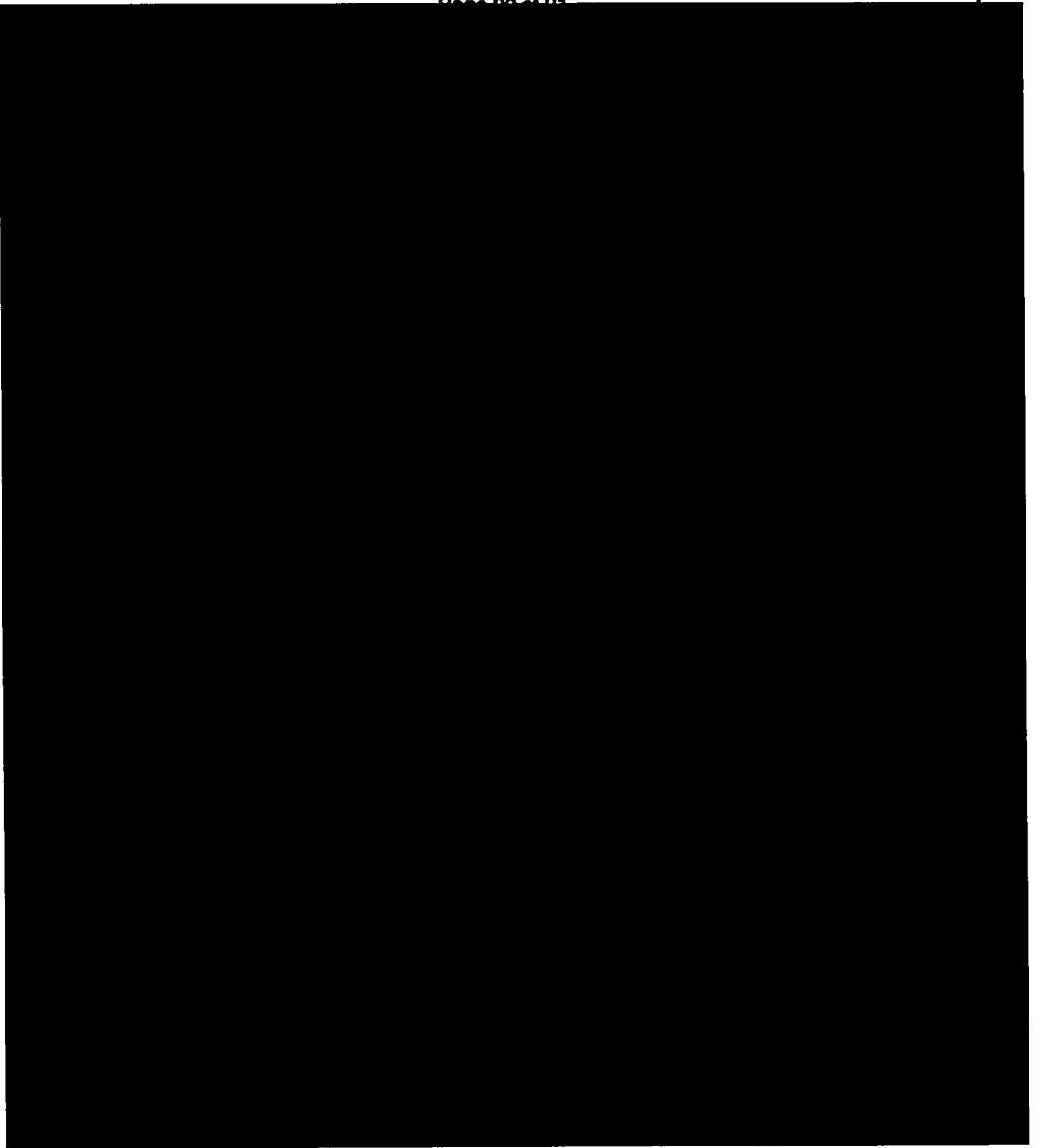


Table 3.7-8 Tails System

Page 21 of 21



Table 3.7-9 Product Blending System

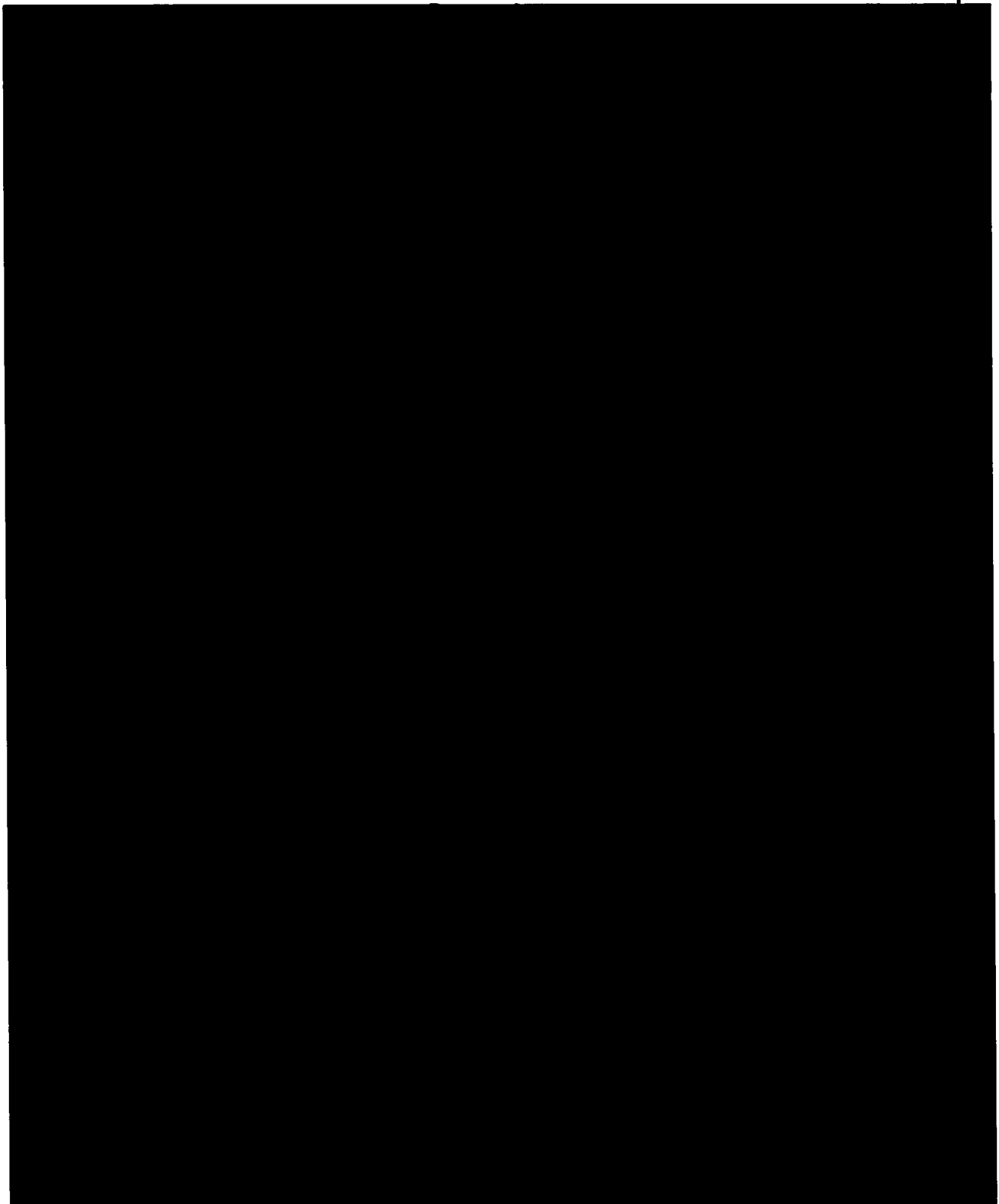


Table 3.7-9 Product Blending System

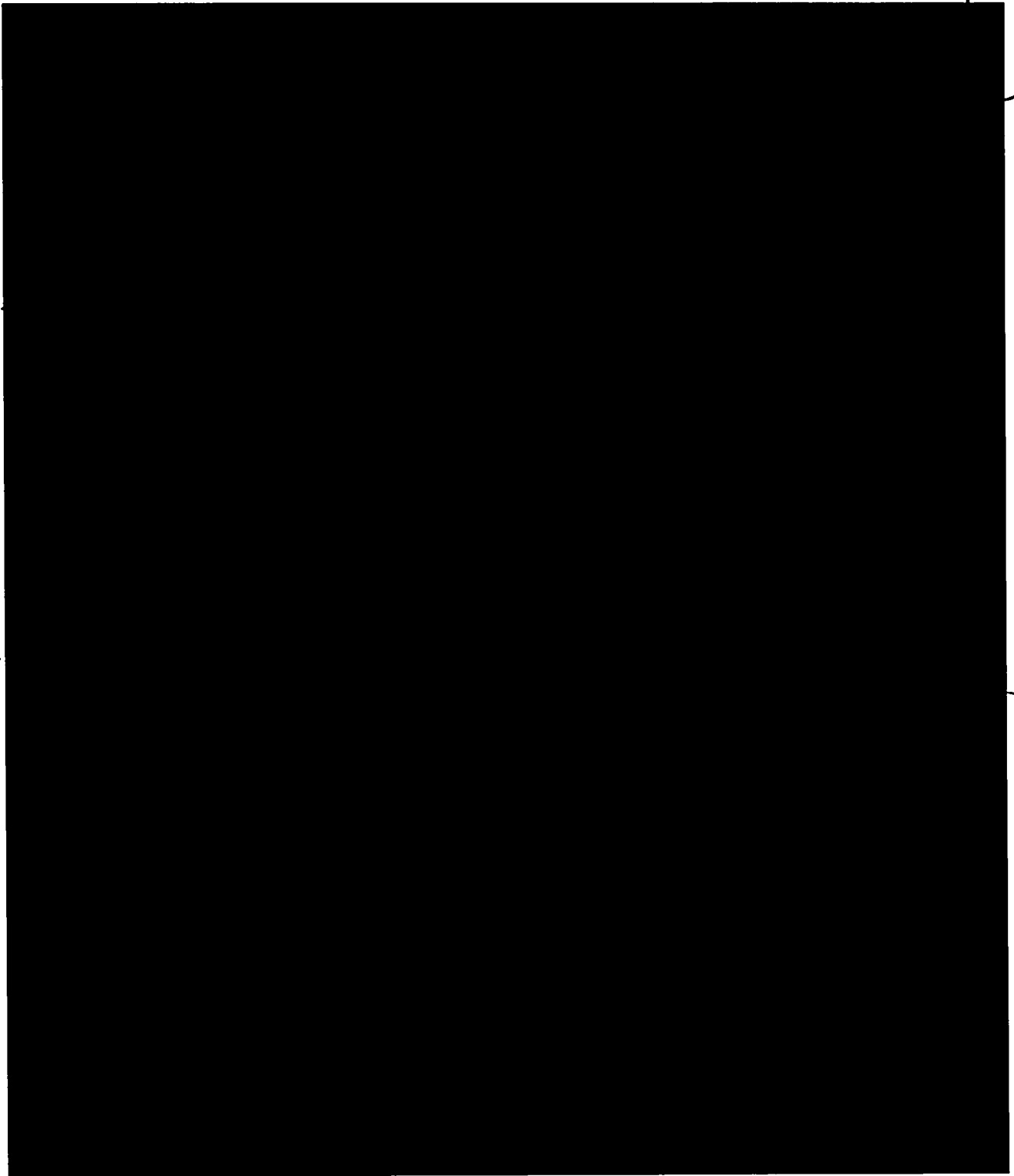


Table 3.7-9 Product Blending System

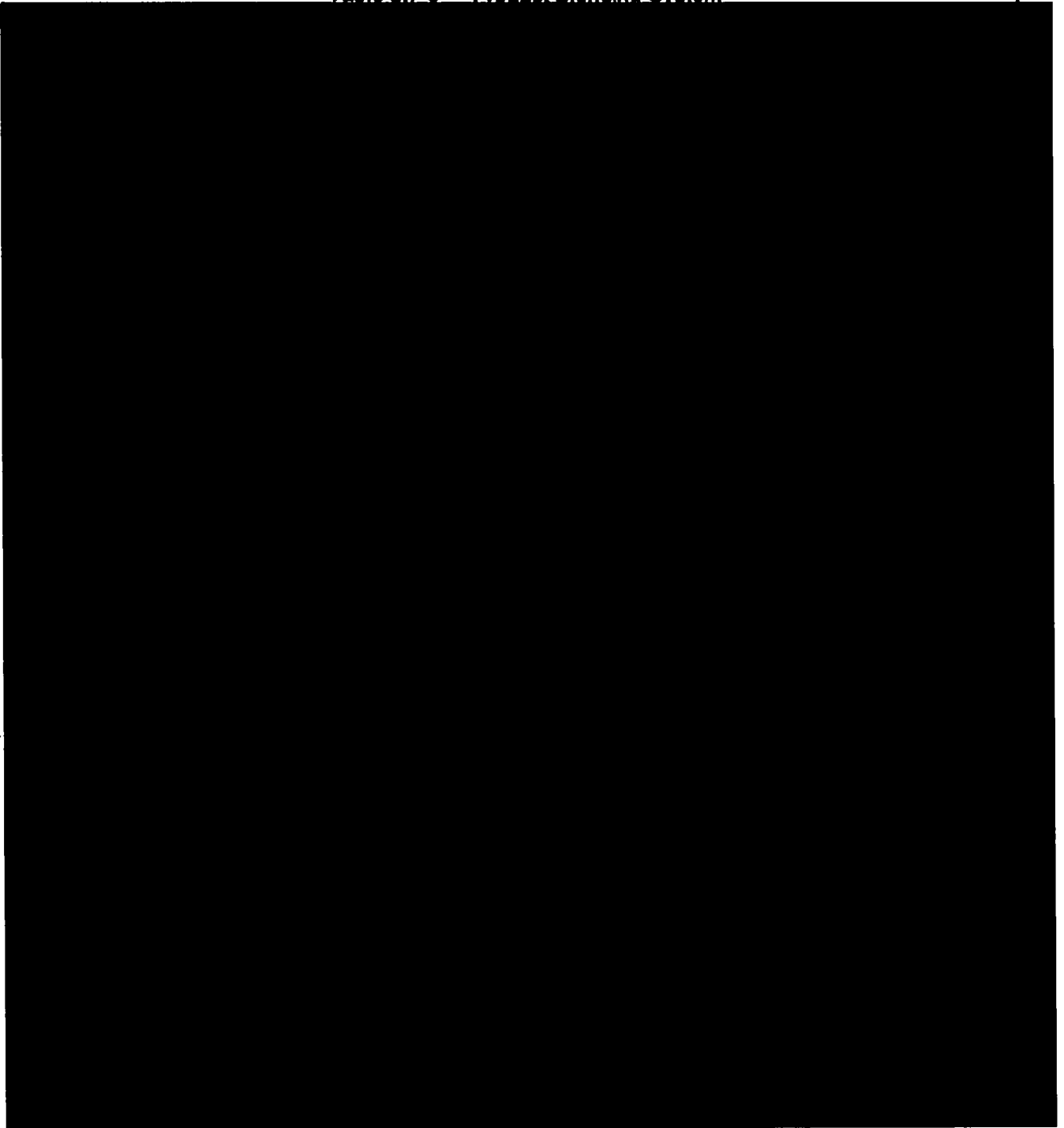


Table 3.7-9 Product Blending System

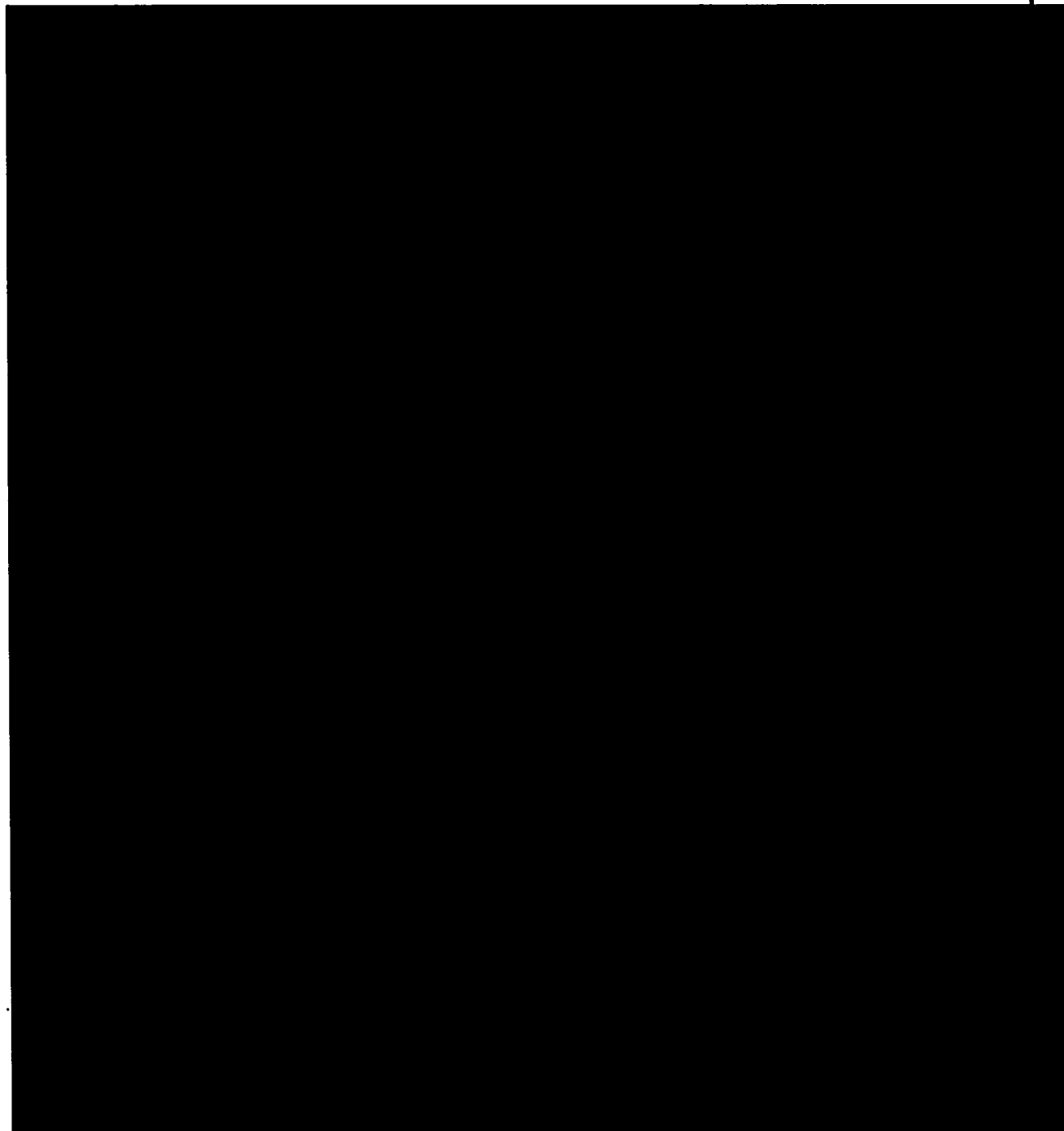


Table 3.7-9 Product Blending System

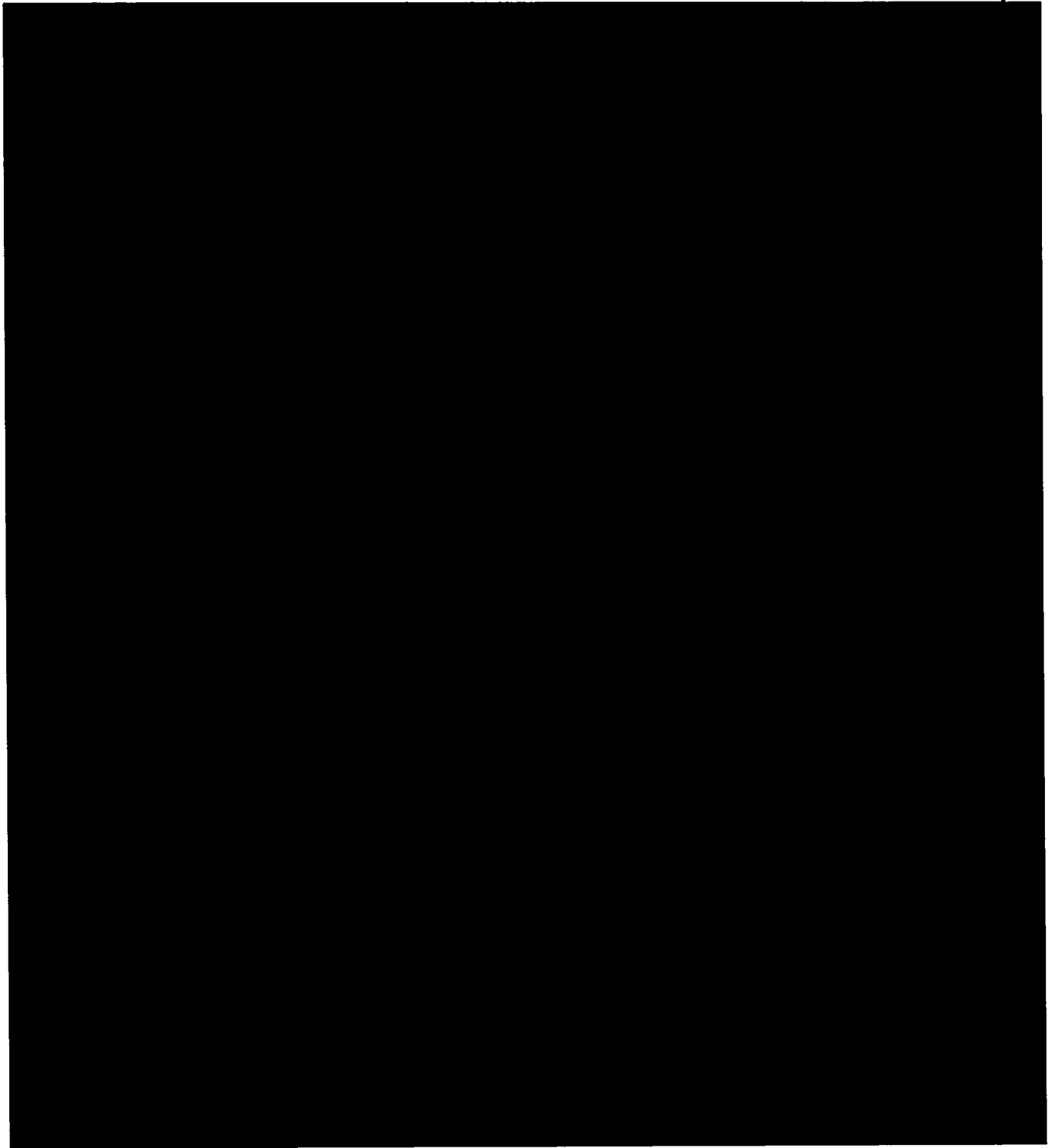


Table 3.7-9 Product Blending System

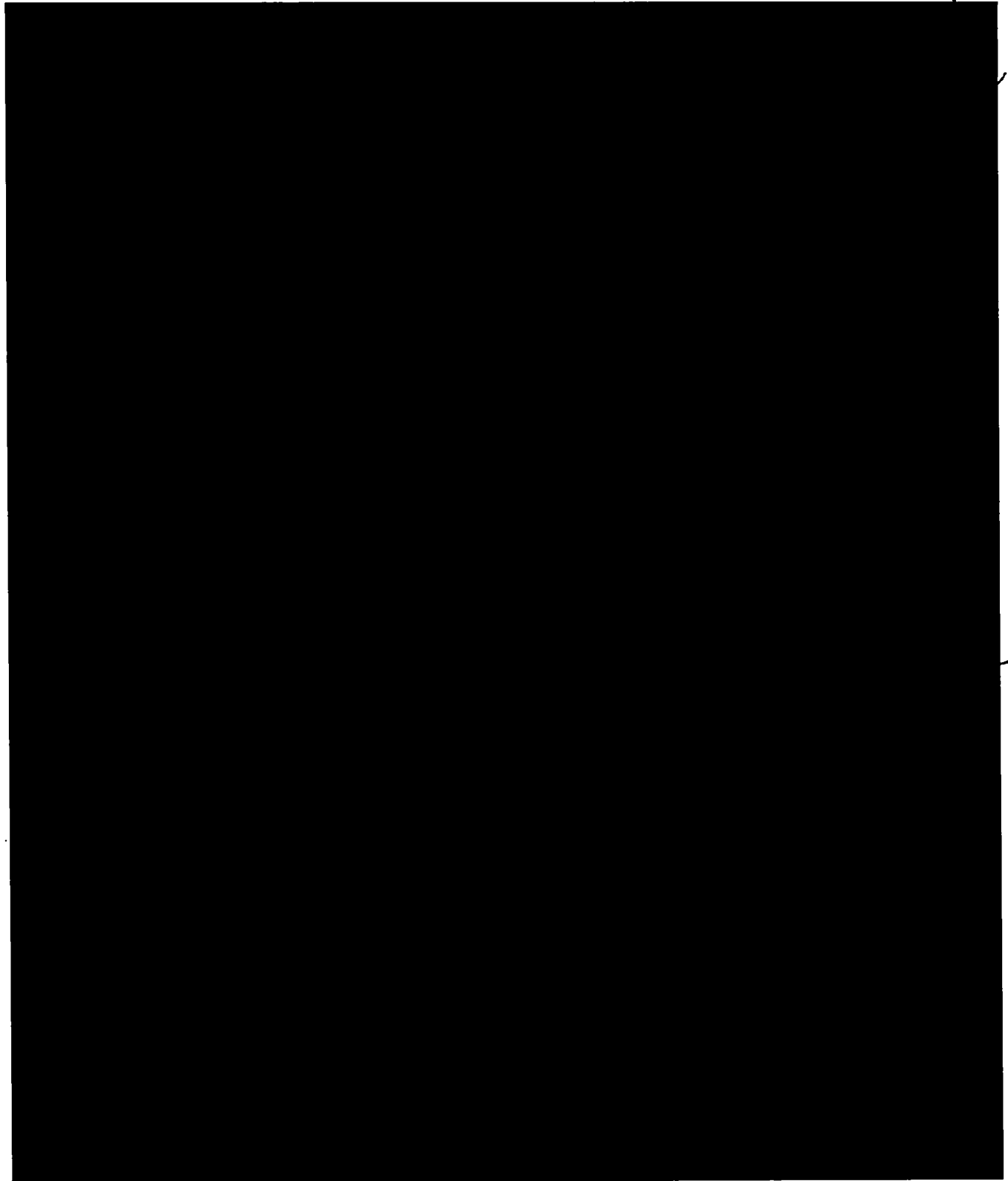


Table 3.7-9 Product Blending System

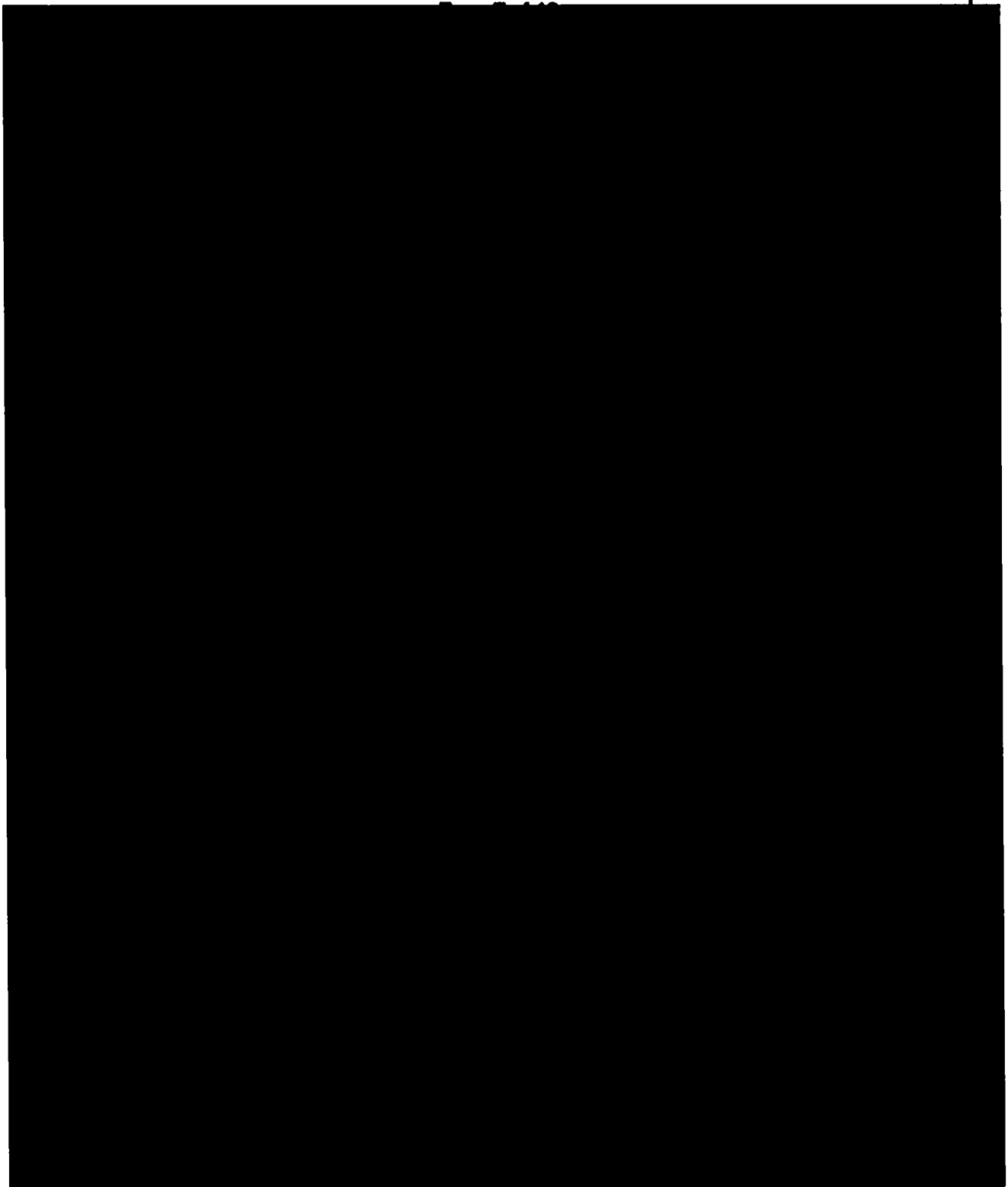
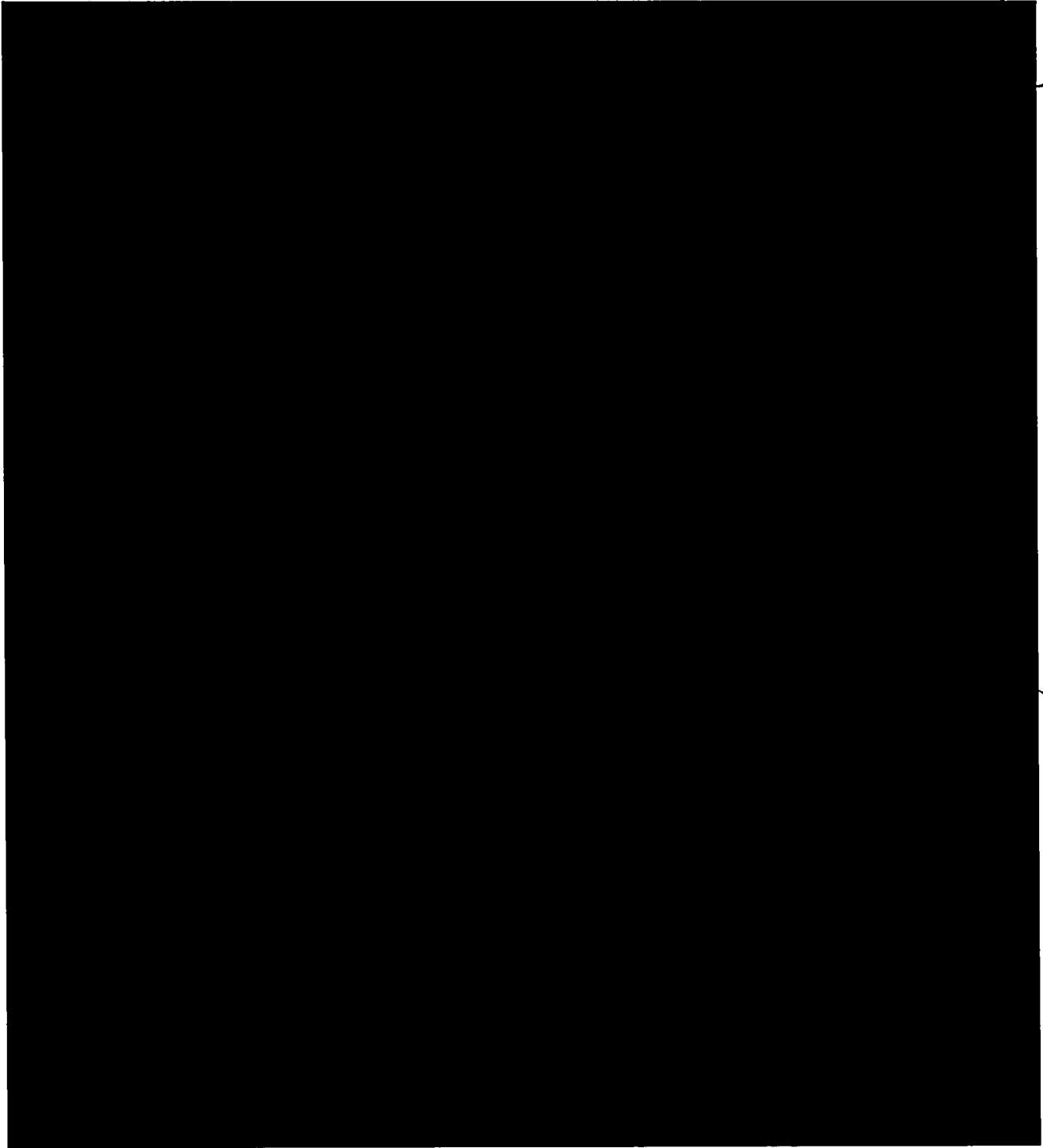


Table 3.7-9 Product Blending System



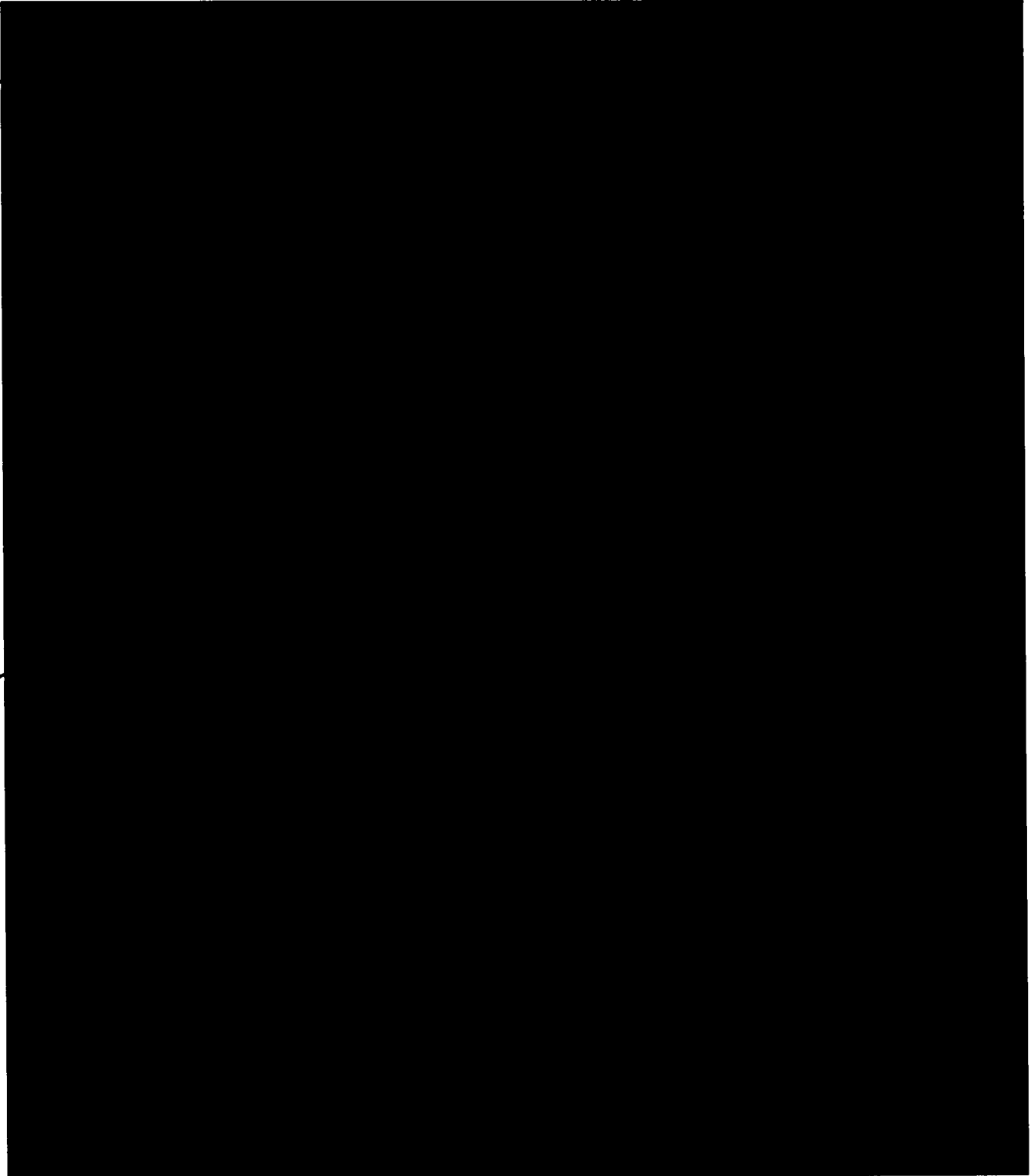
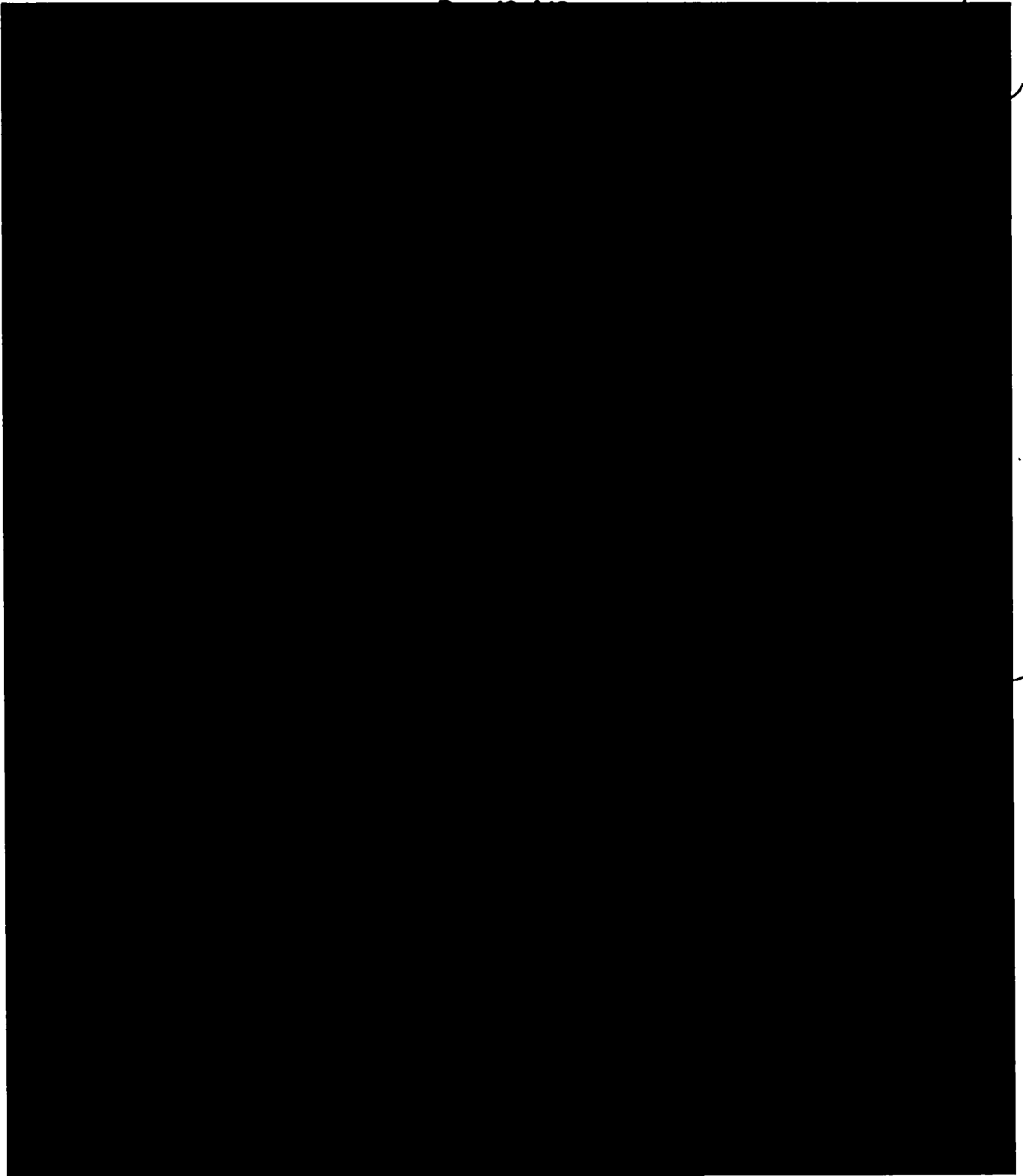


Table 3.7-9 Product Blending System



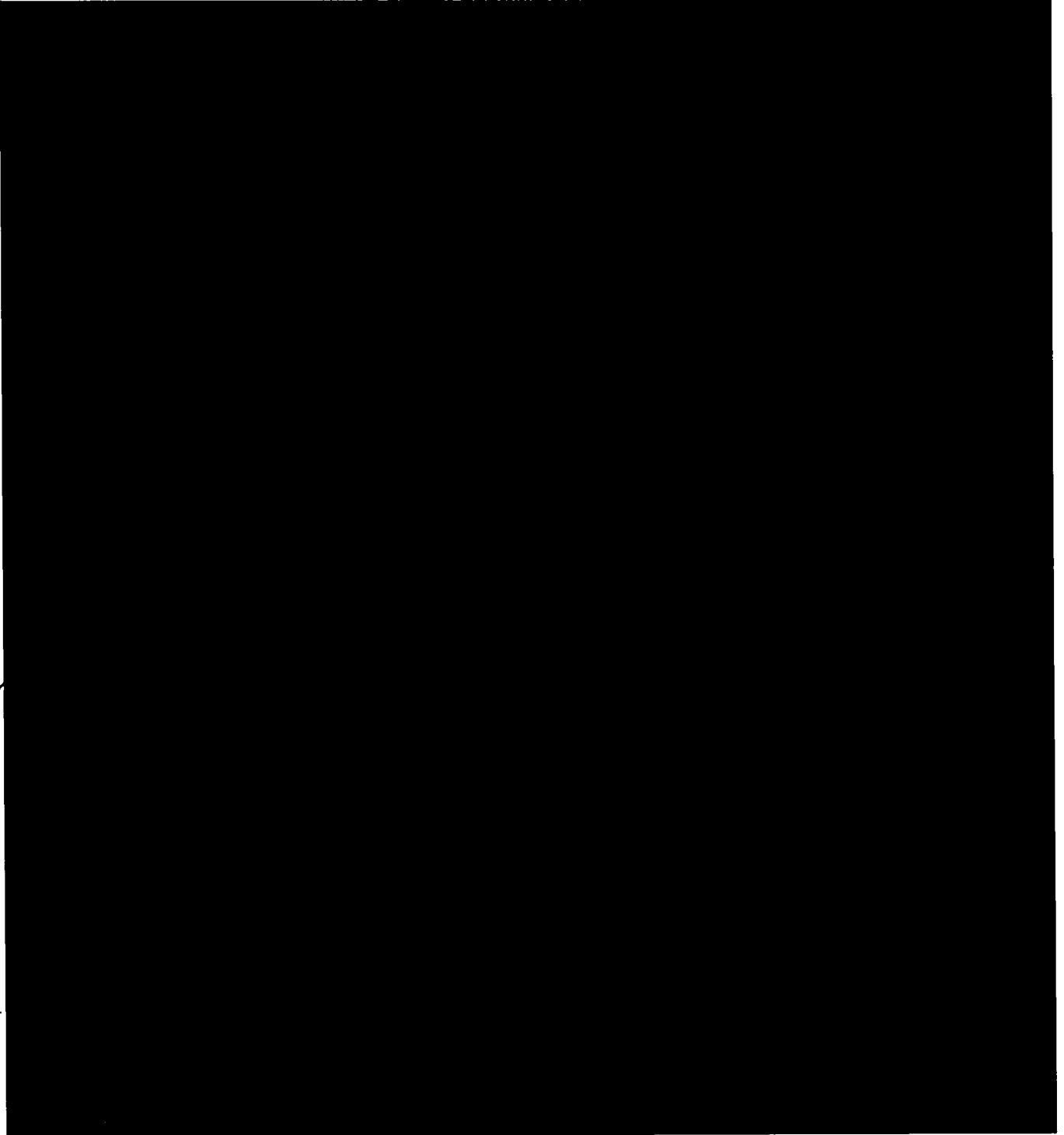
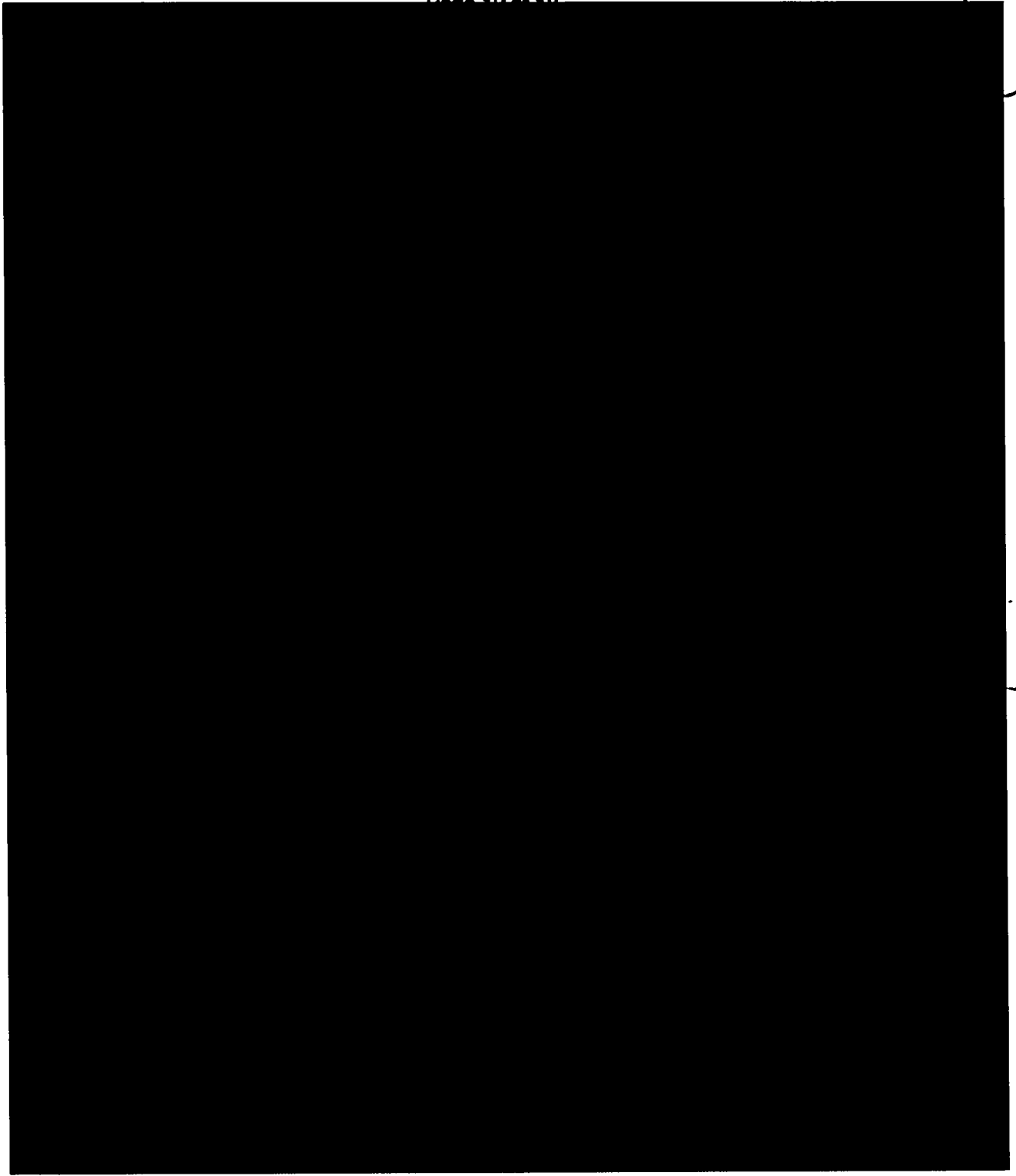


Table 3.7-9 Product Blending System

Page 10 of 10



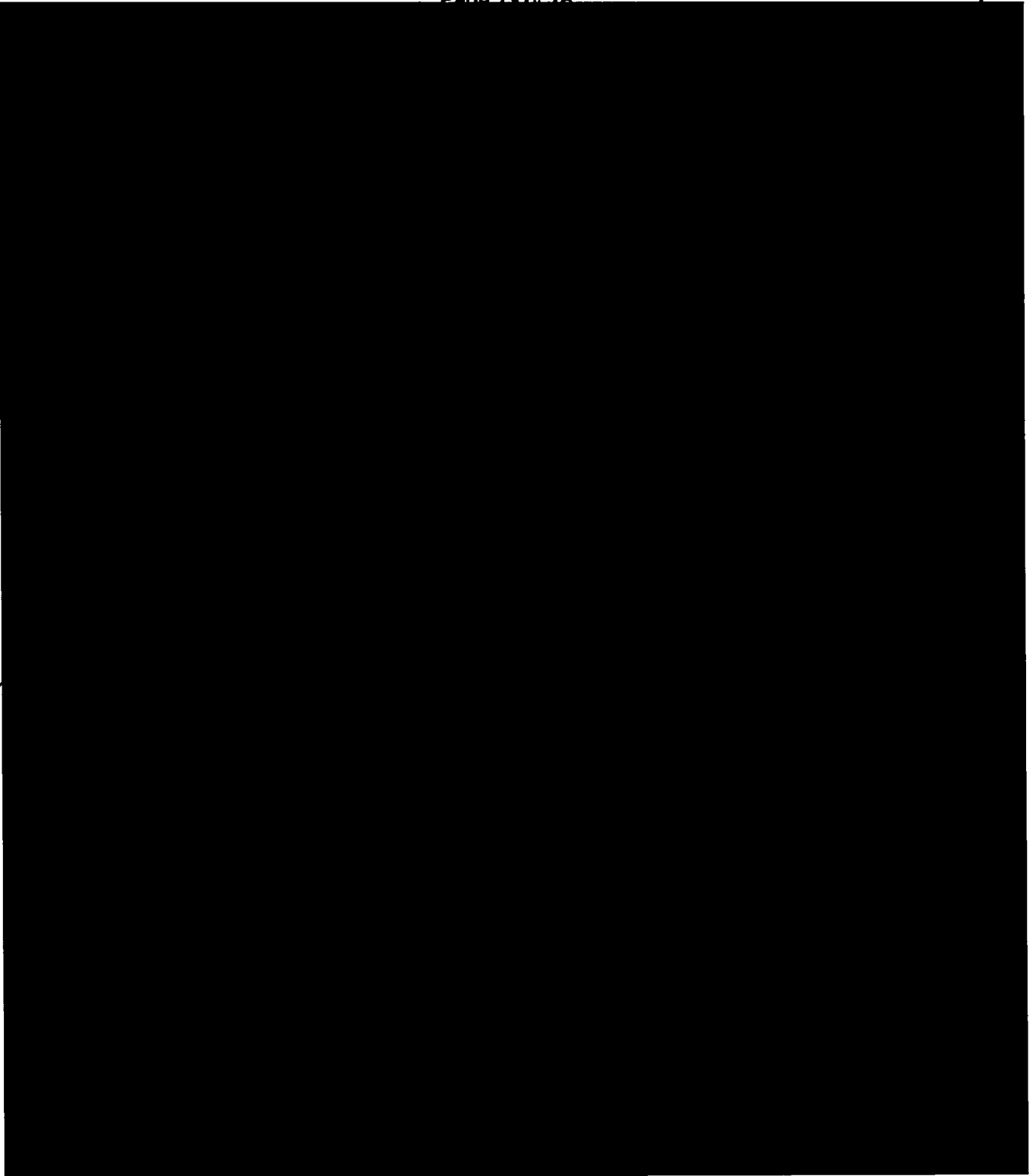
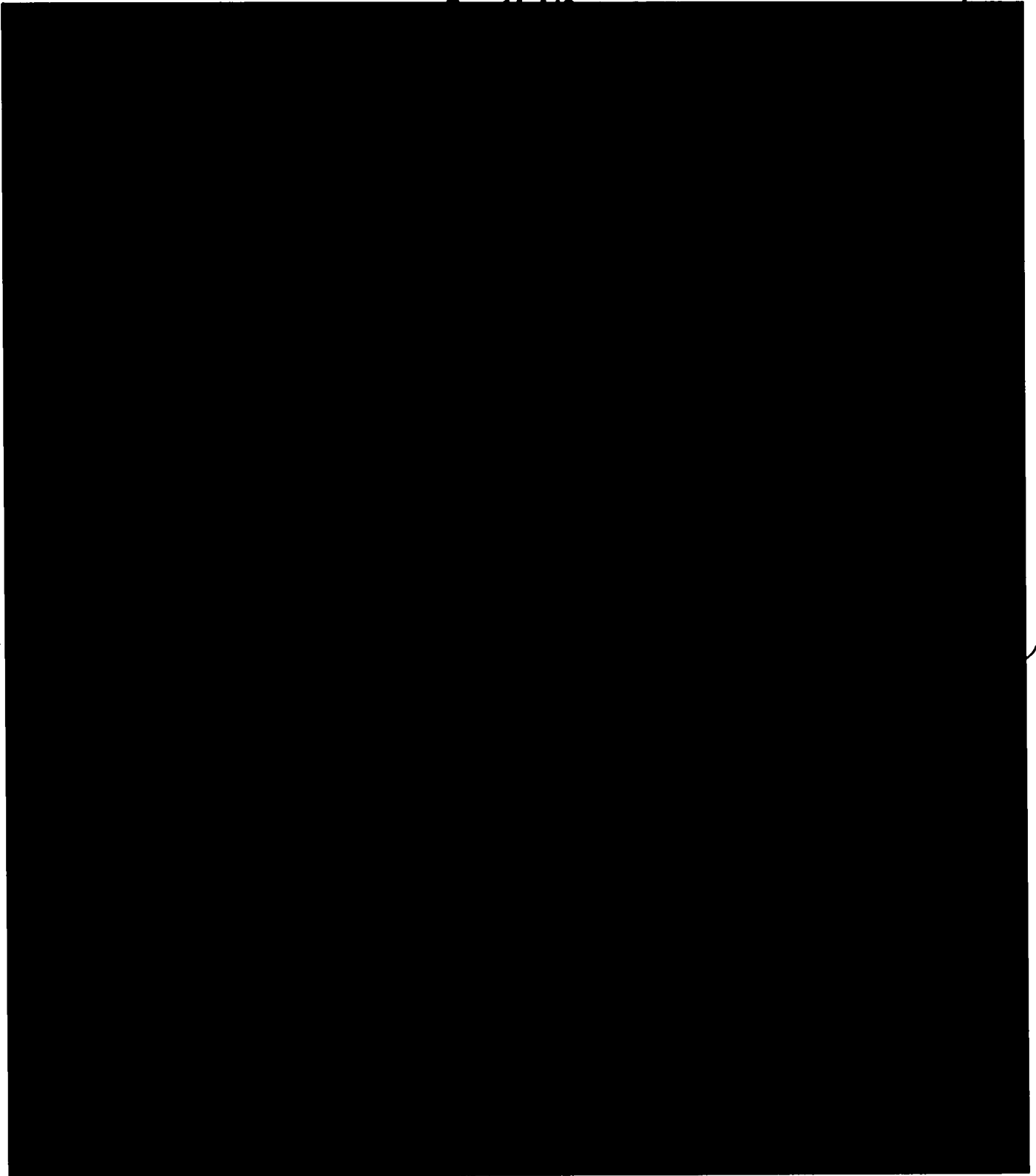


Table 3.7-9 Product Blending System



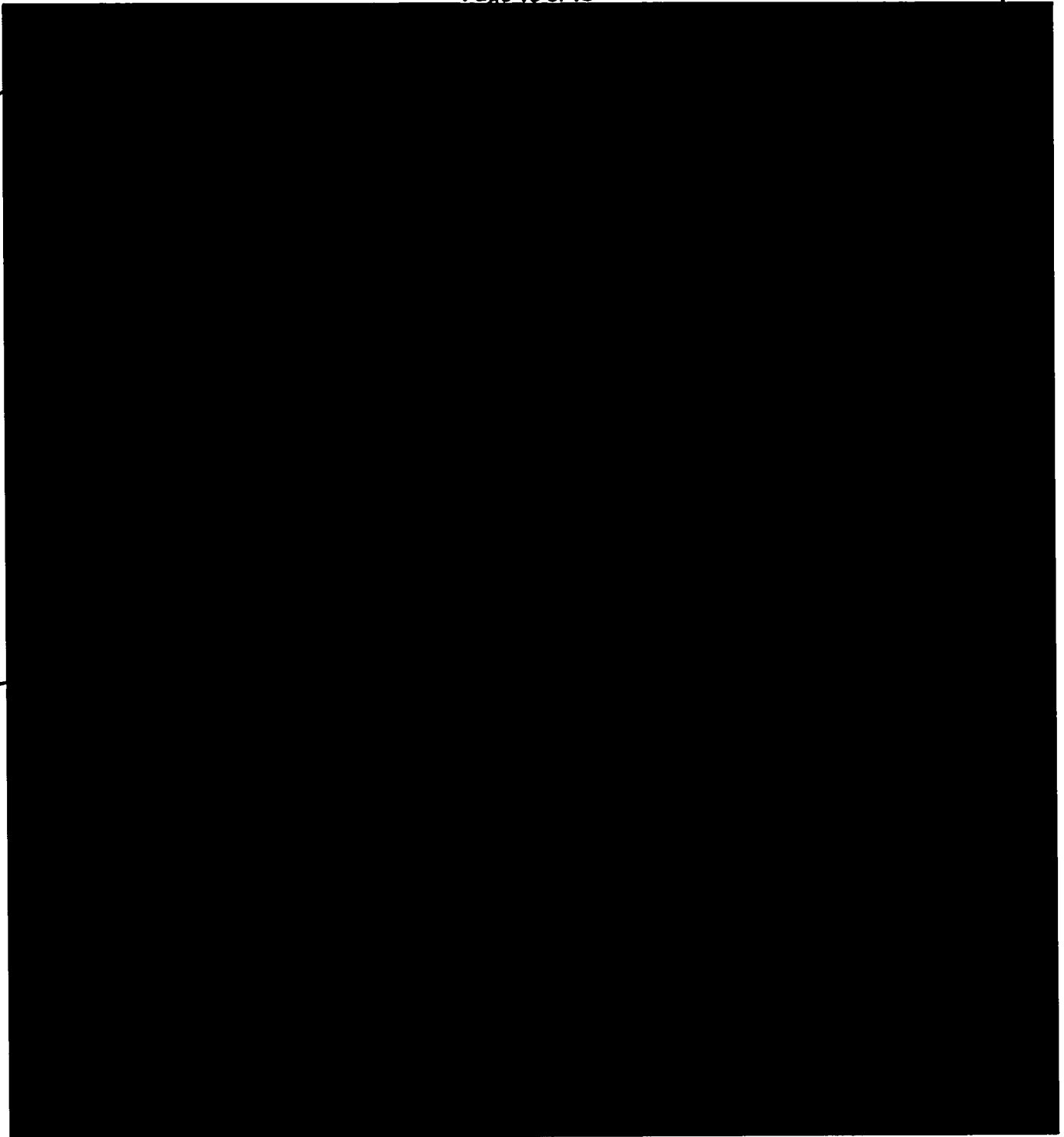


Table 3.7-9 Product Blending System

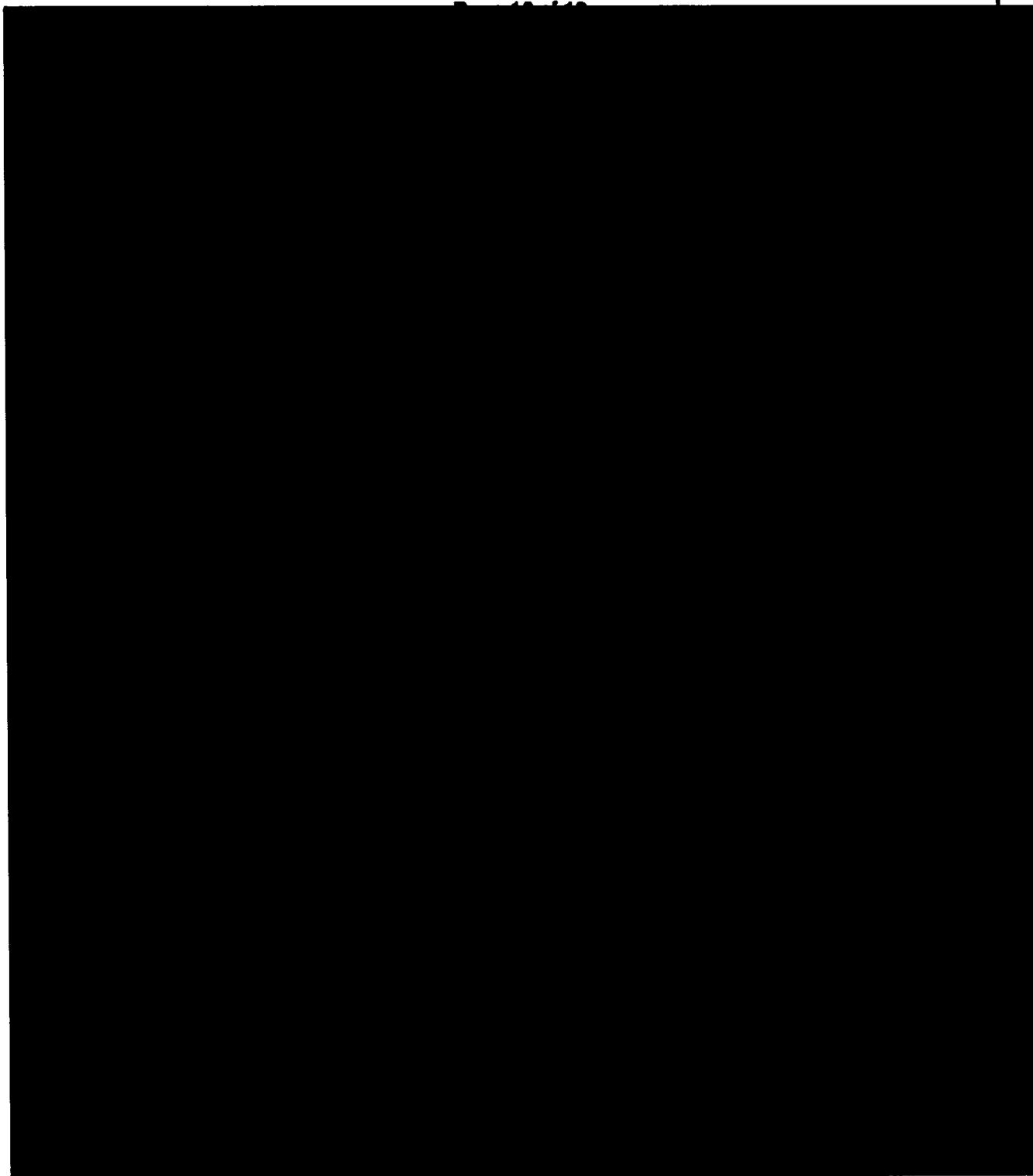


Table 3.7-9 Product Blending System

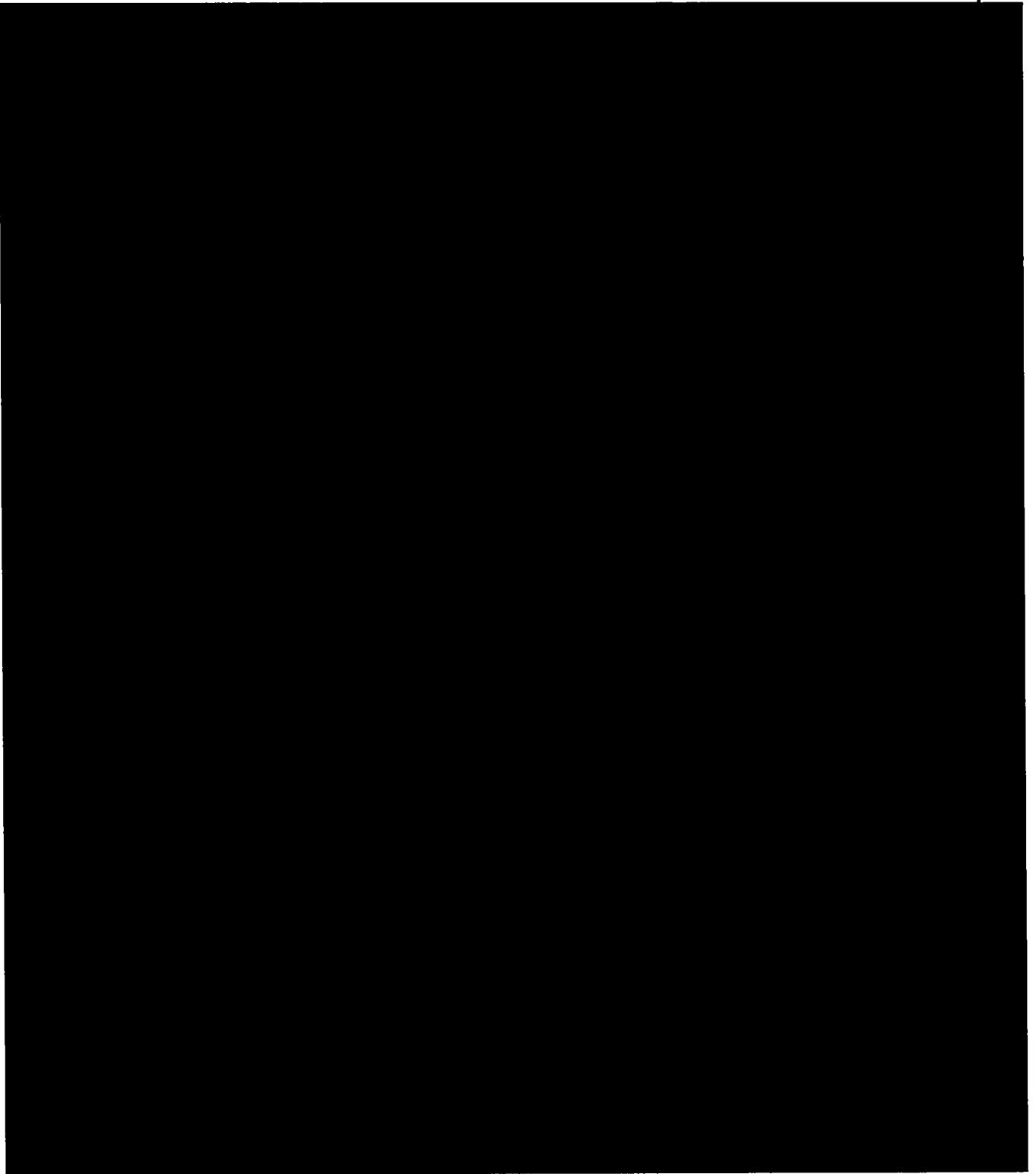


Table 3.7-9 Product Blending System

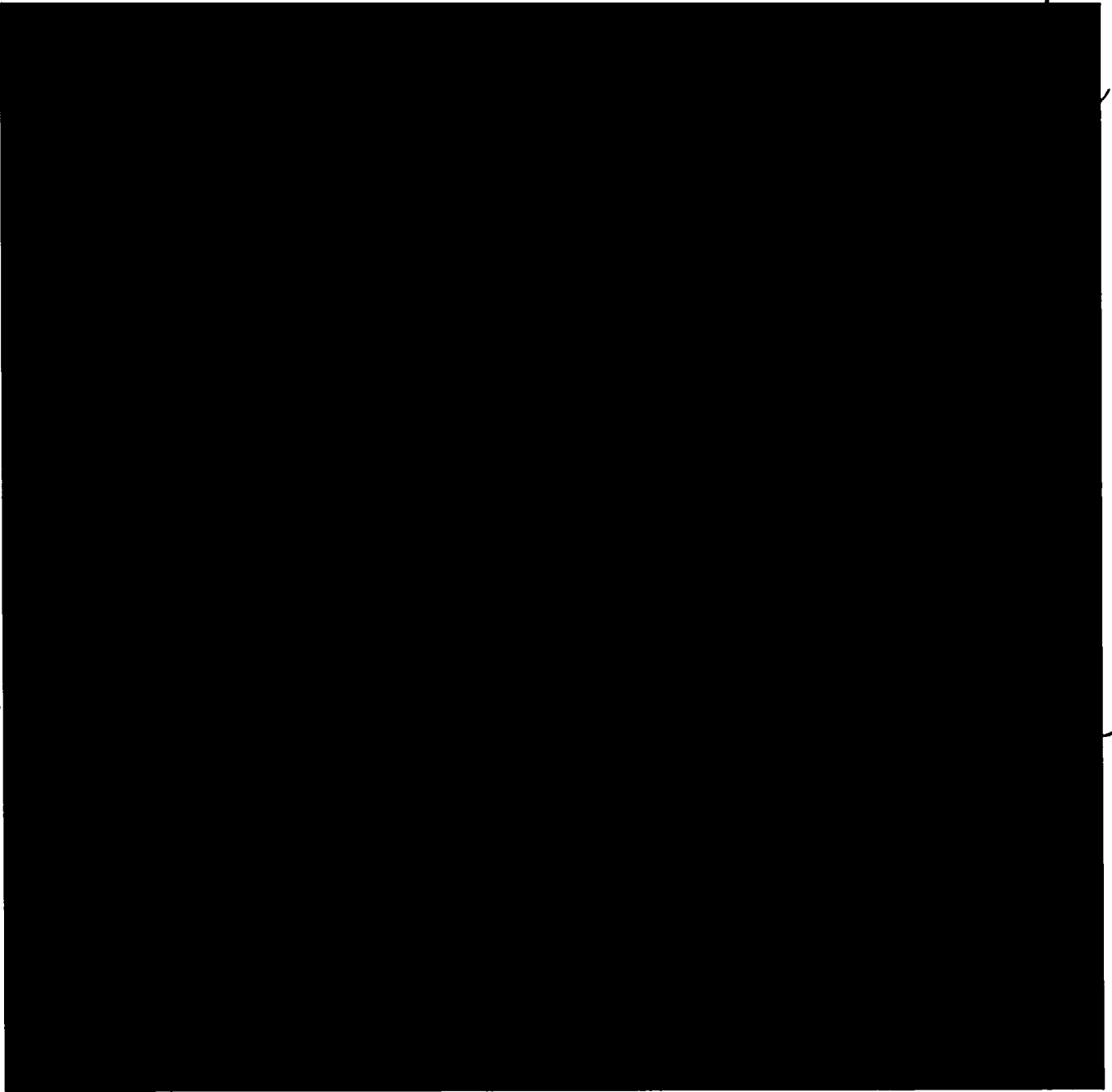


Table 3.7-10 Product Liquid Sampling

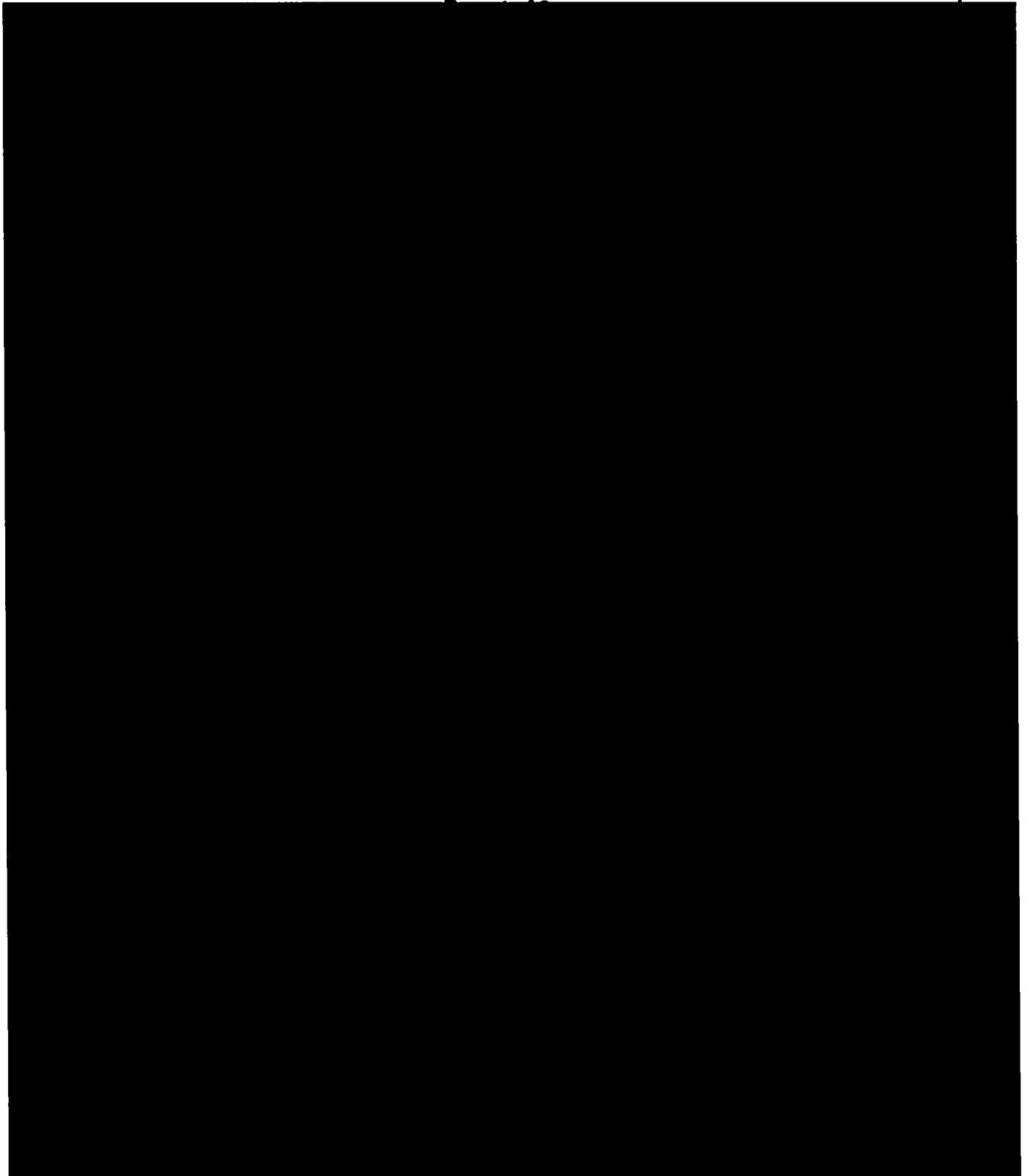


Table 3.7-10 Product Liquid Sampling

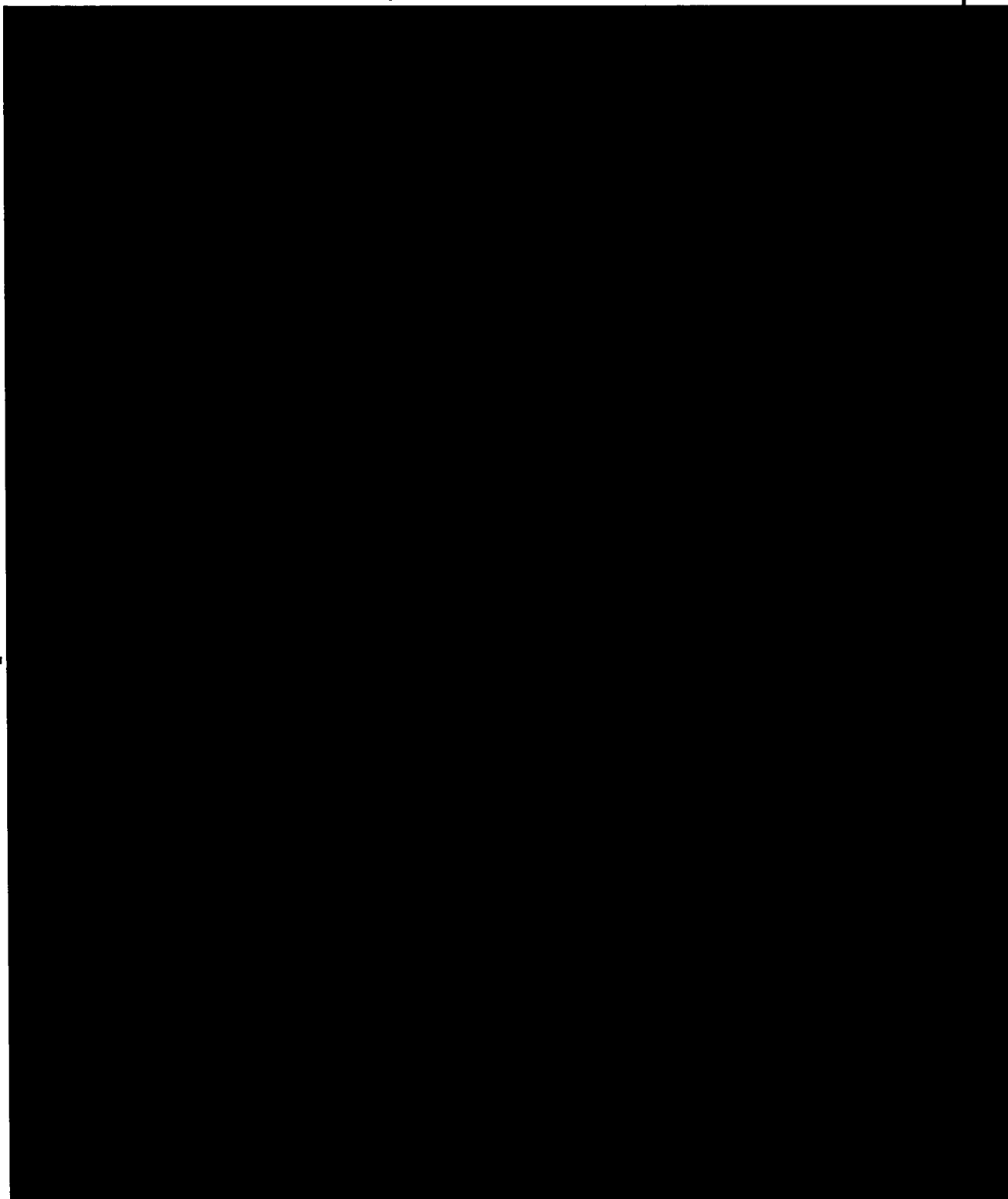


Table 3.7-10 Product Liquid Sampling

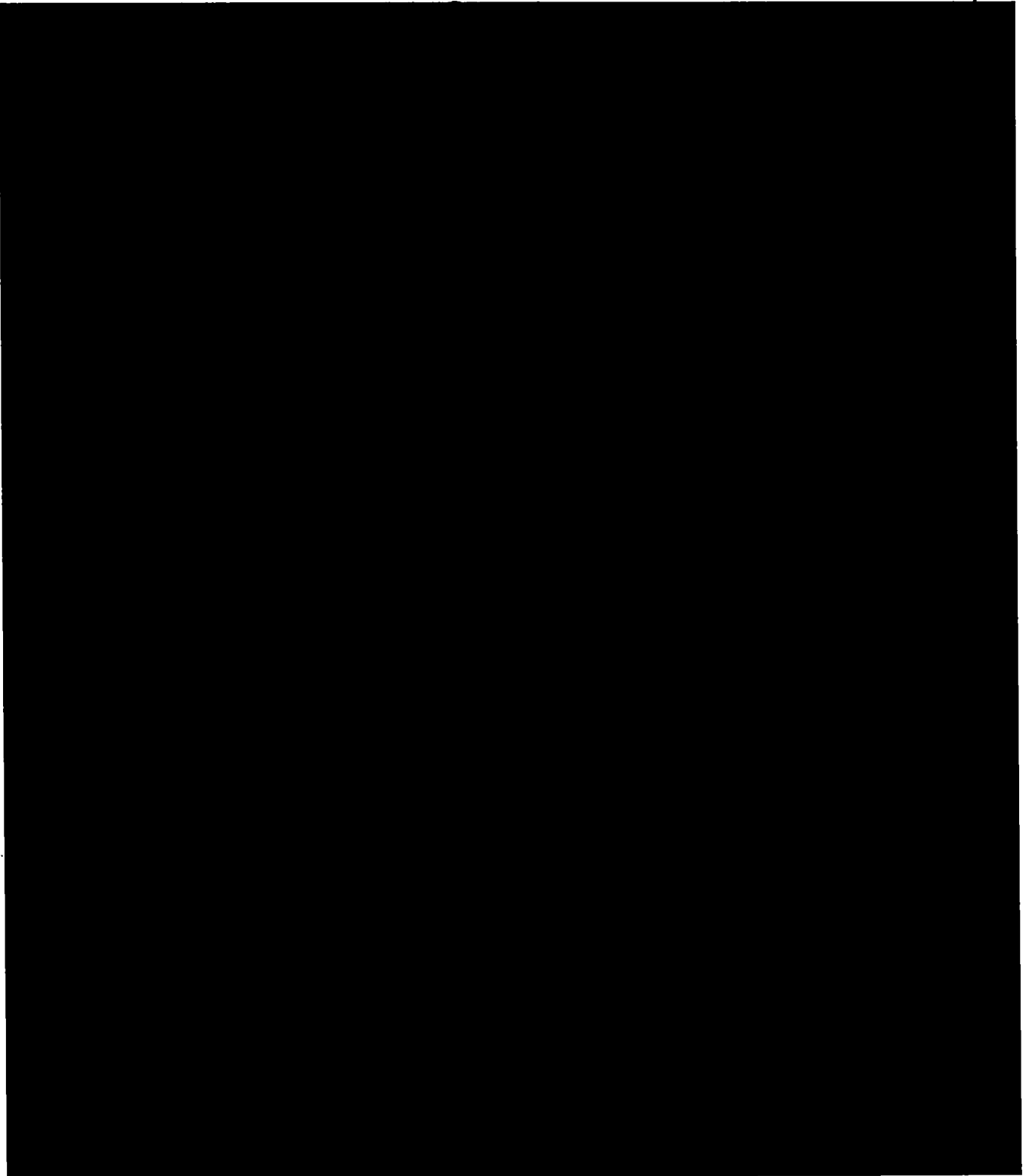


Table 3.7-10 Product Liquid Sampling

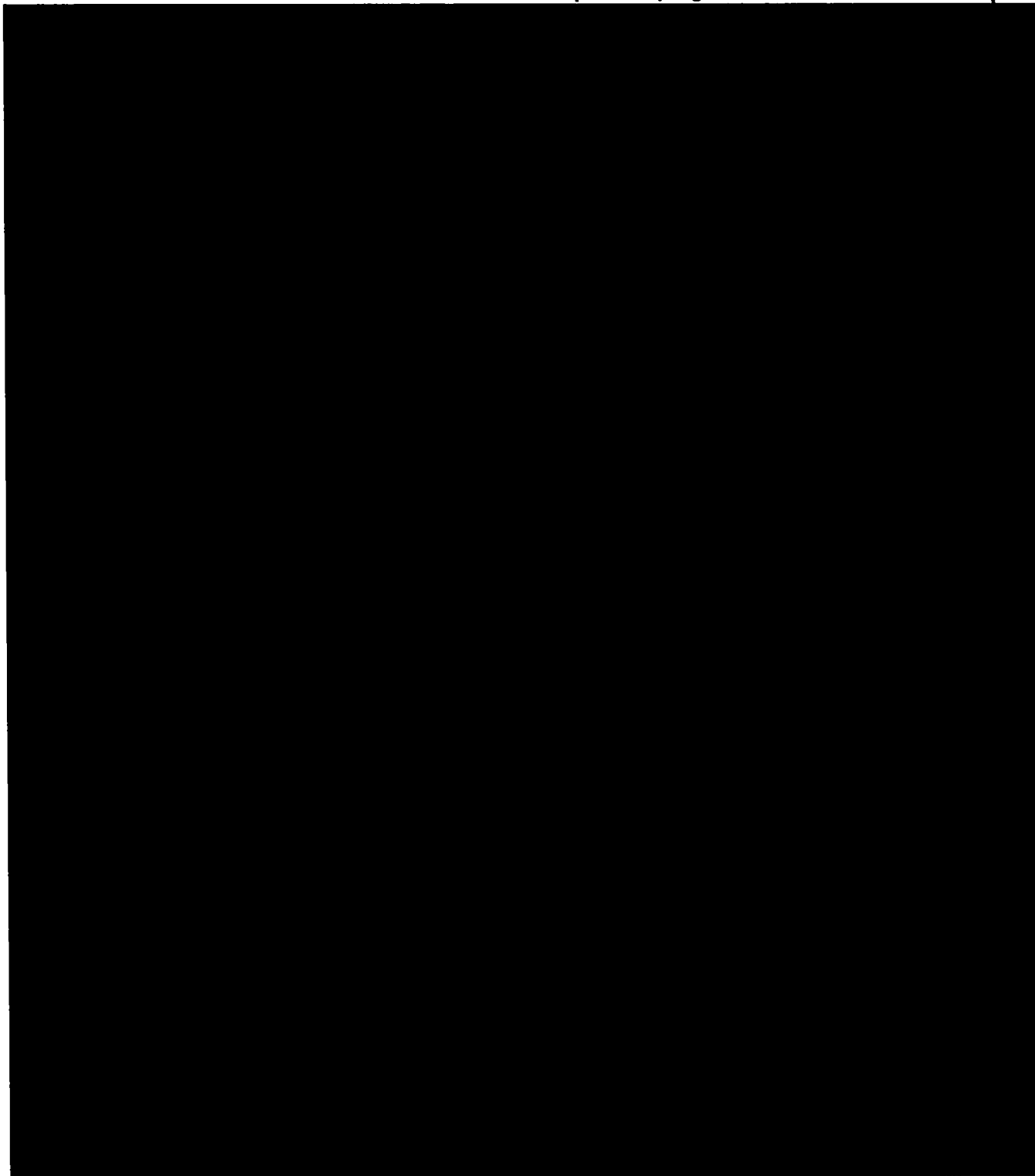


Table 3.7-10 Product Liquid Sampling

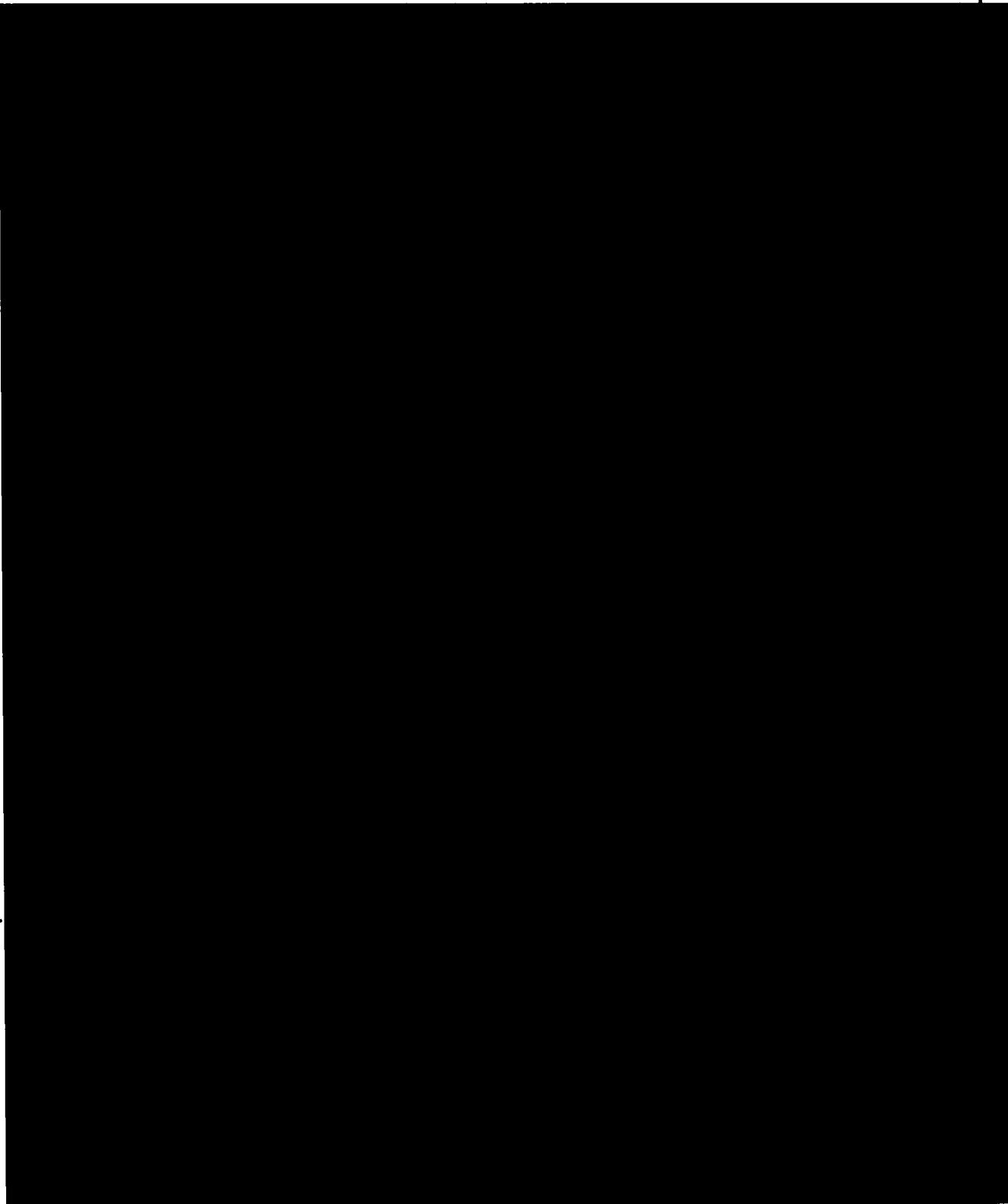


Table 3.7-10 Product Liquid Sampling

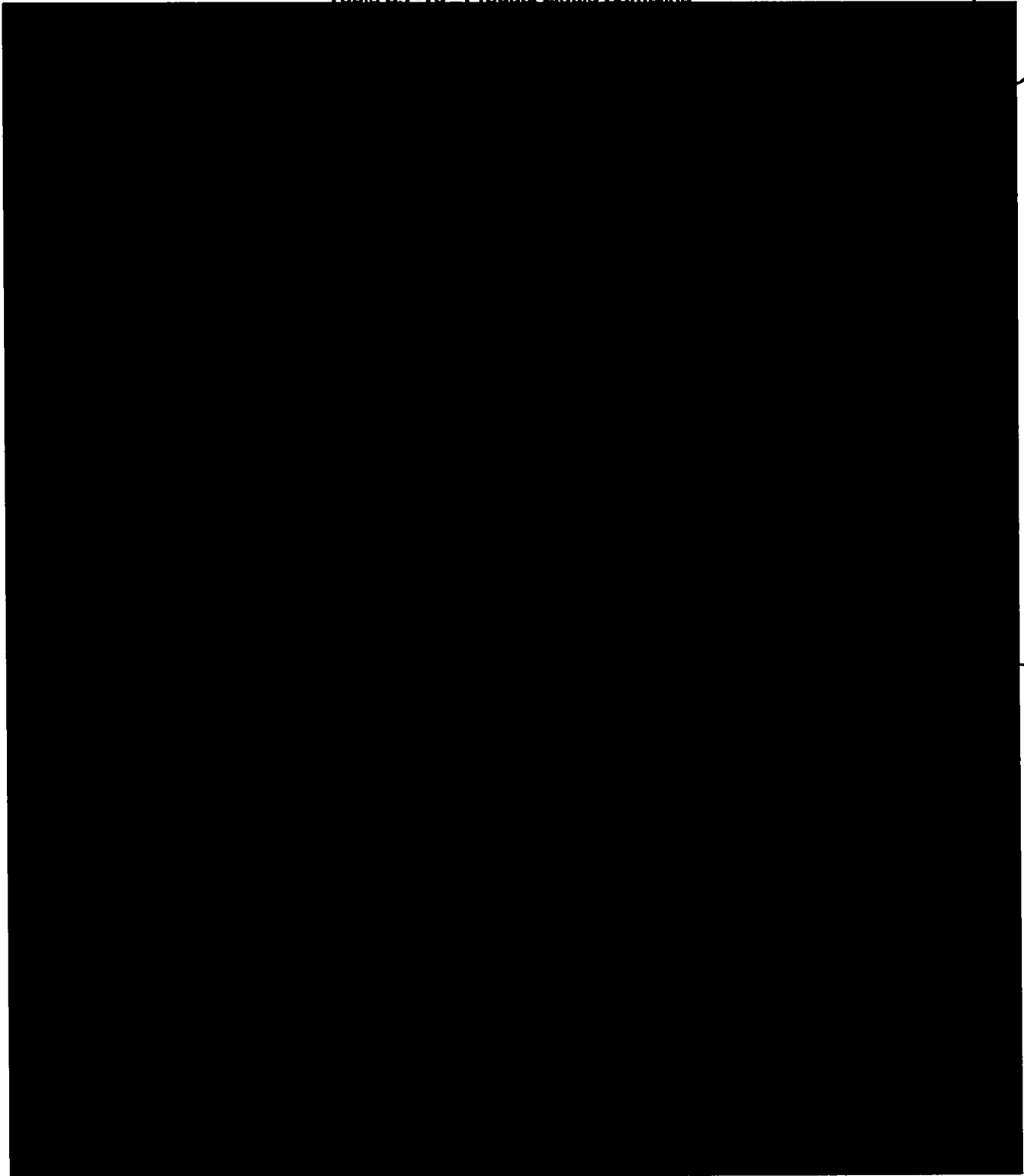


Table 3.7-10 Product Liquid Sampling

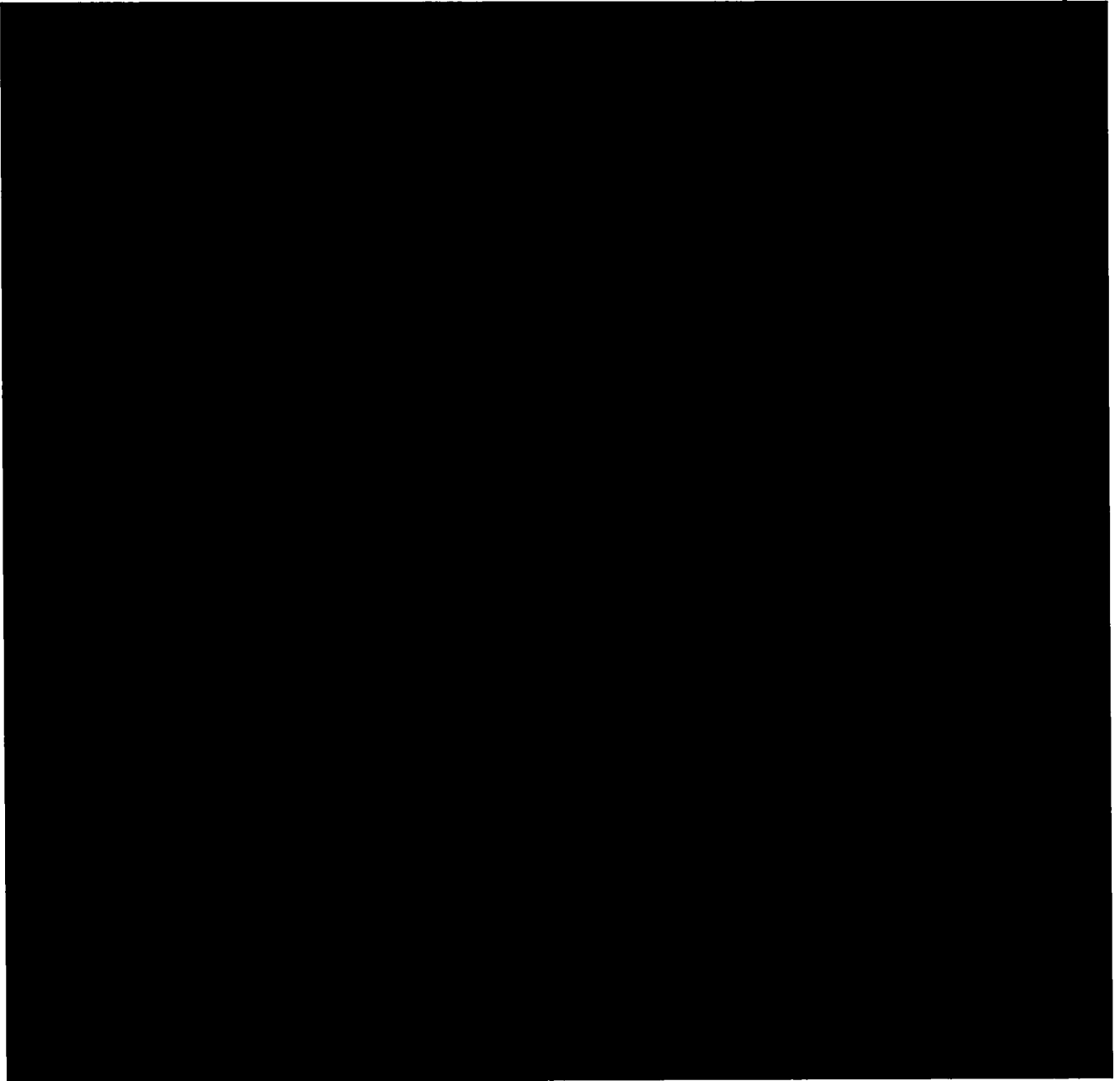
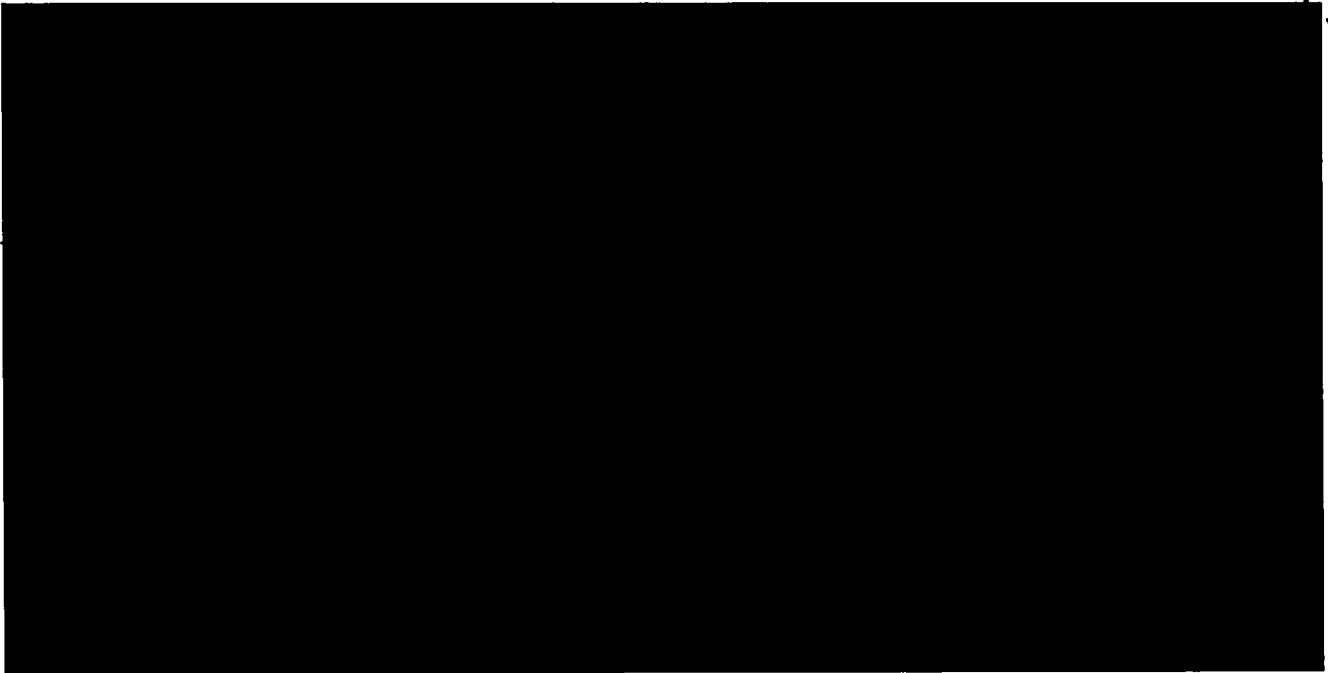
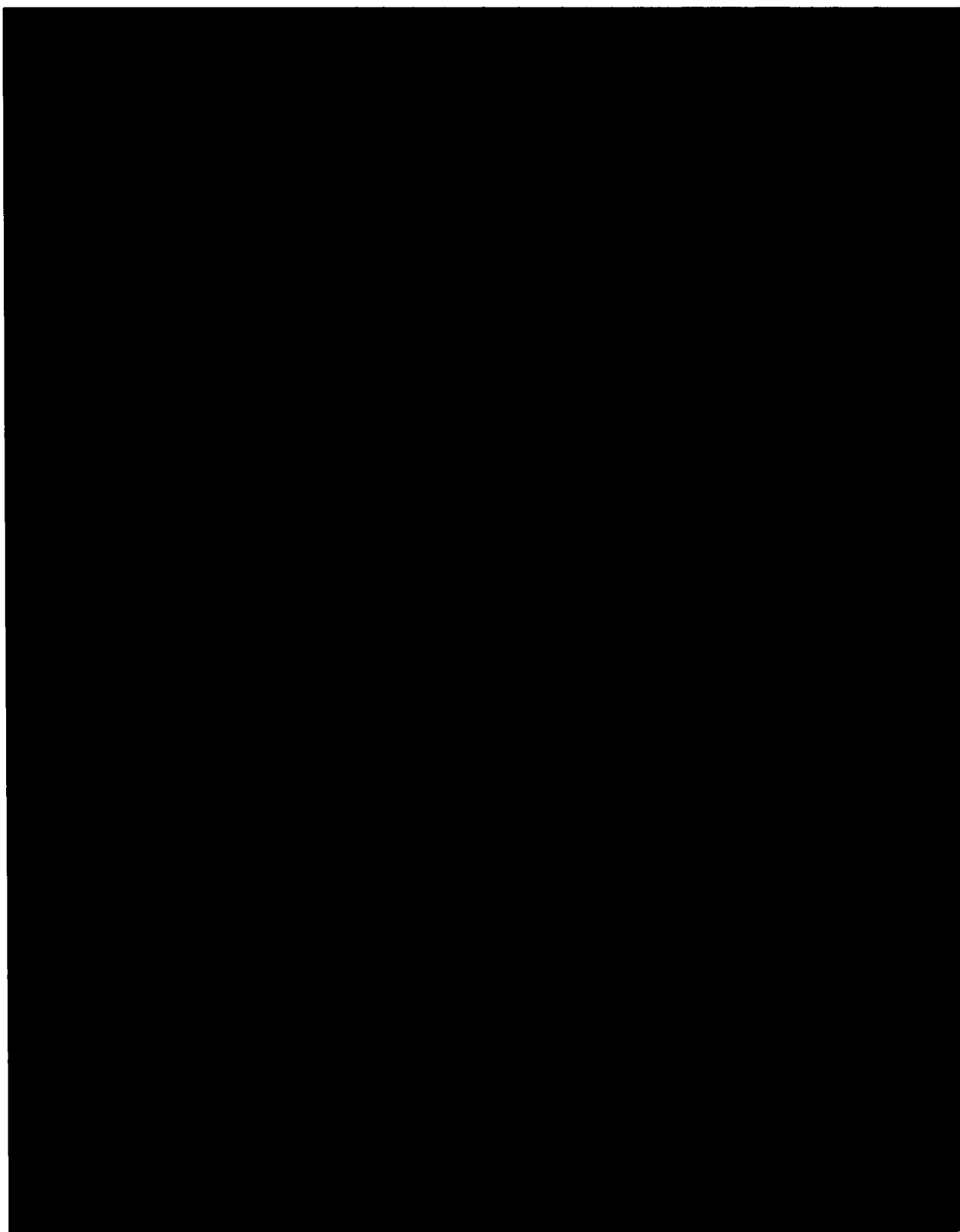


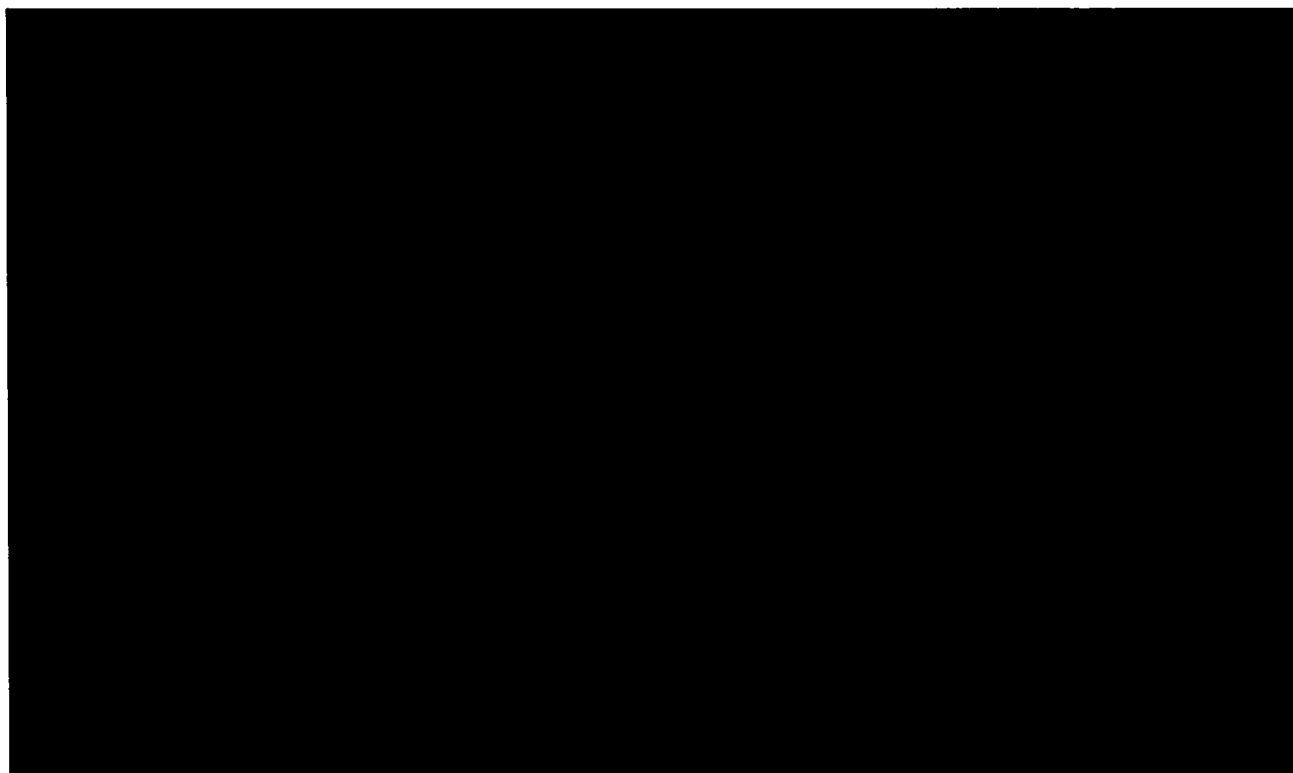
Table 3.7-10 Product Liquid Sampling
Page 8 of 8



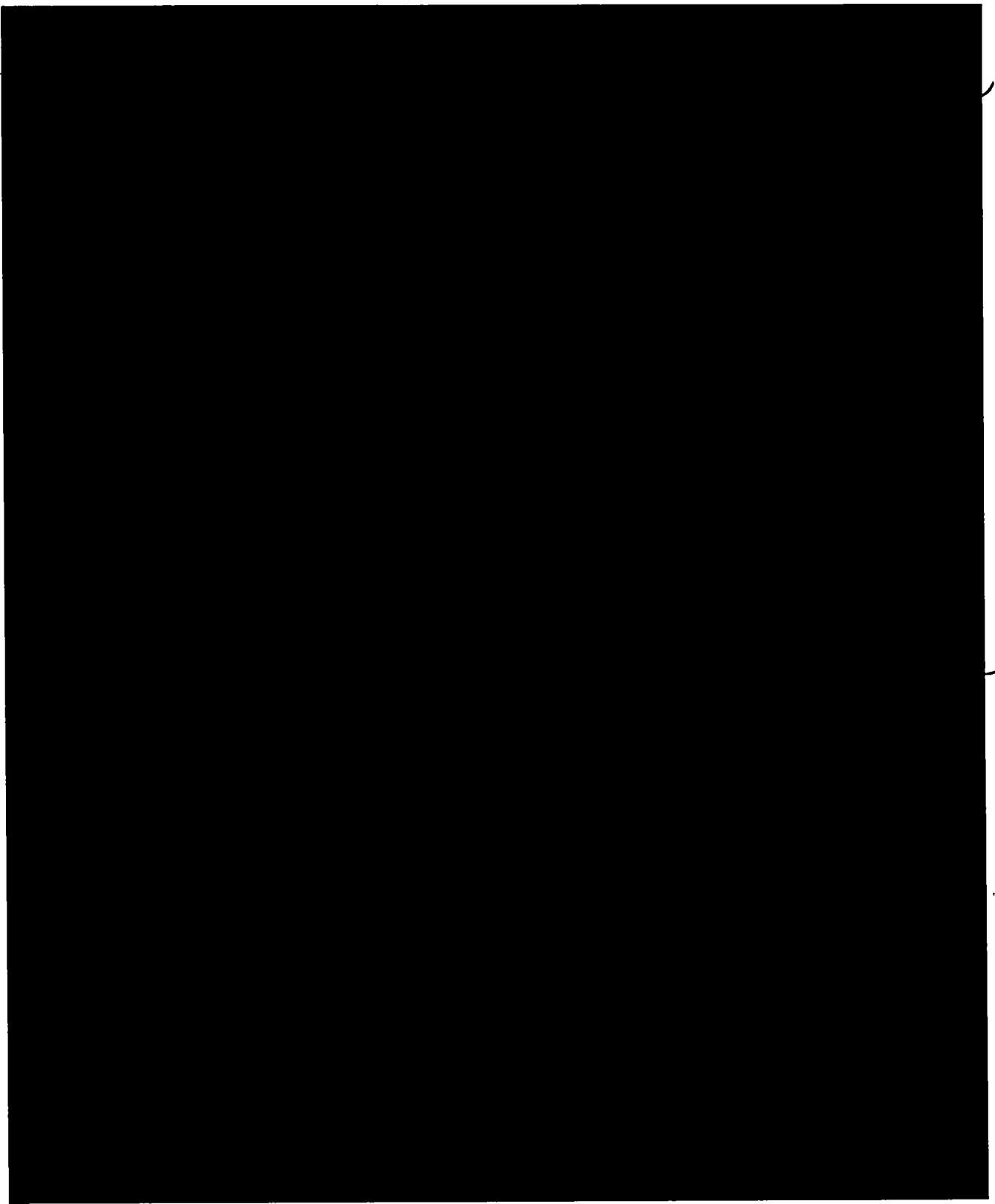
**Table 3.7-11 Contingency Dump System
(Note 1)**

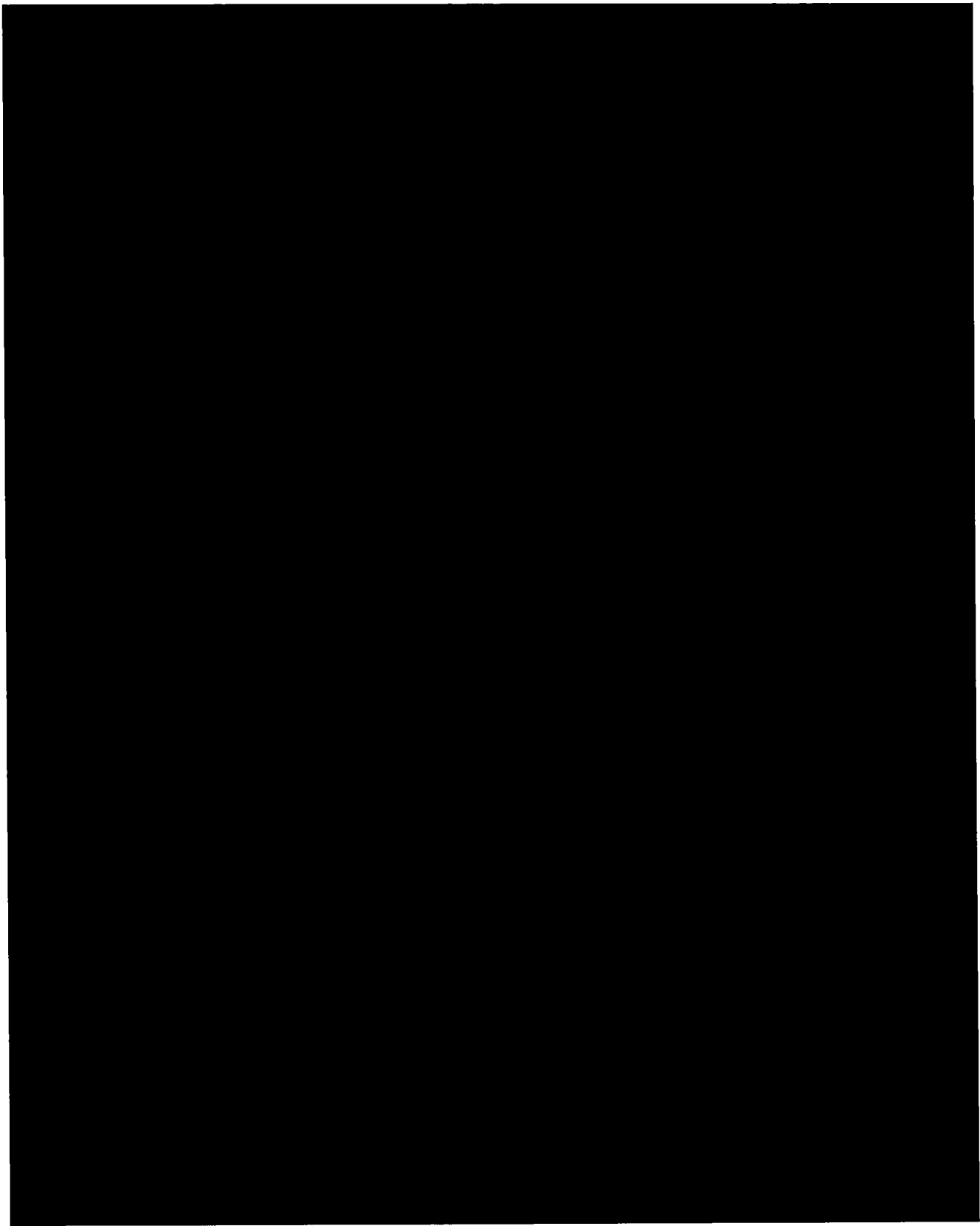


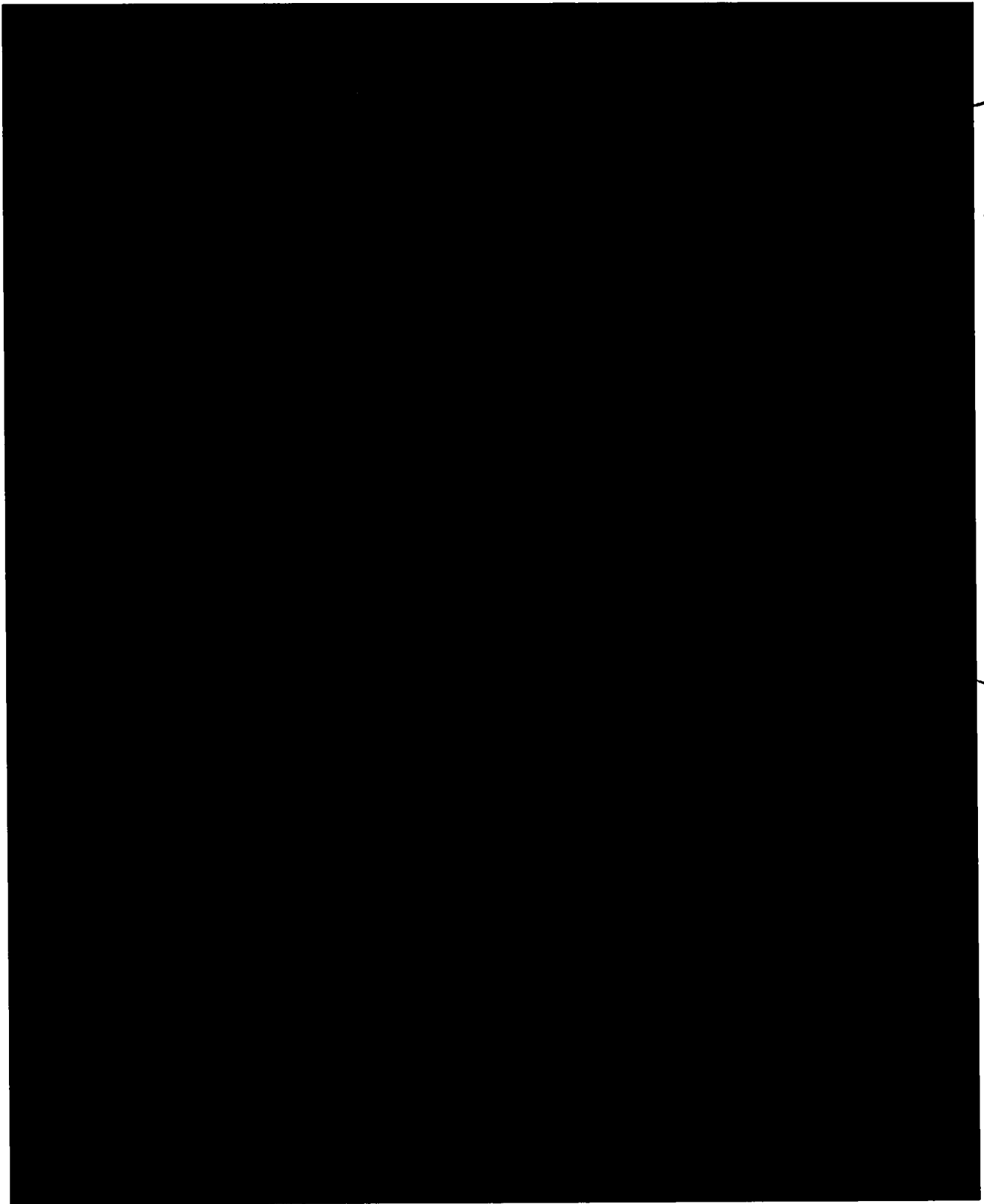


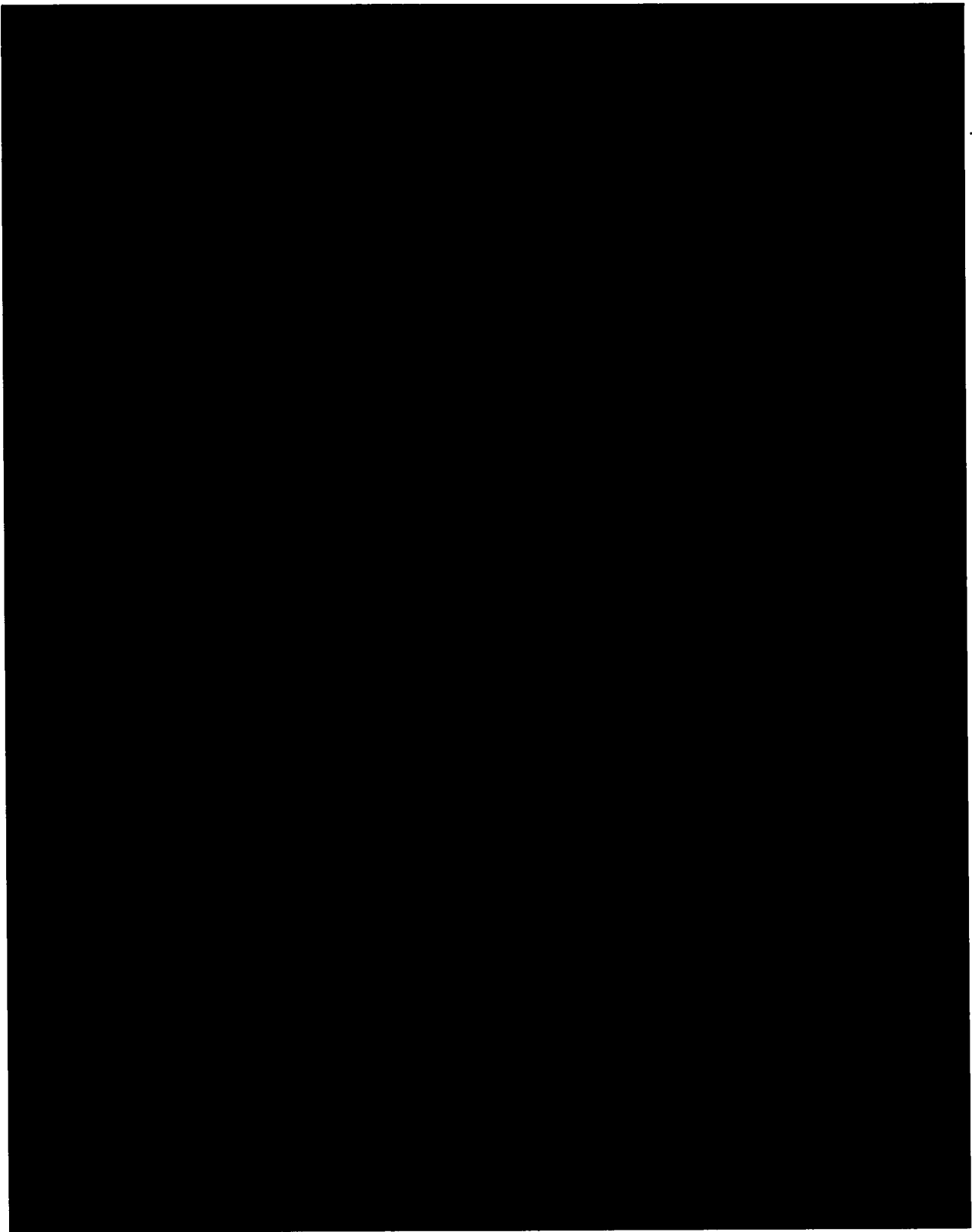


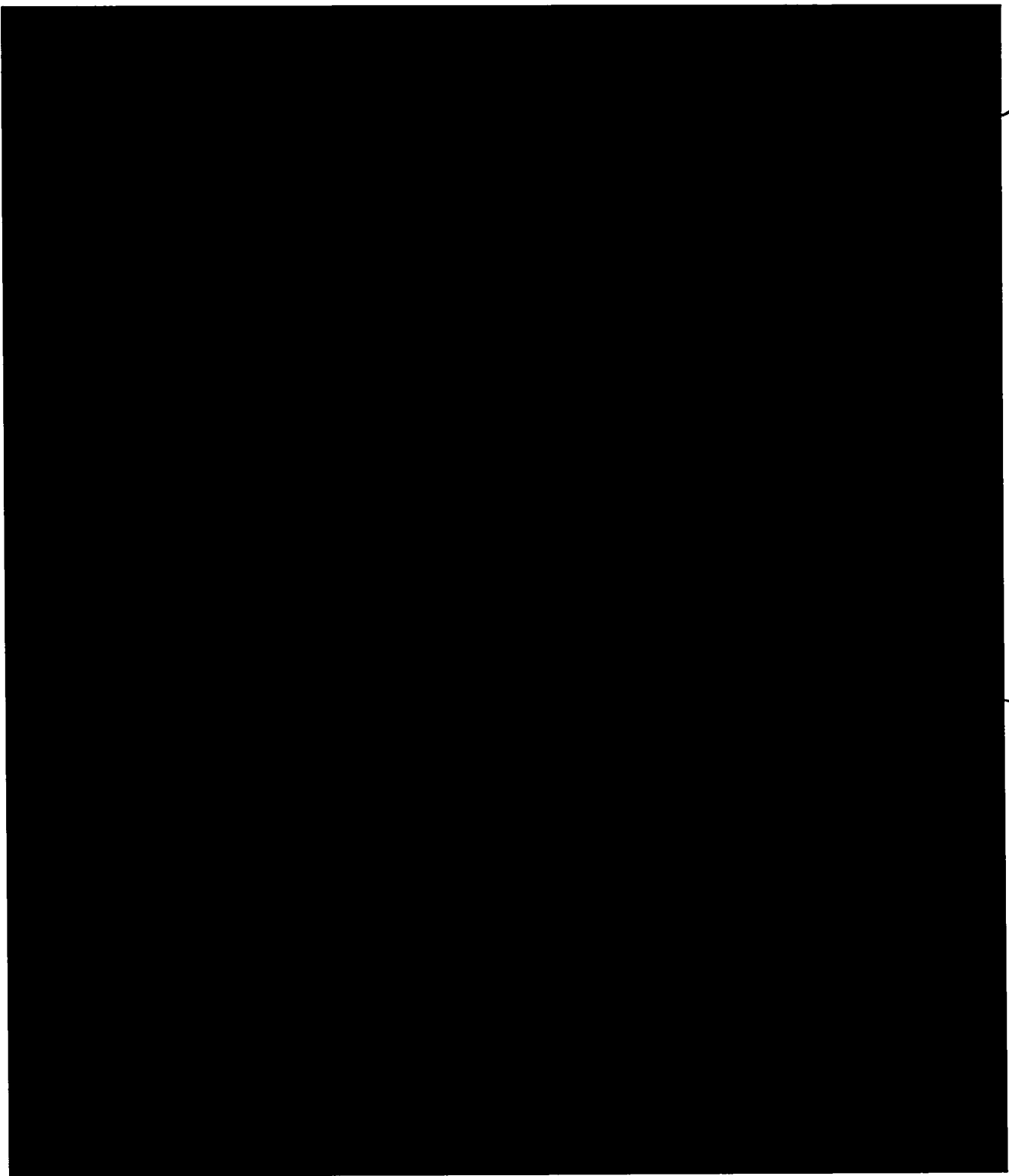


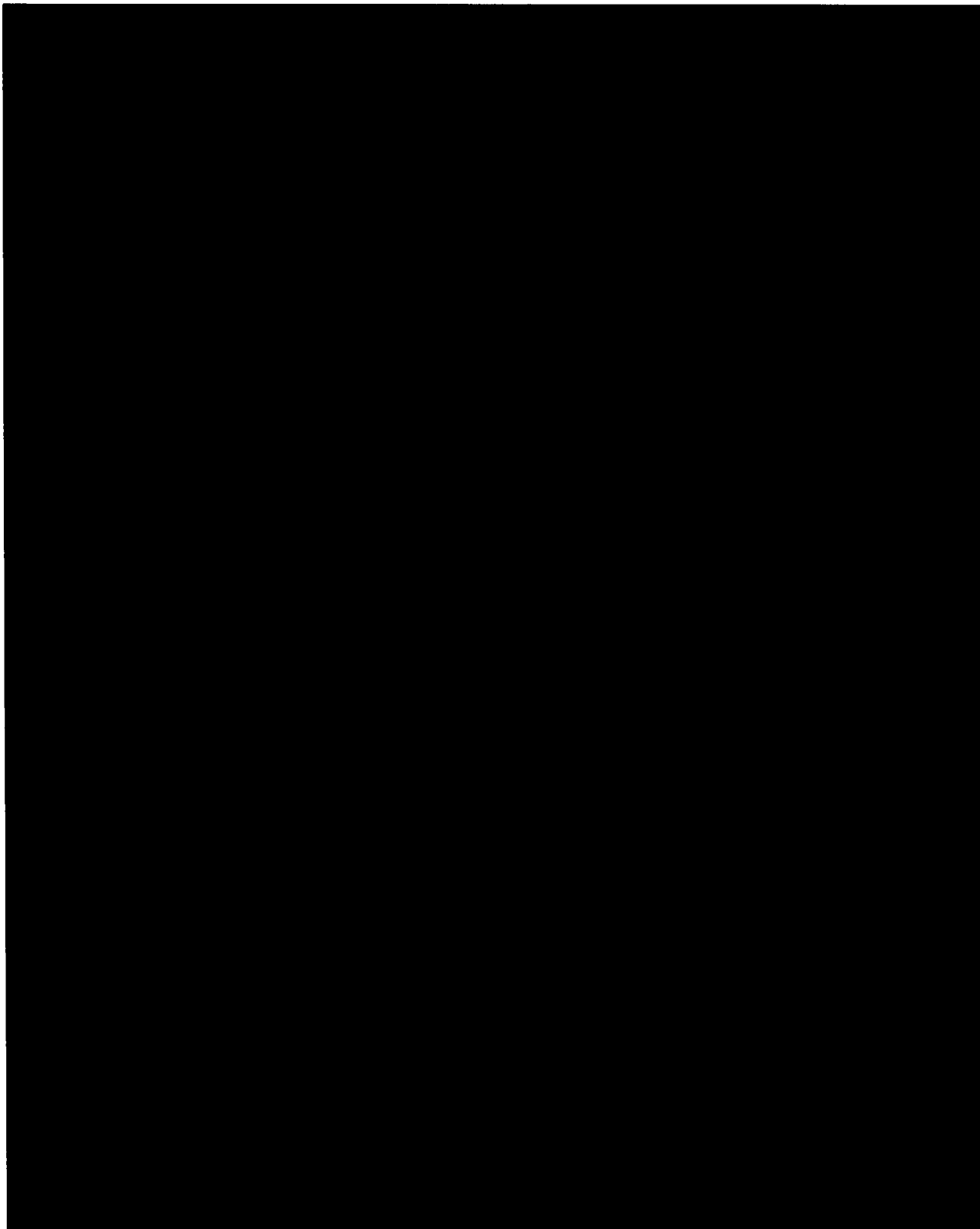


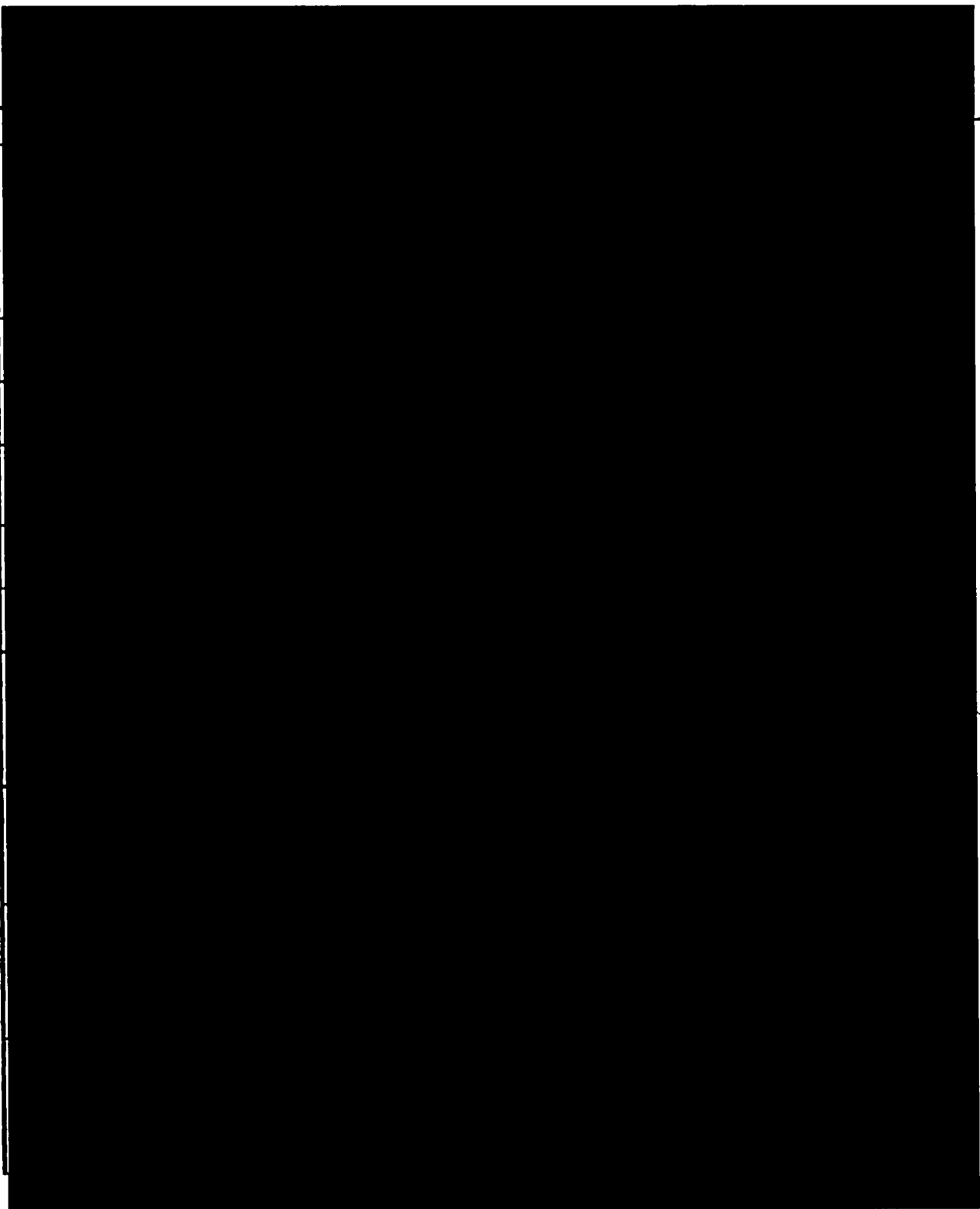


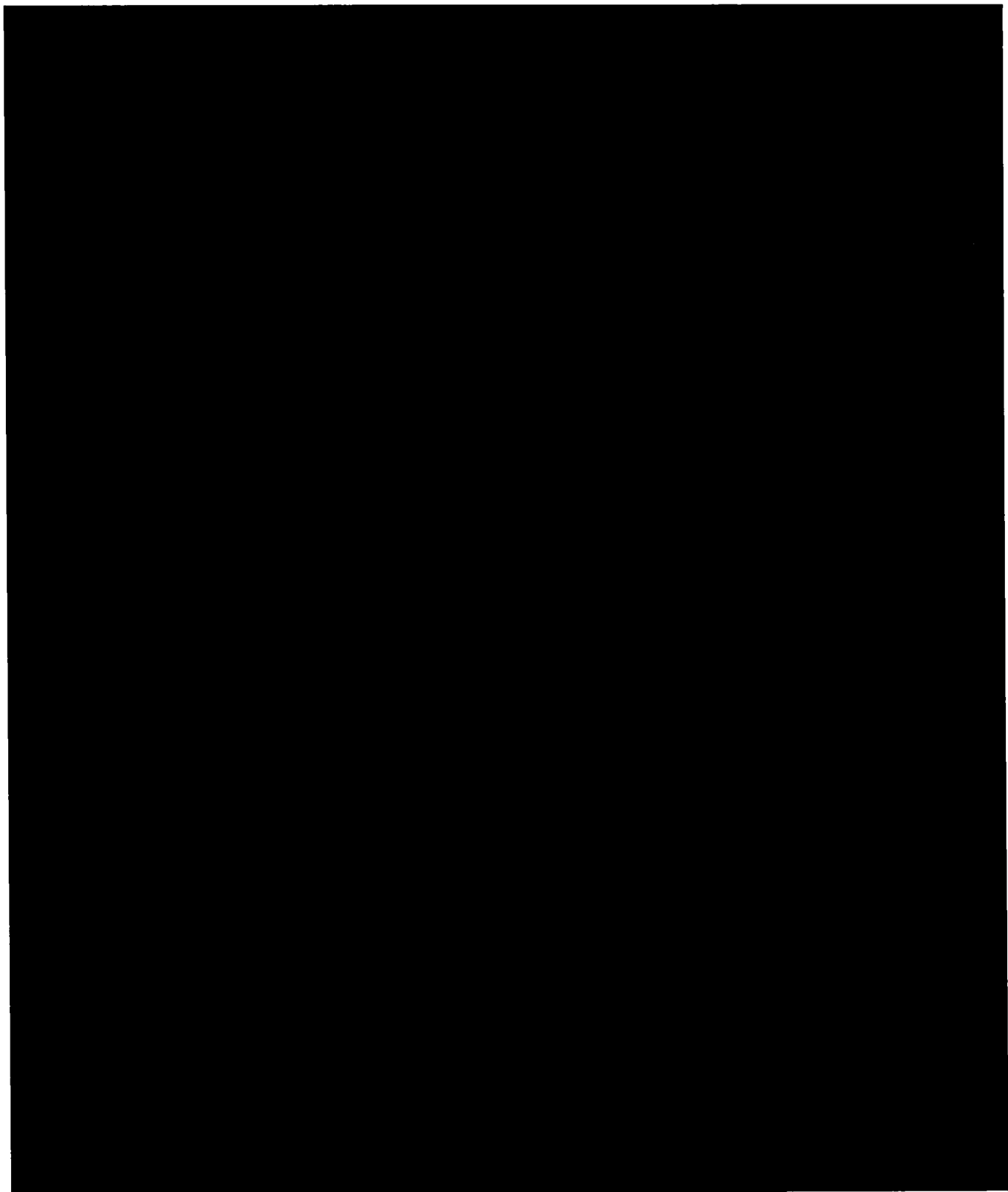


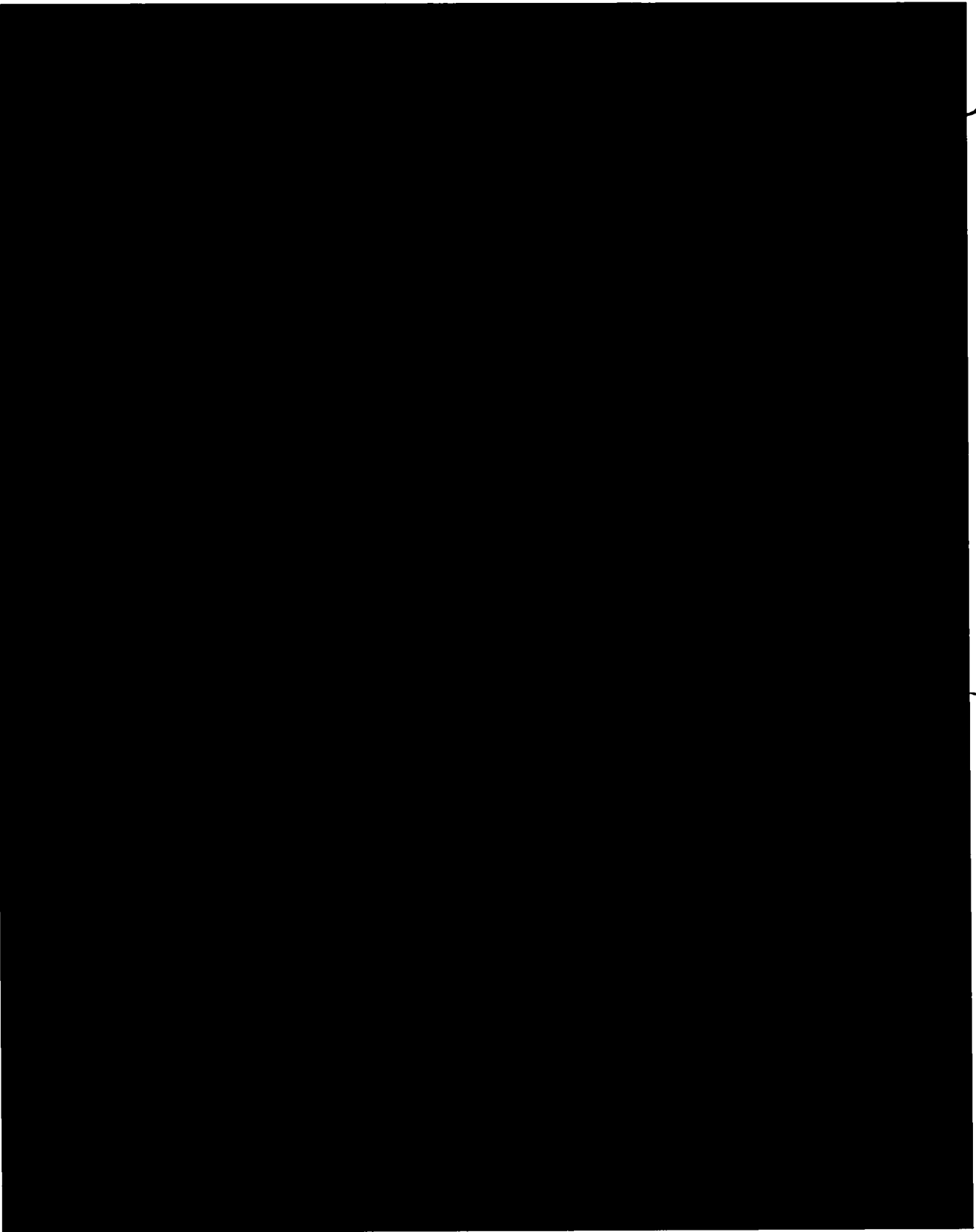


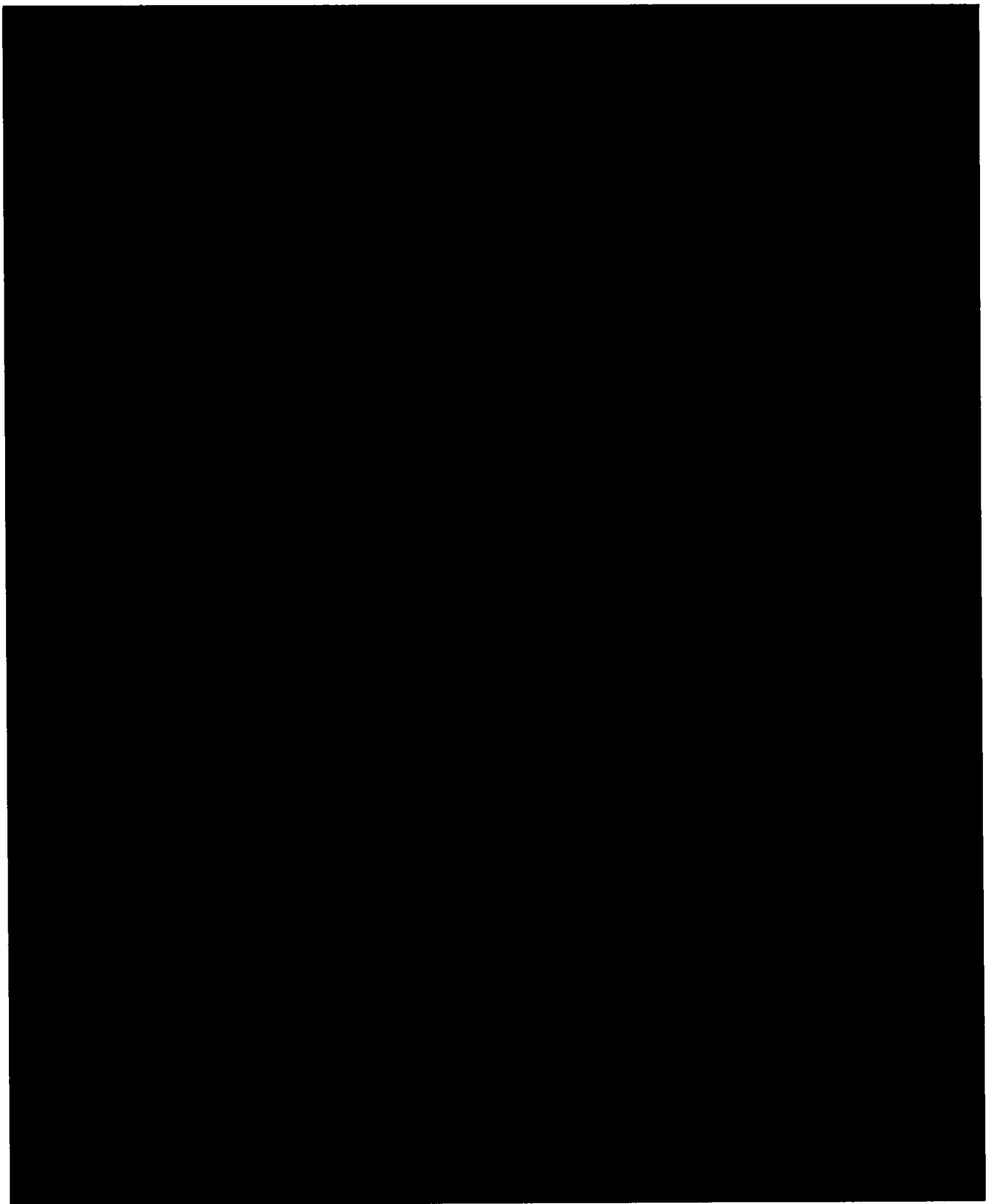


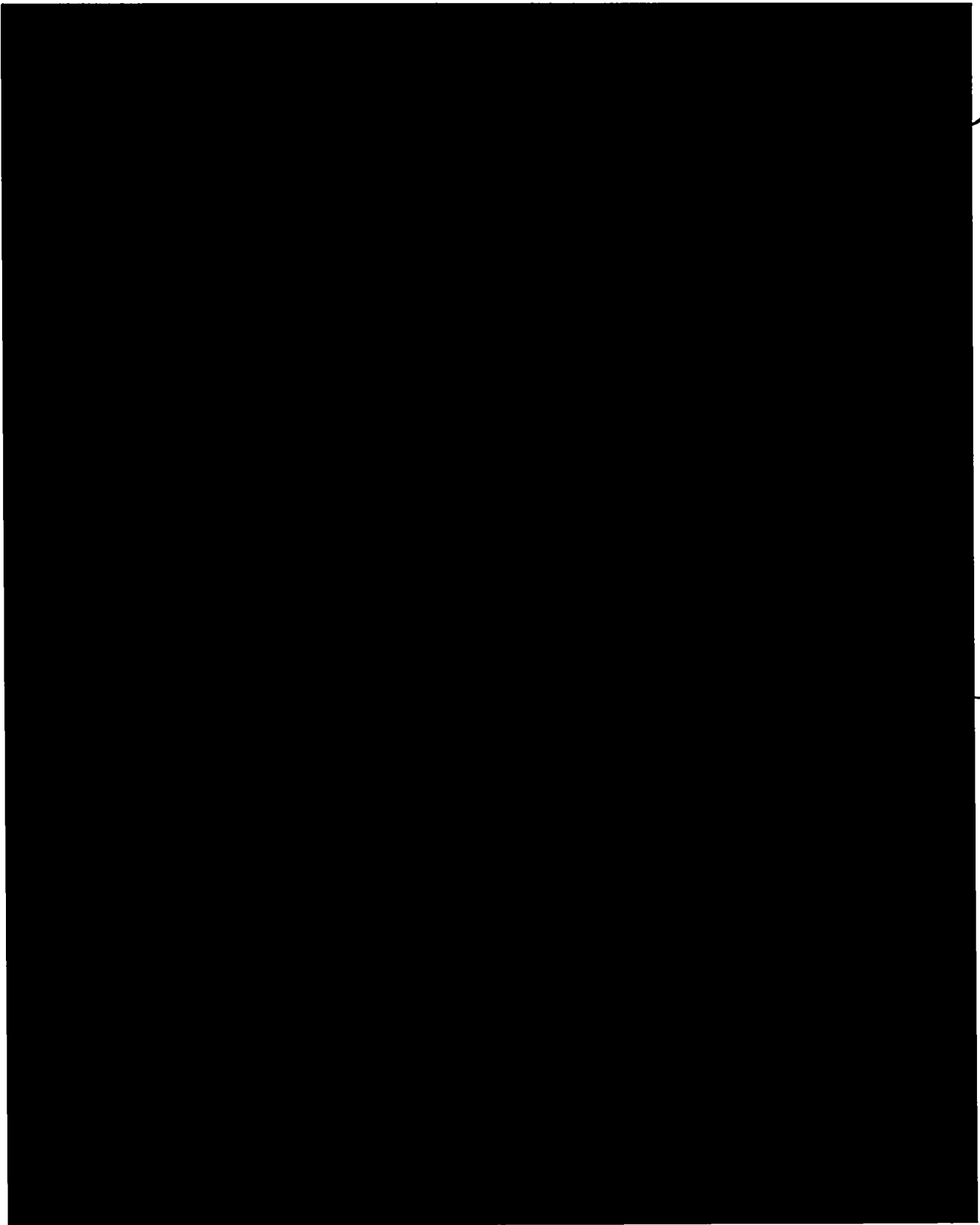


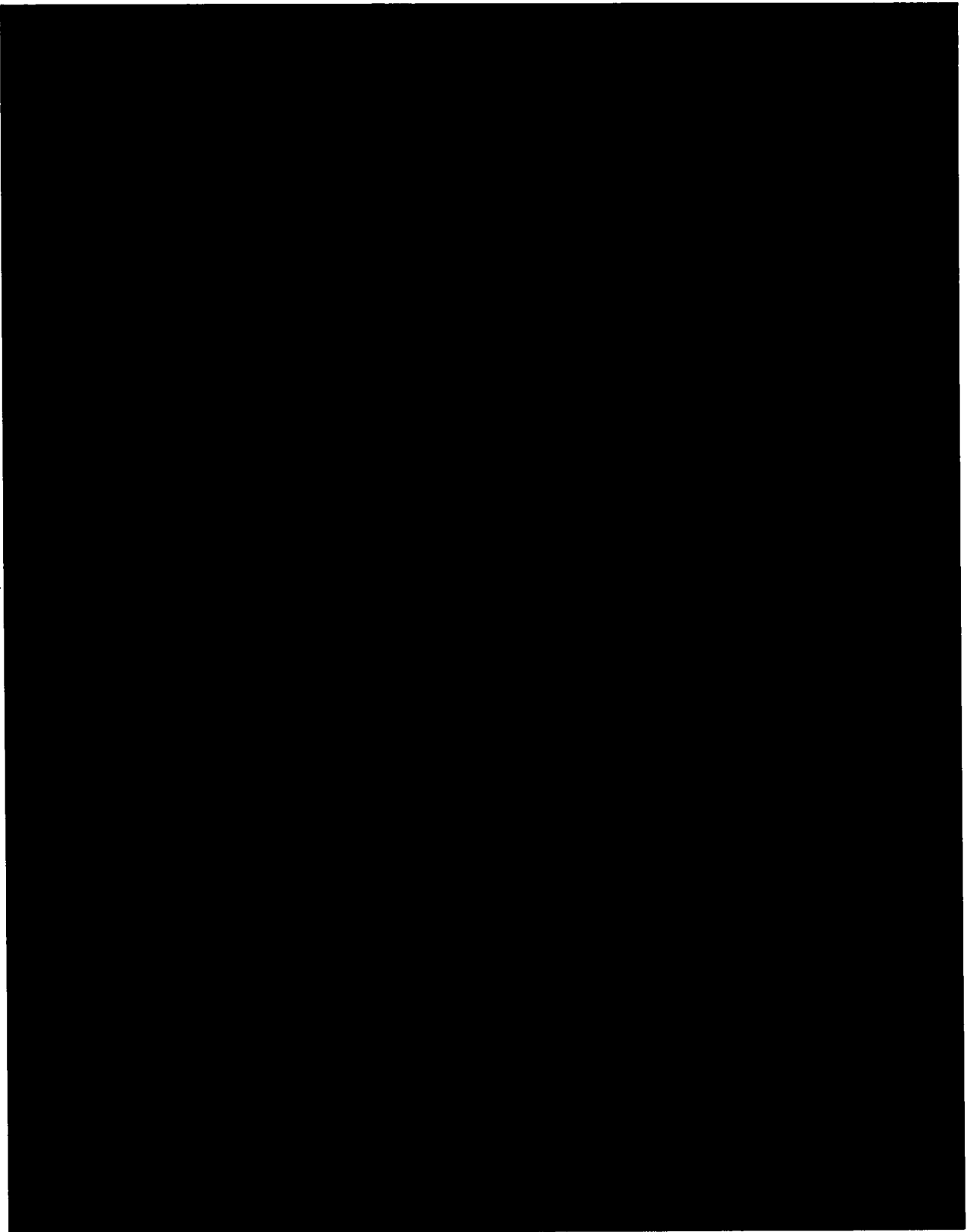


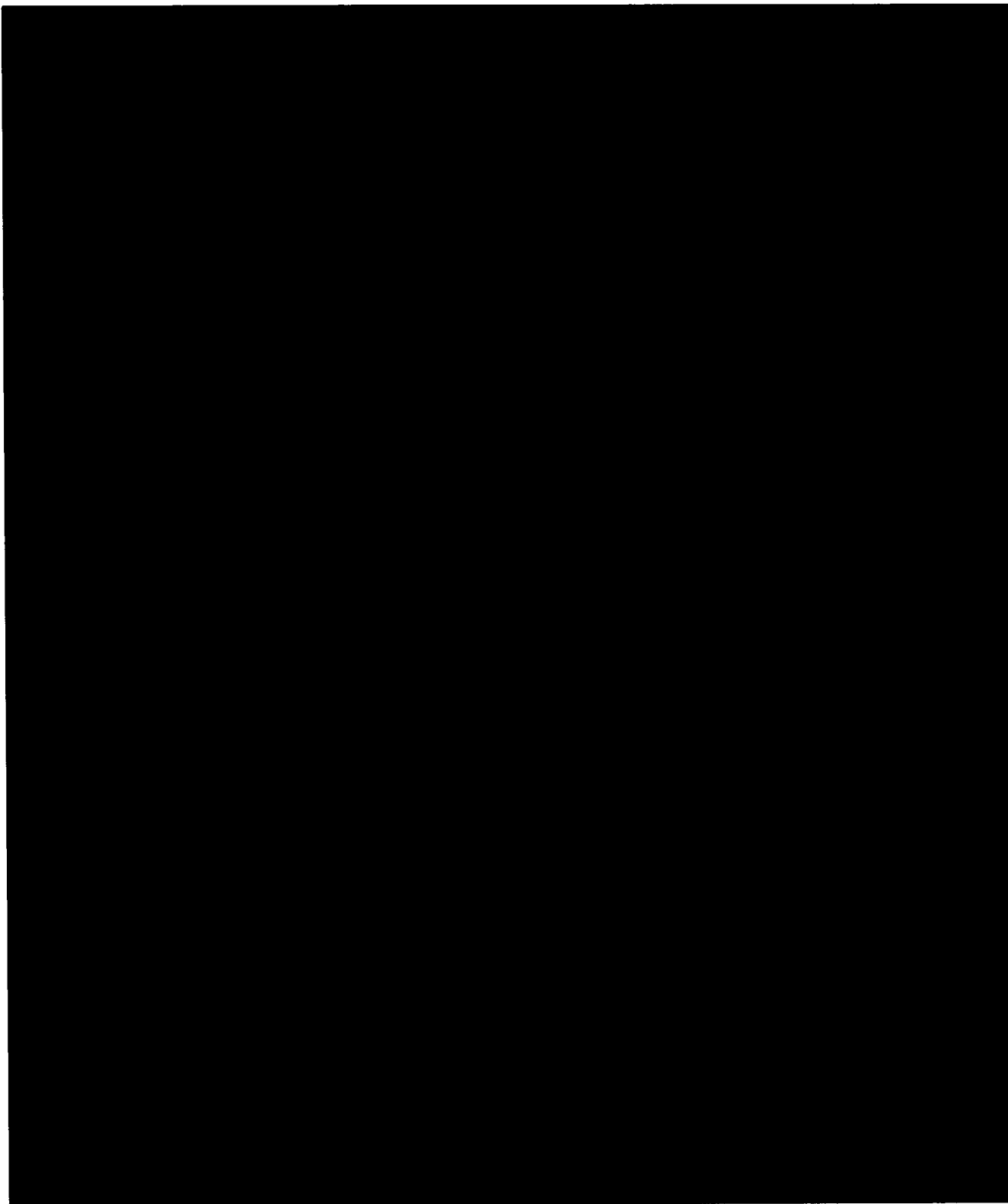


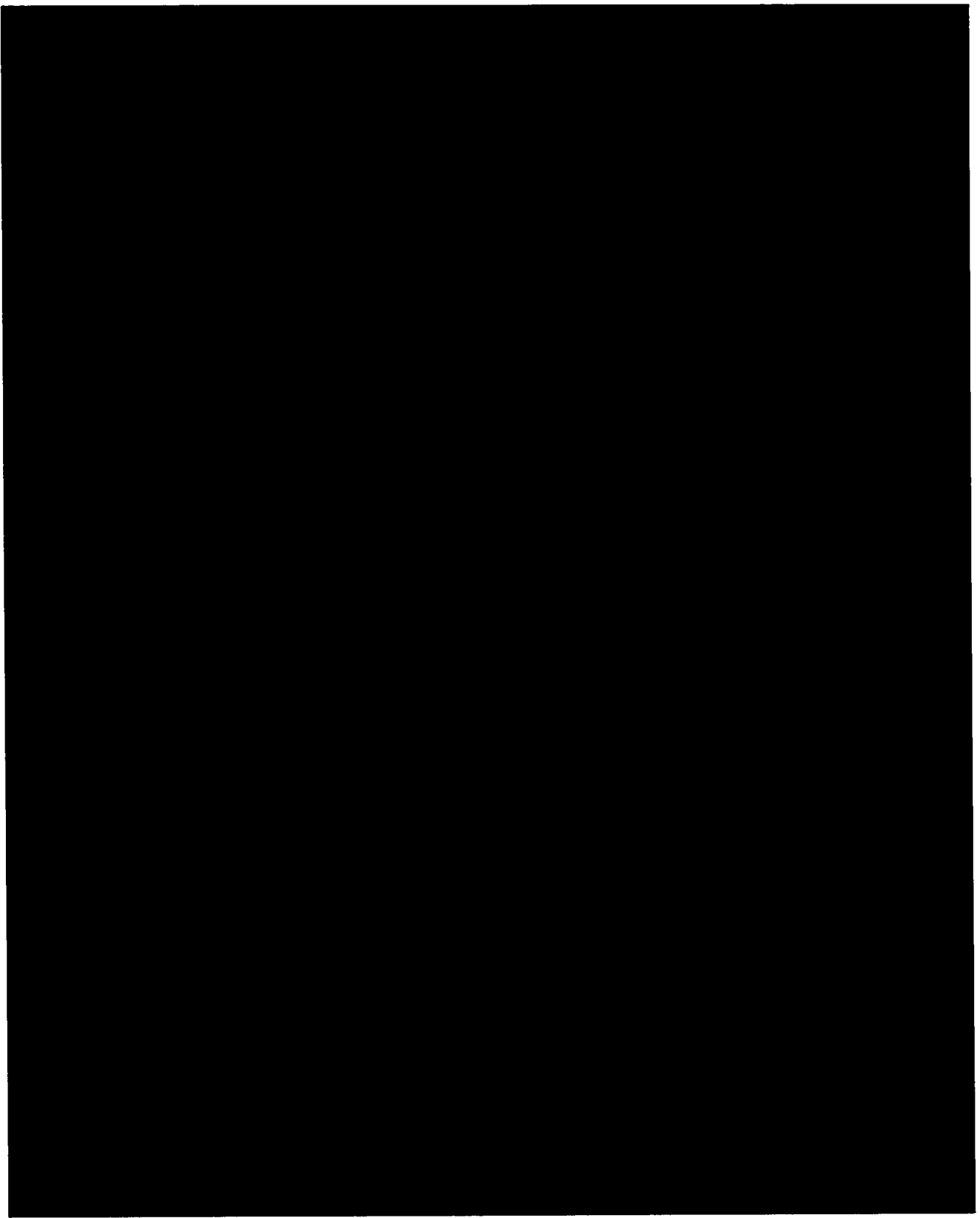


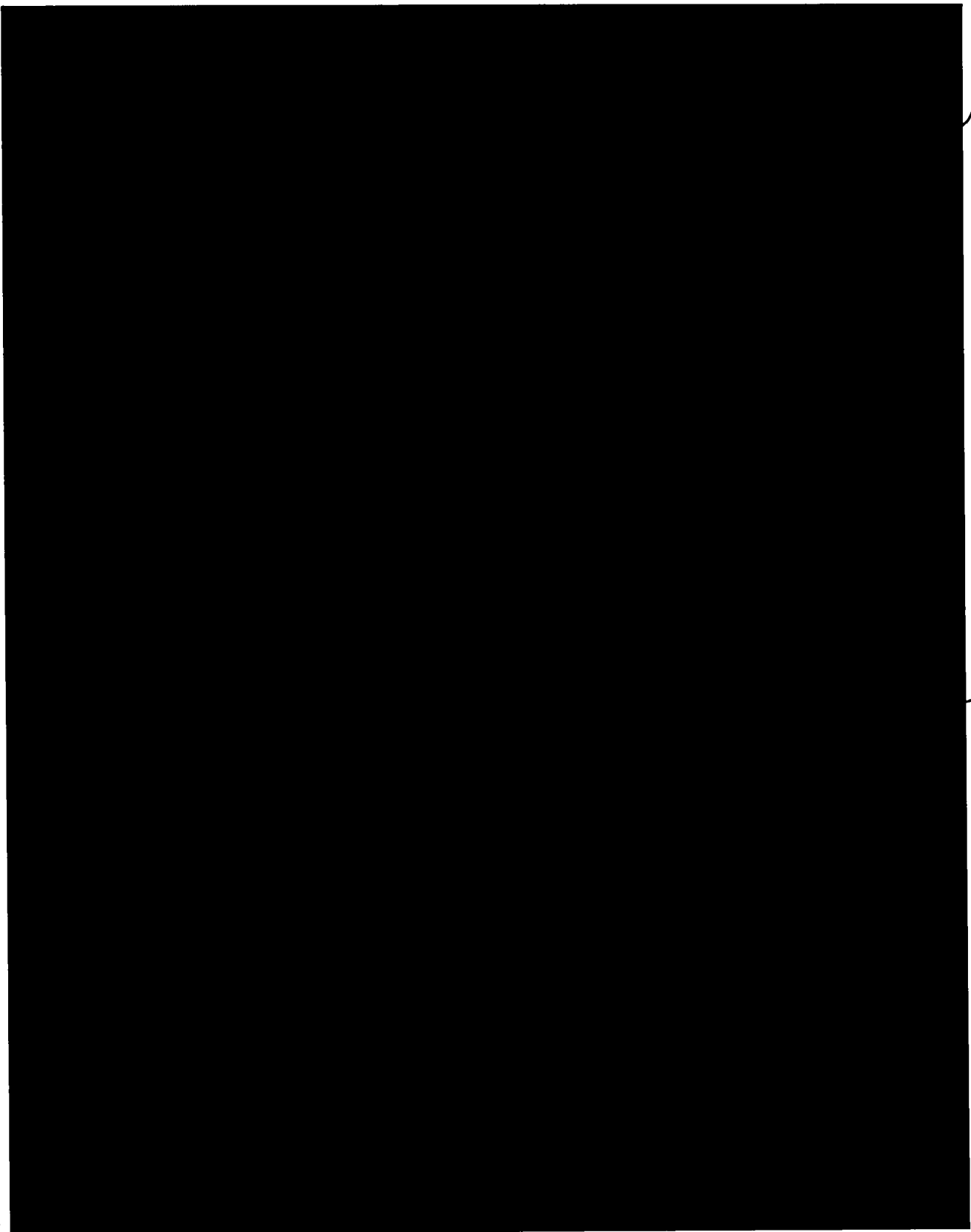


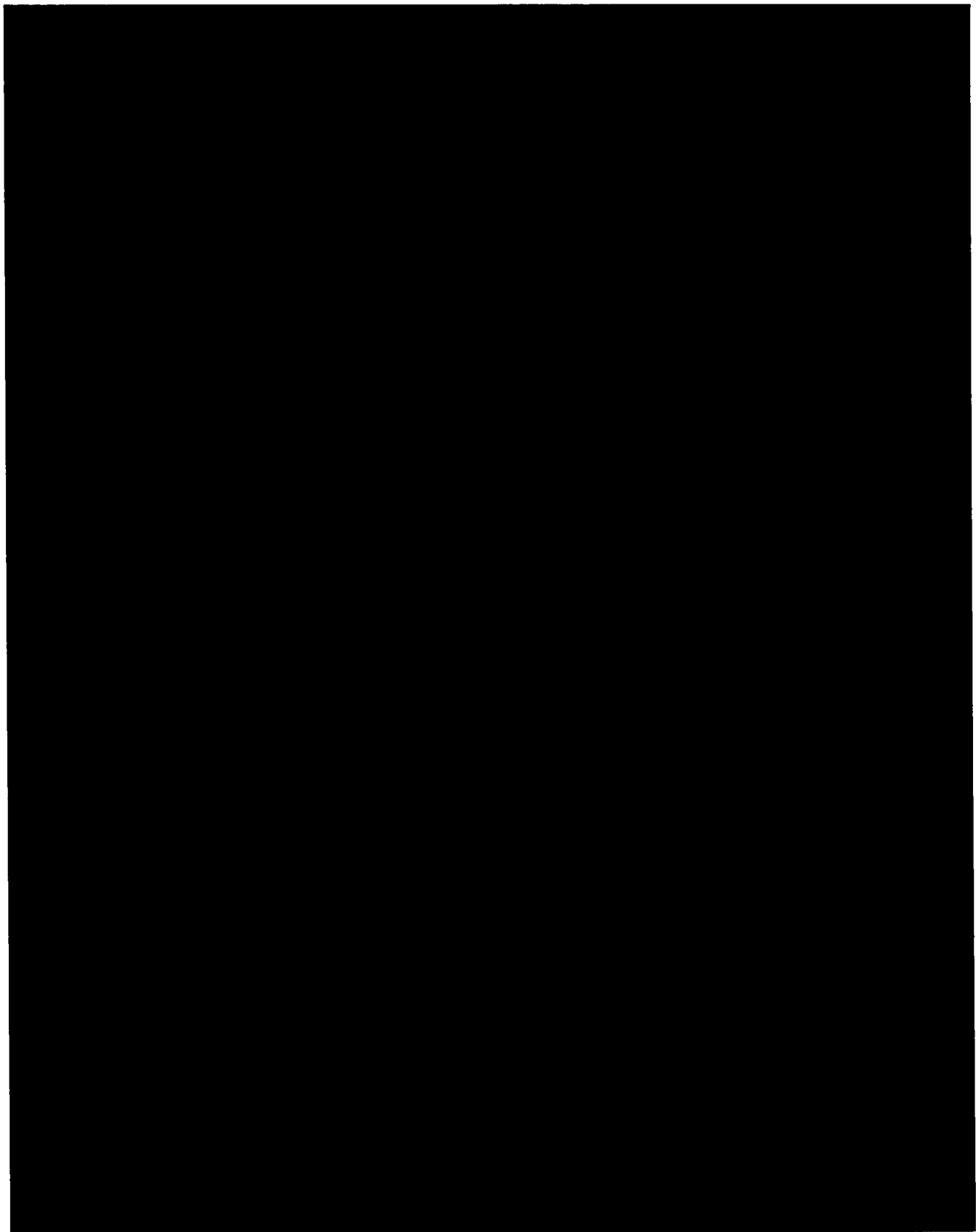


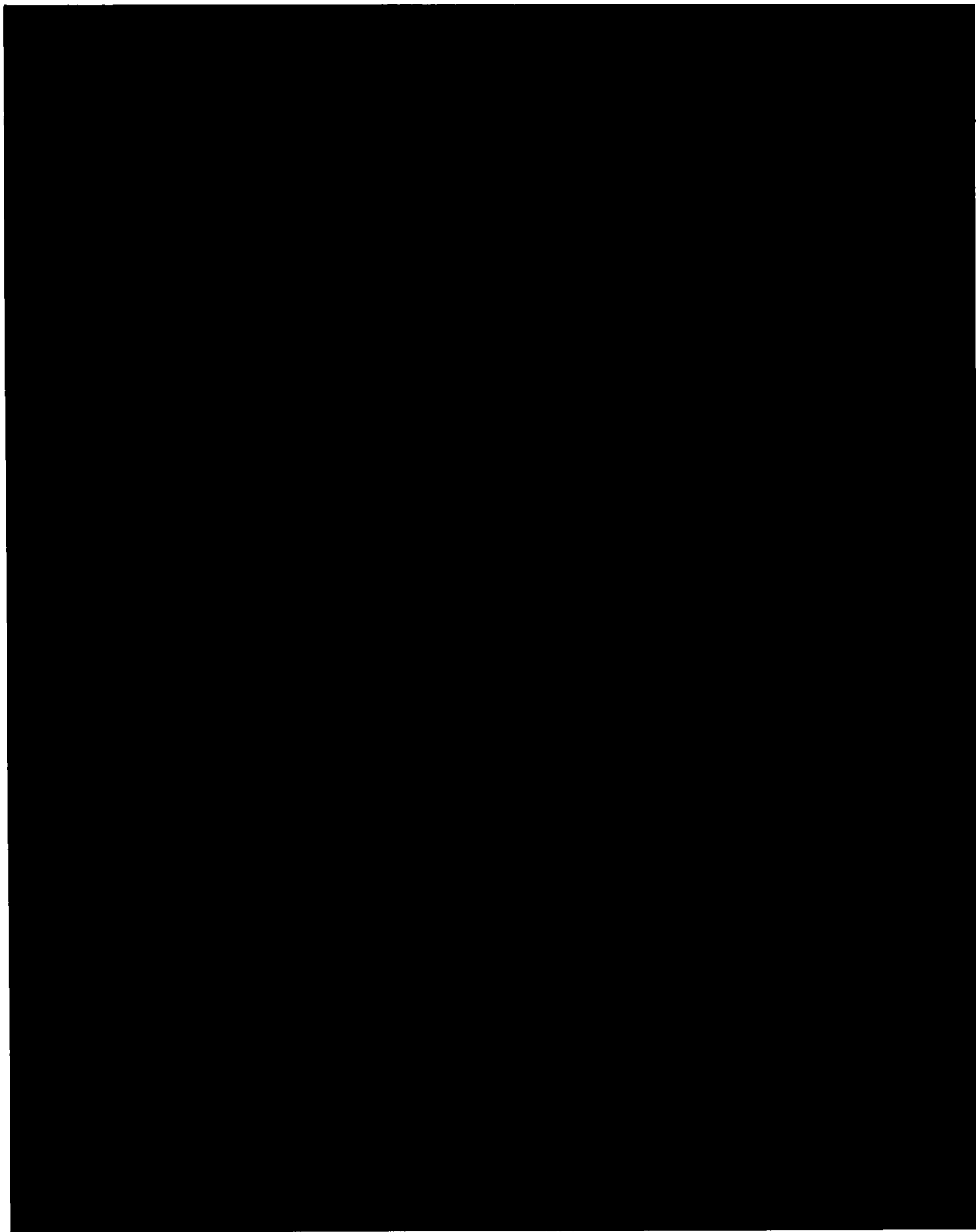


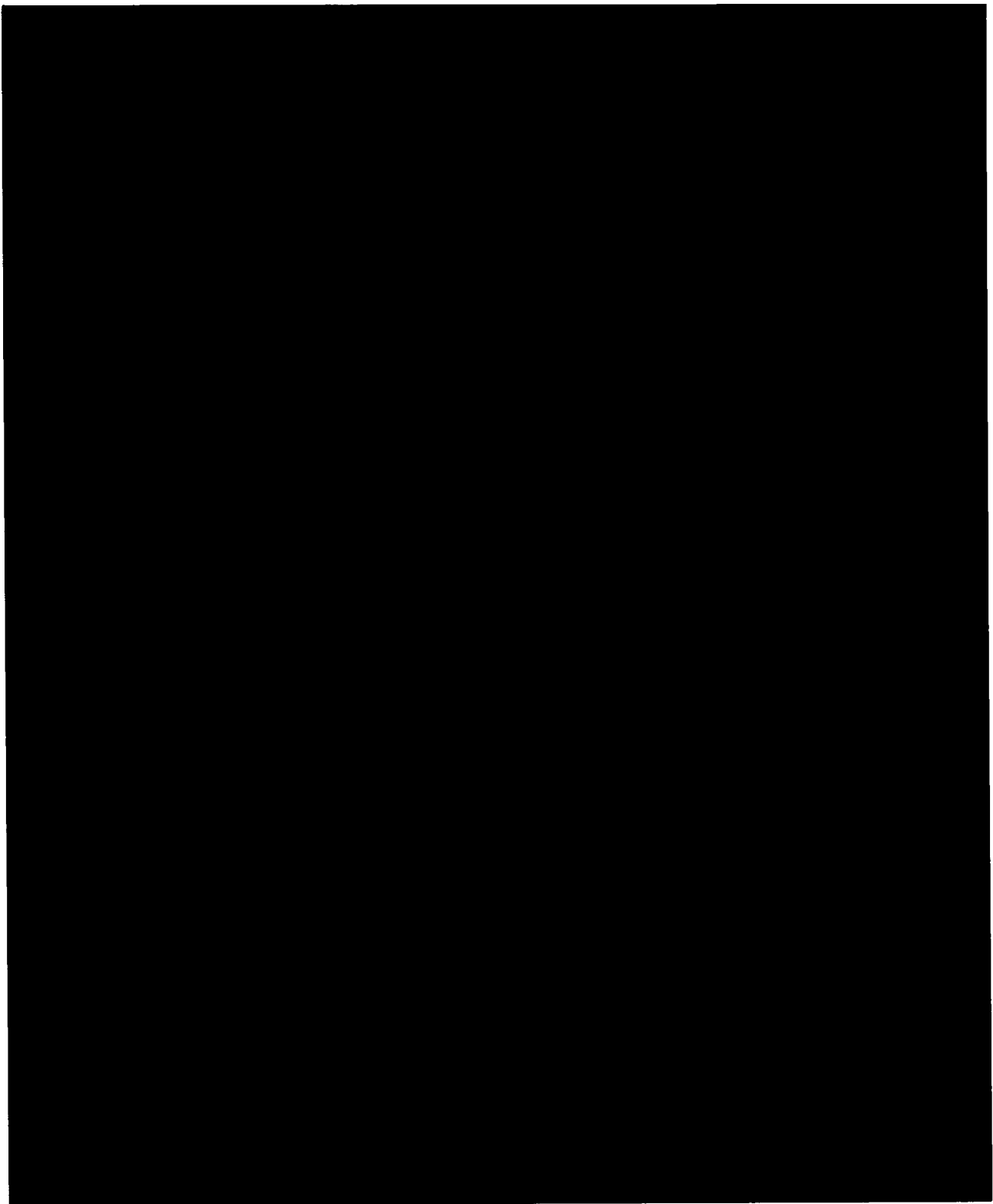


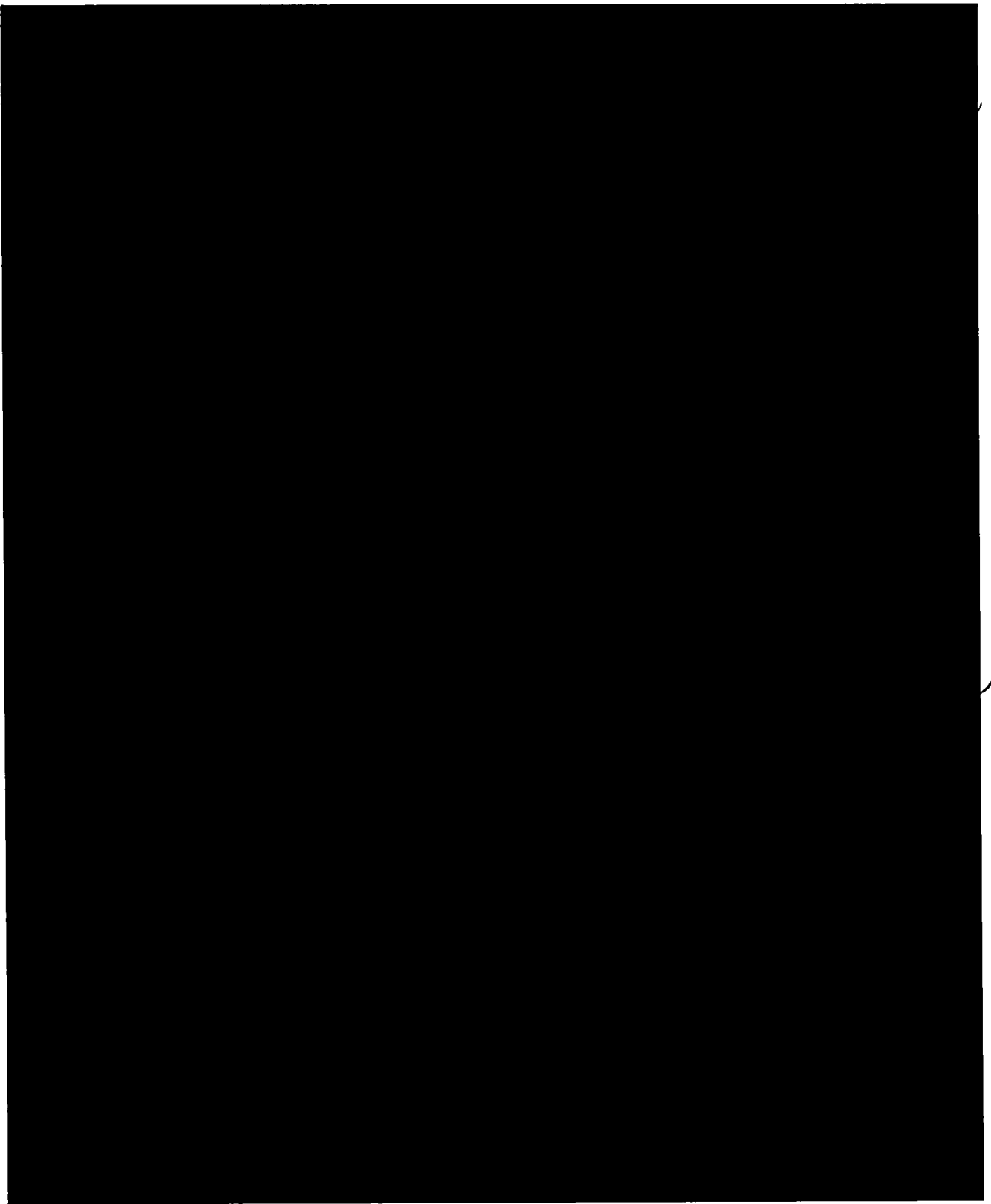


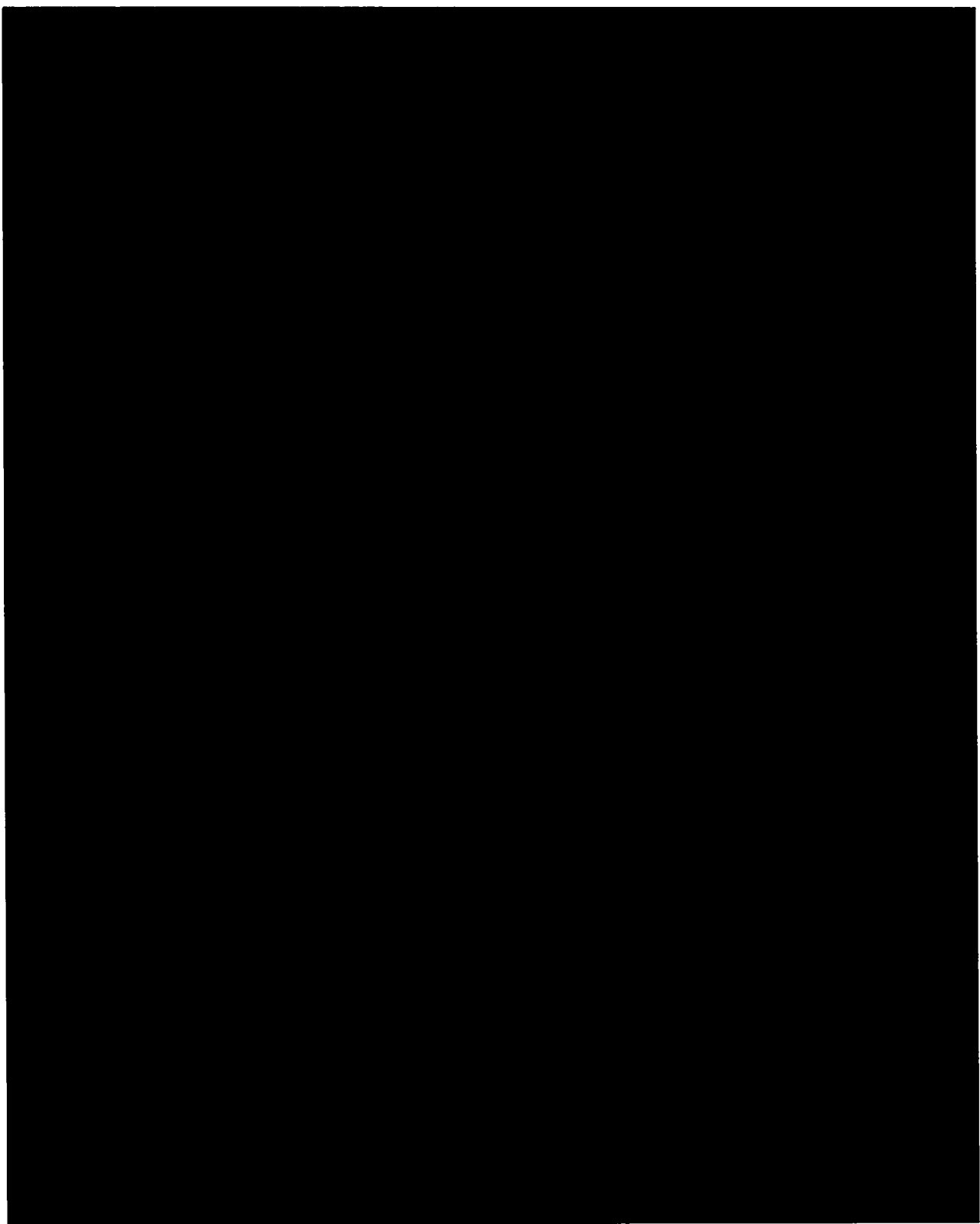


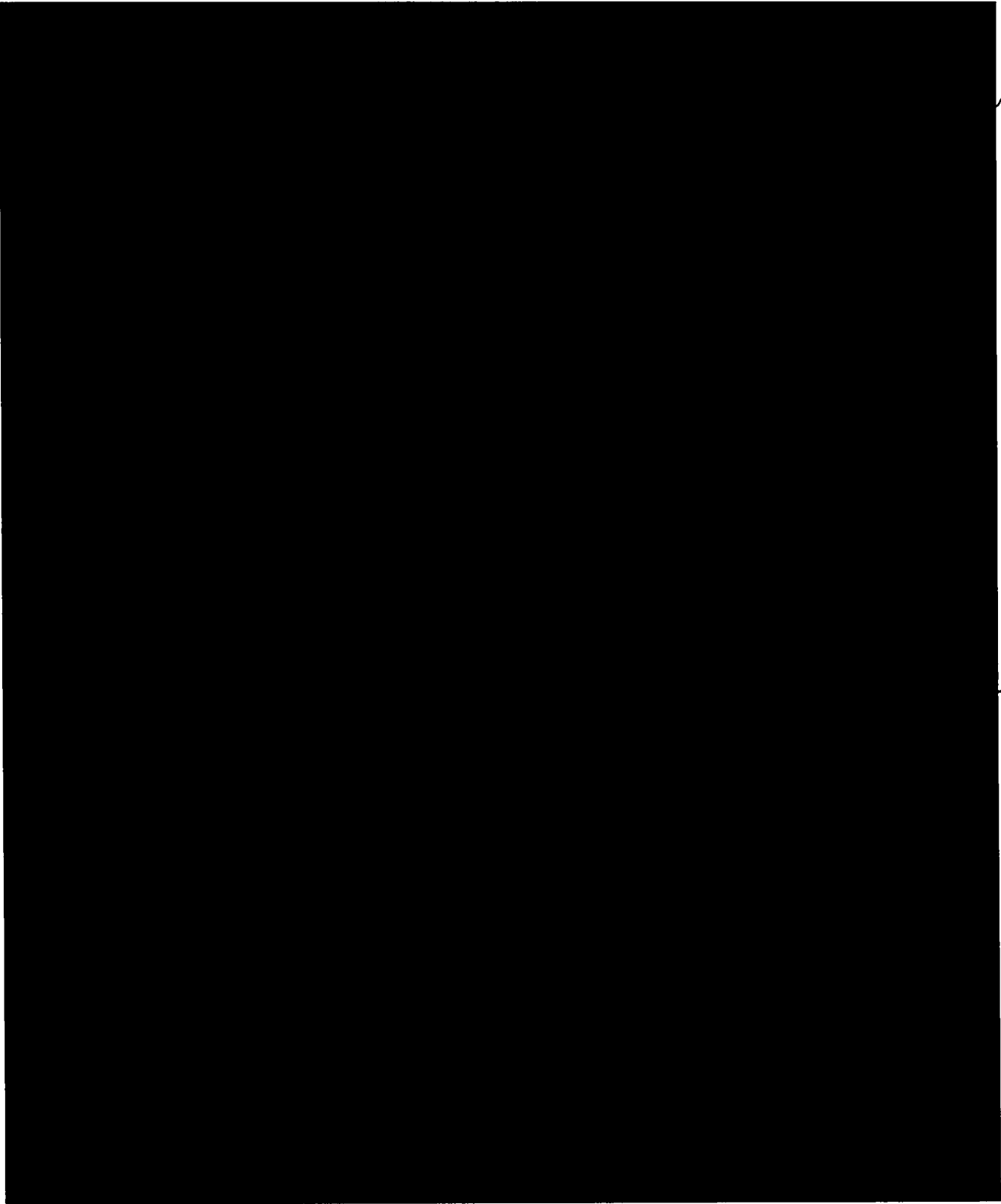


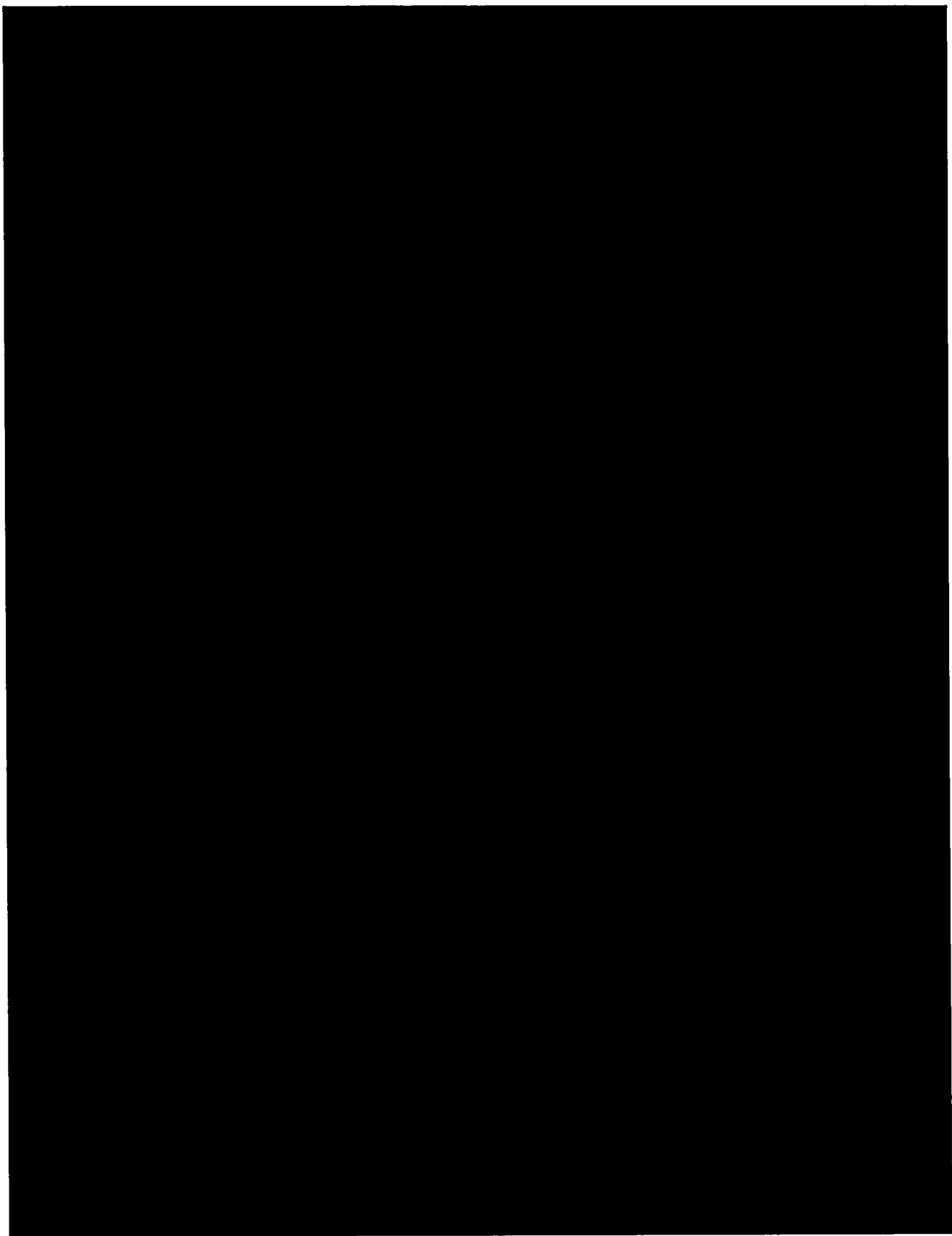


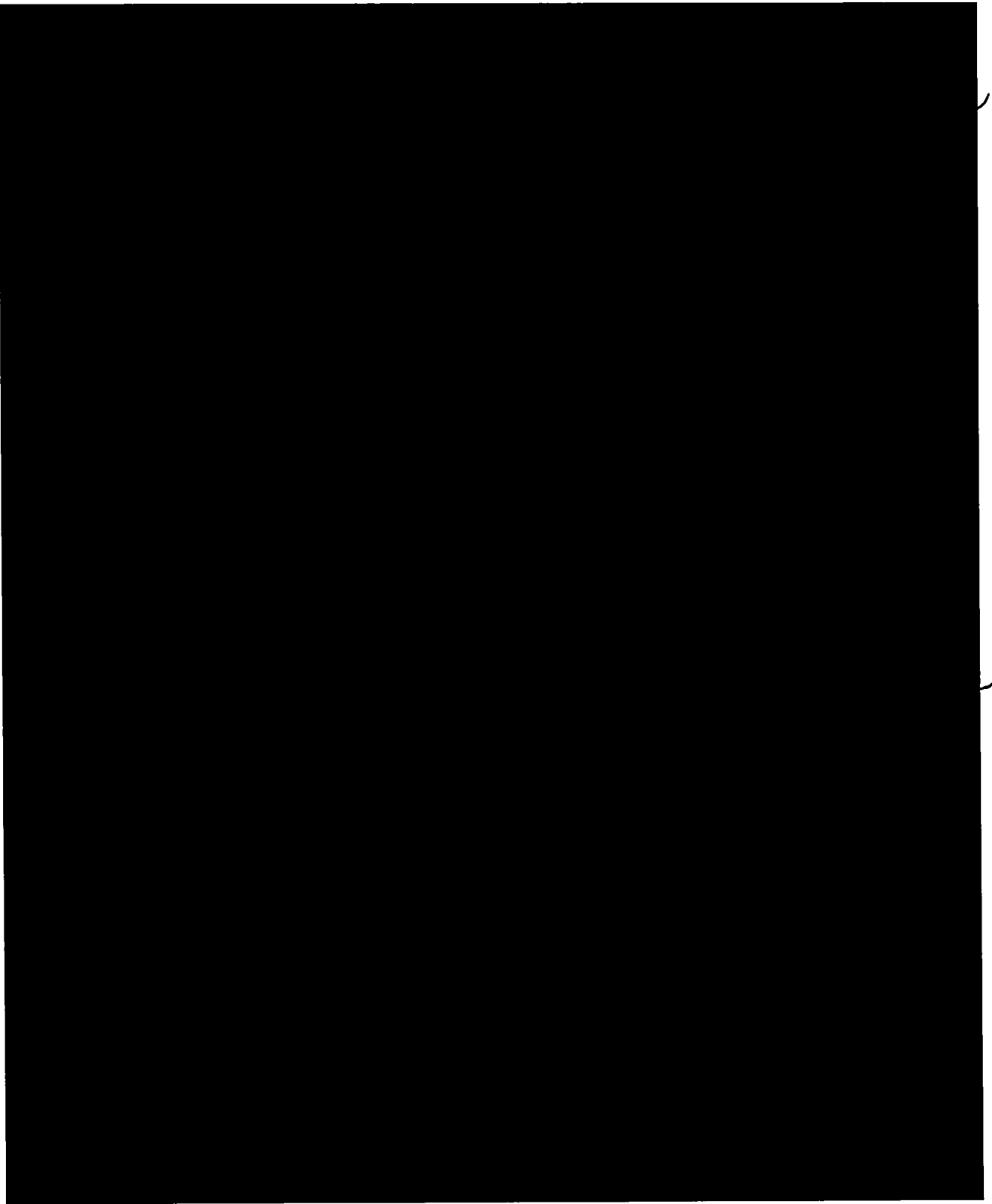


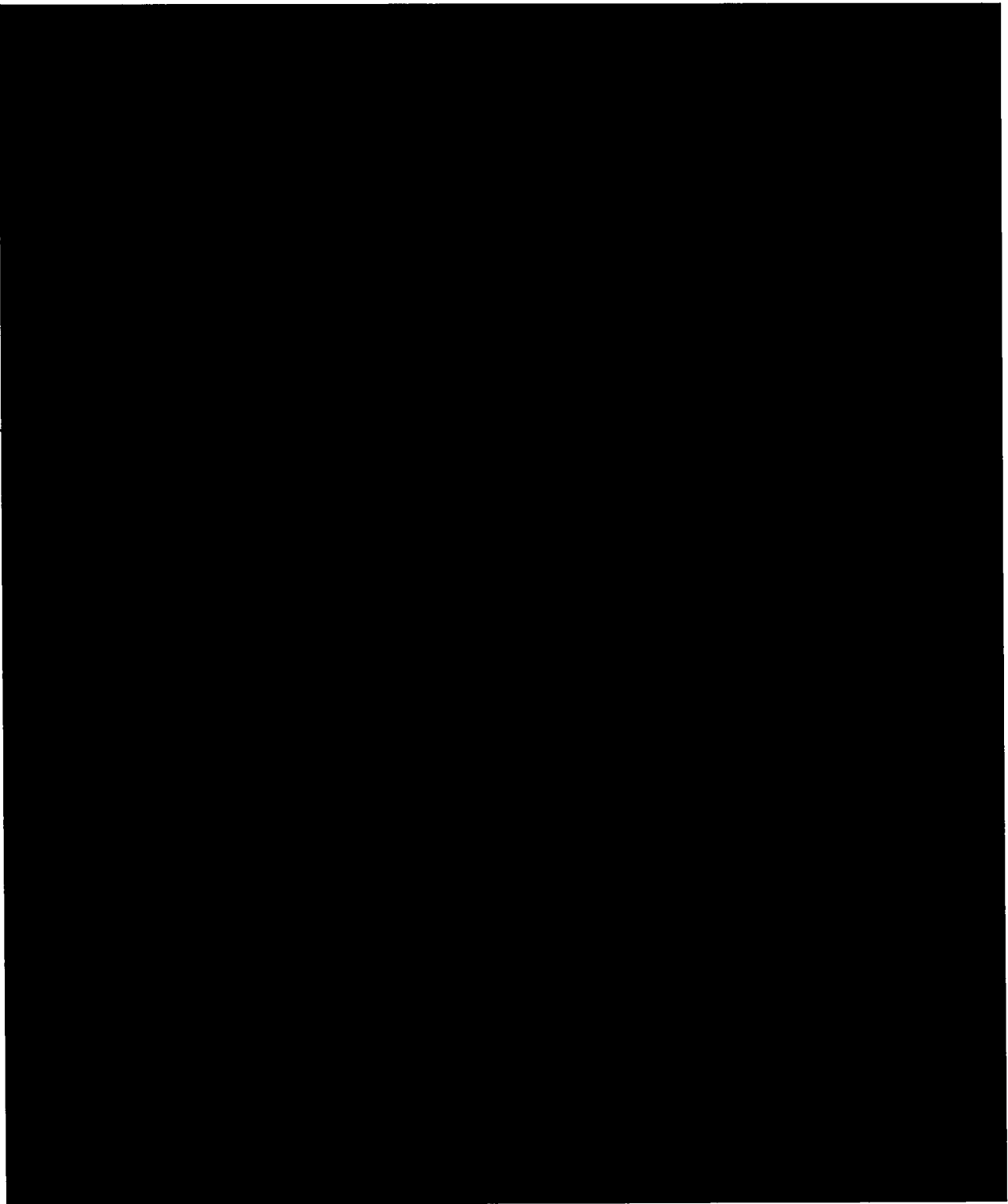


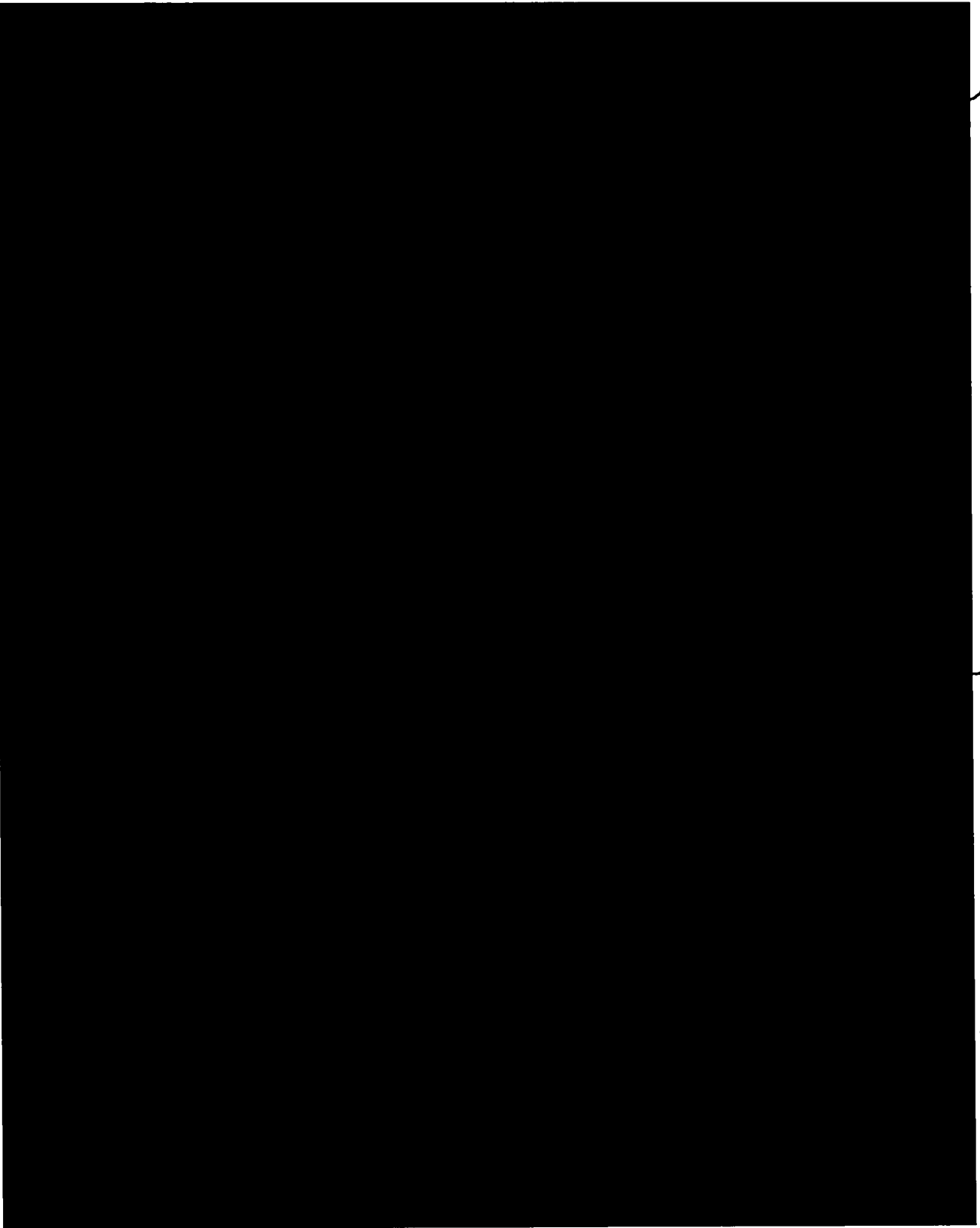


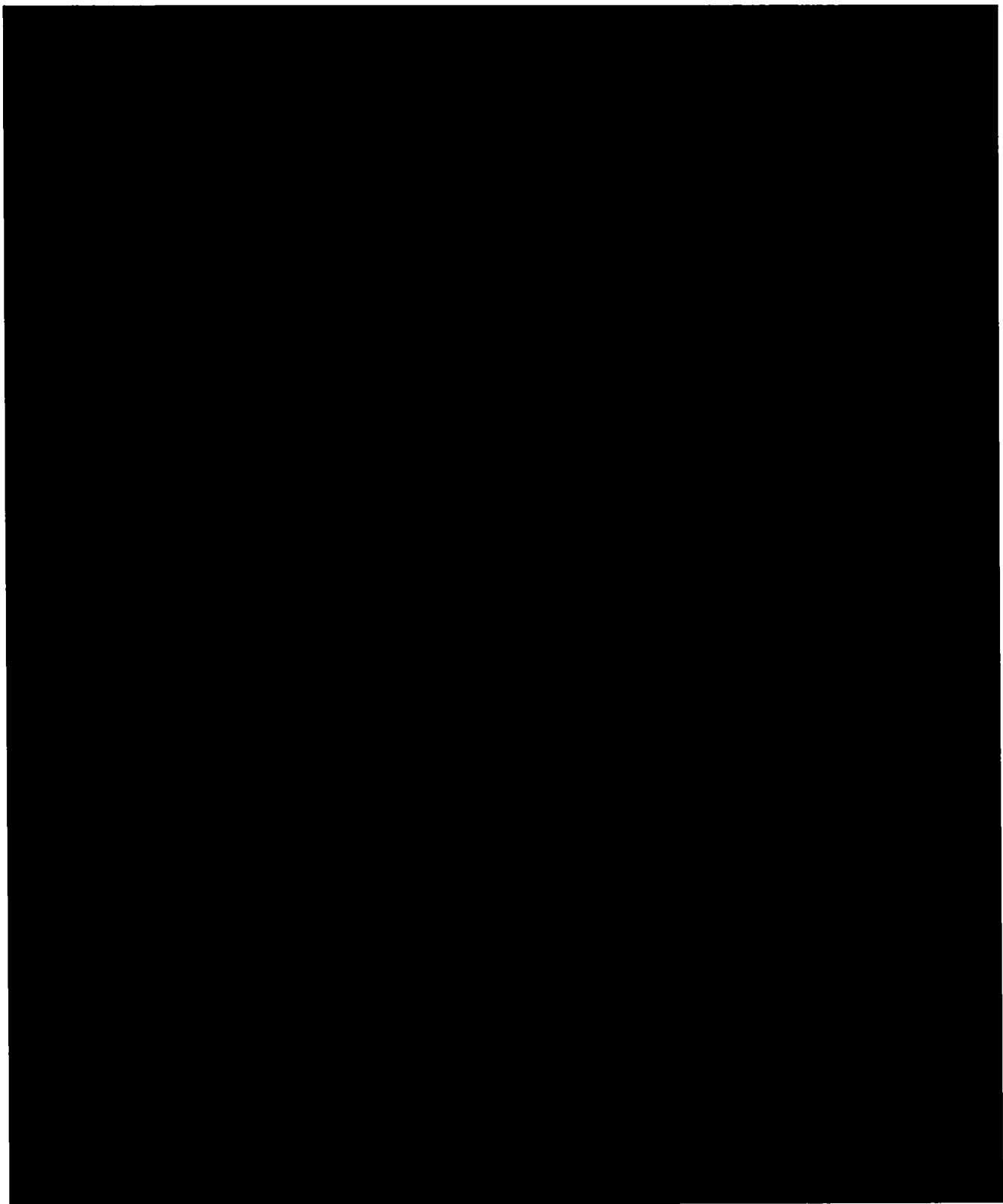


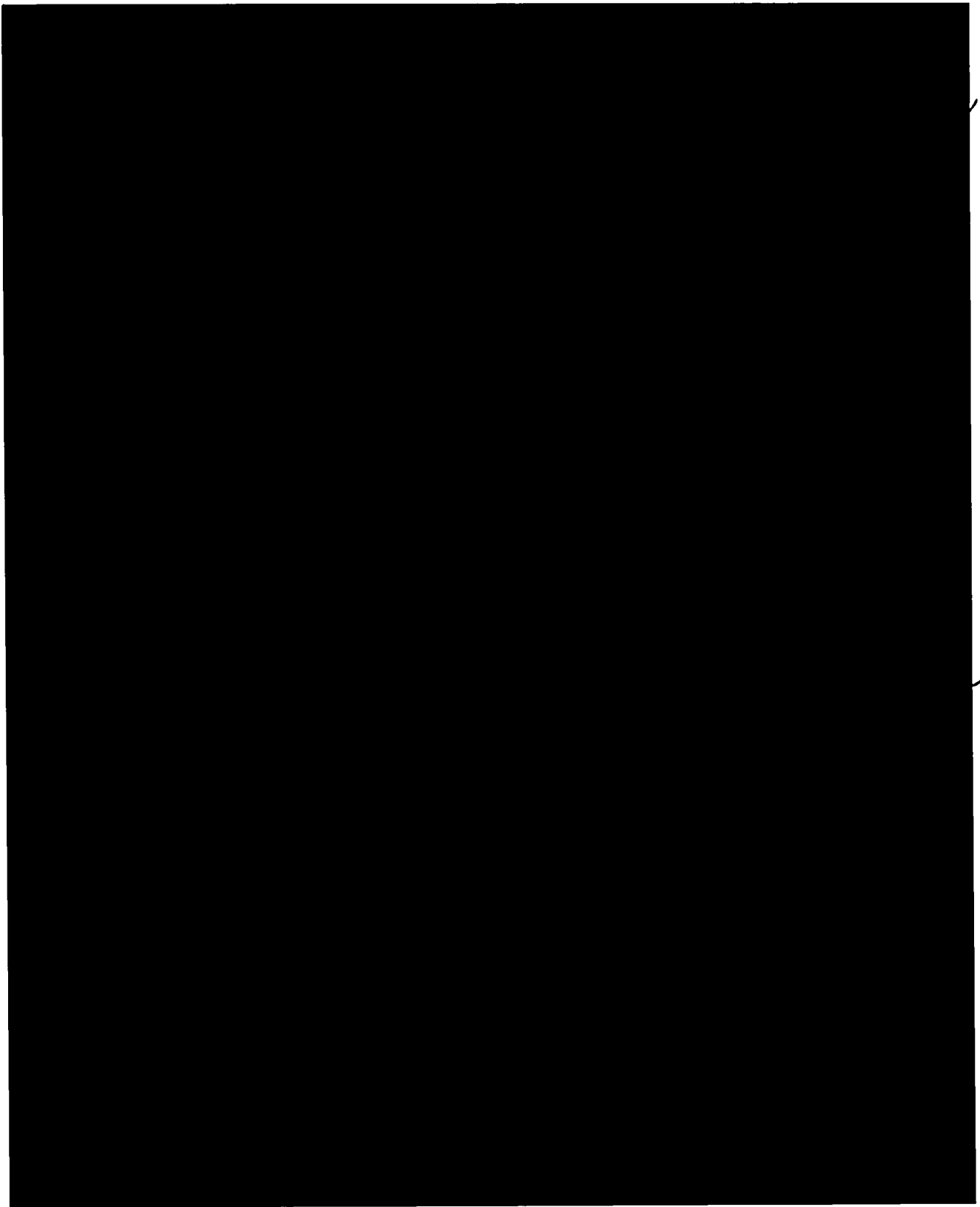


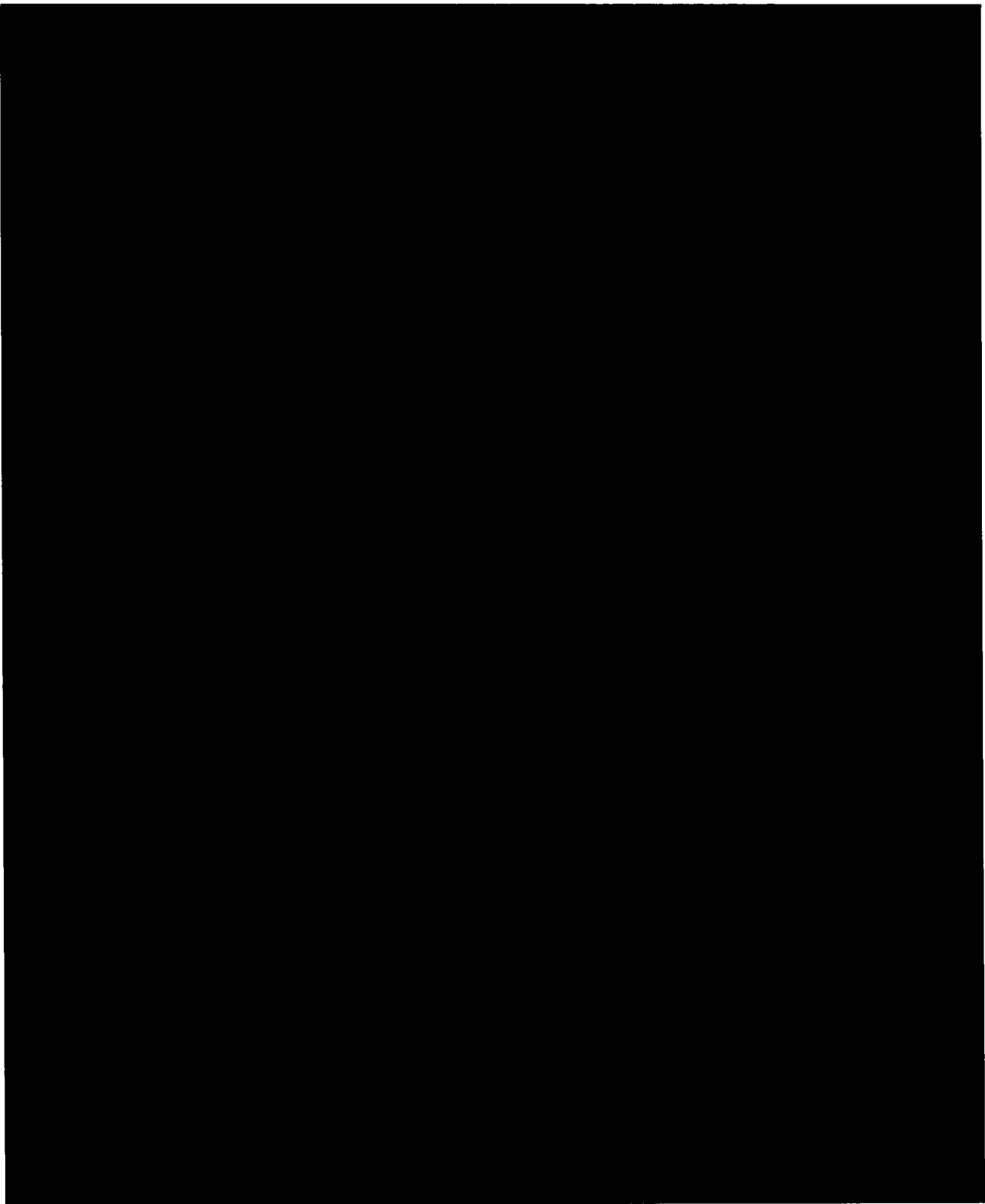


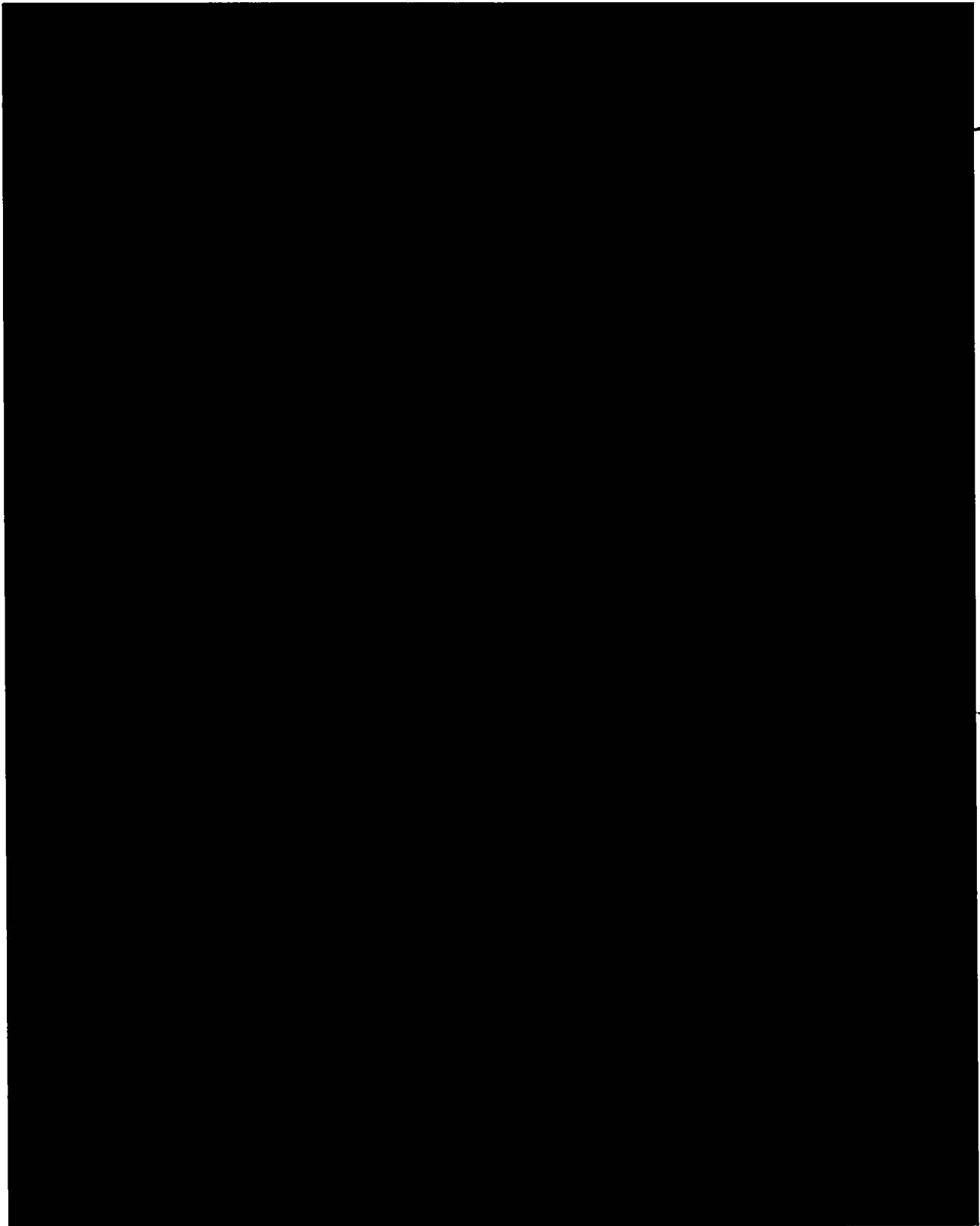


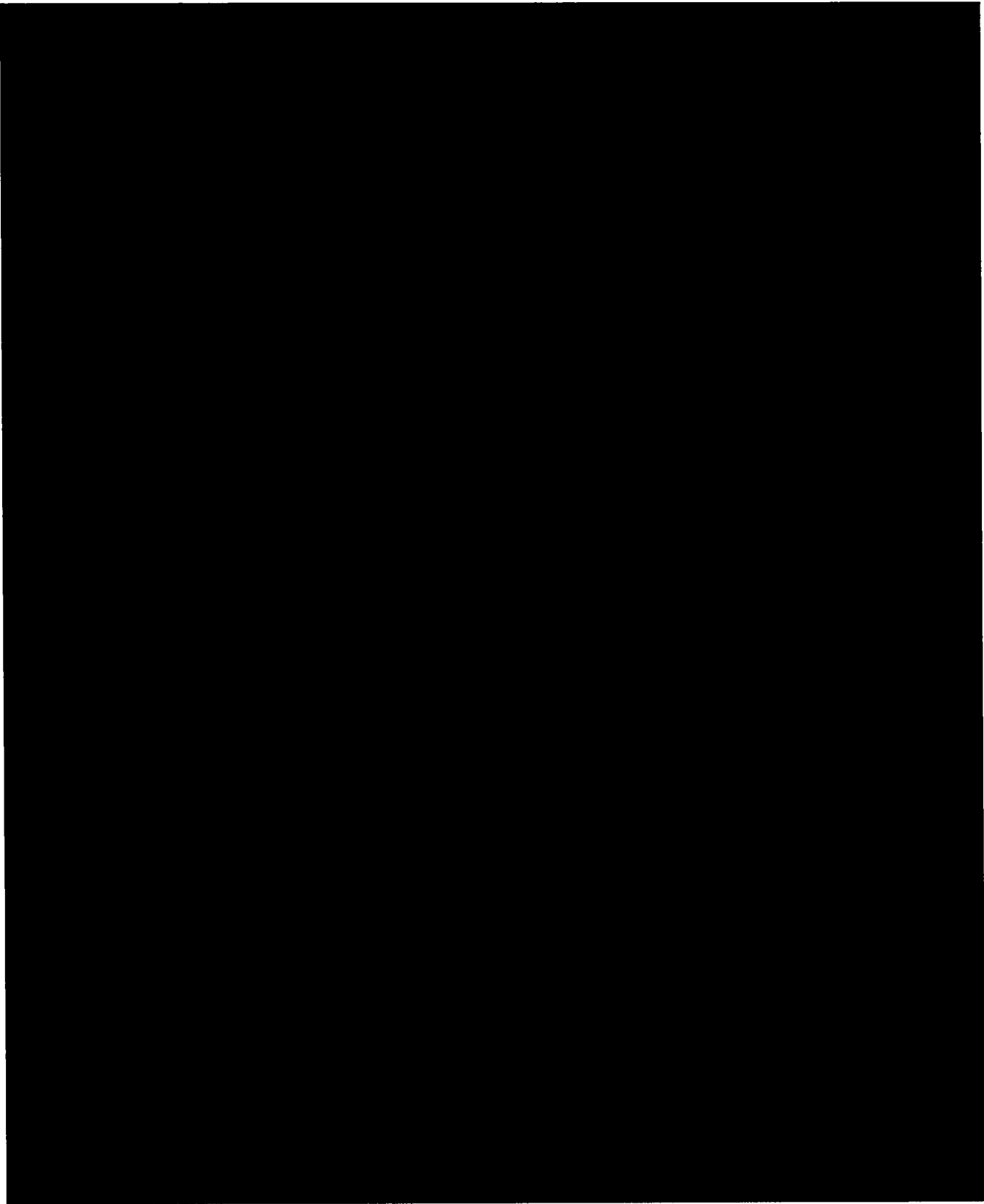


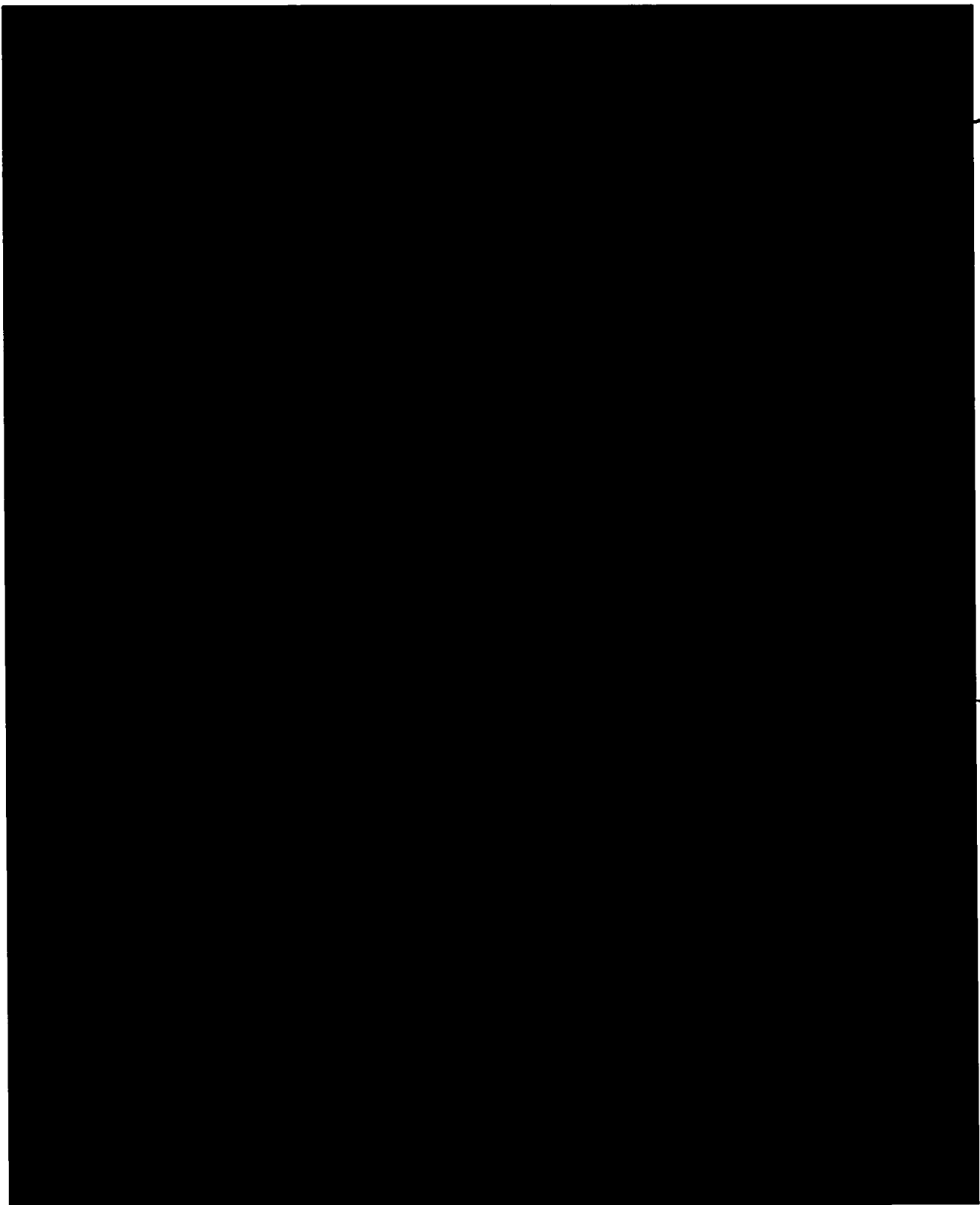


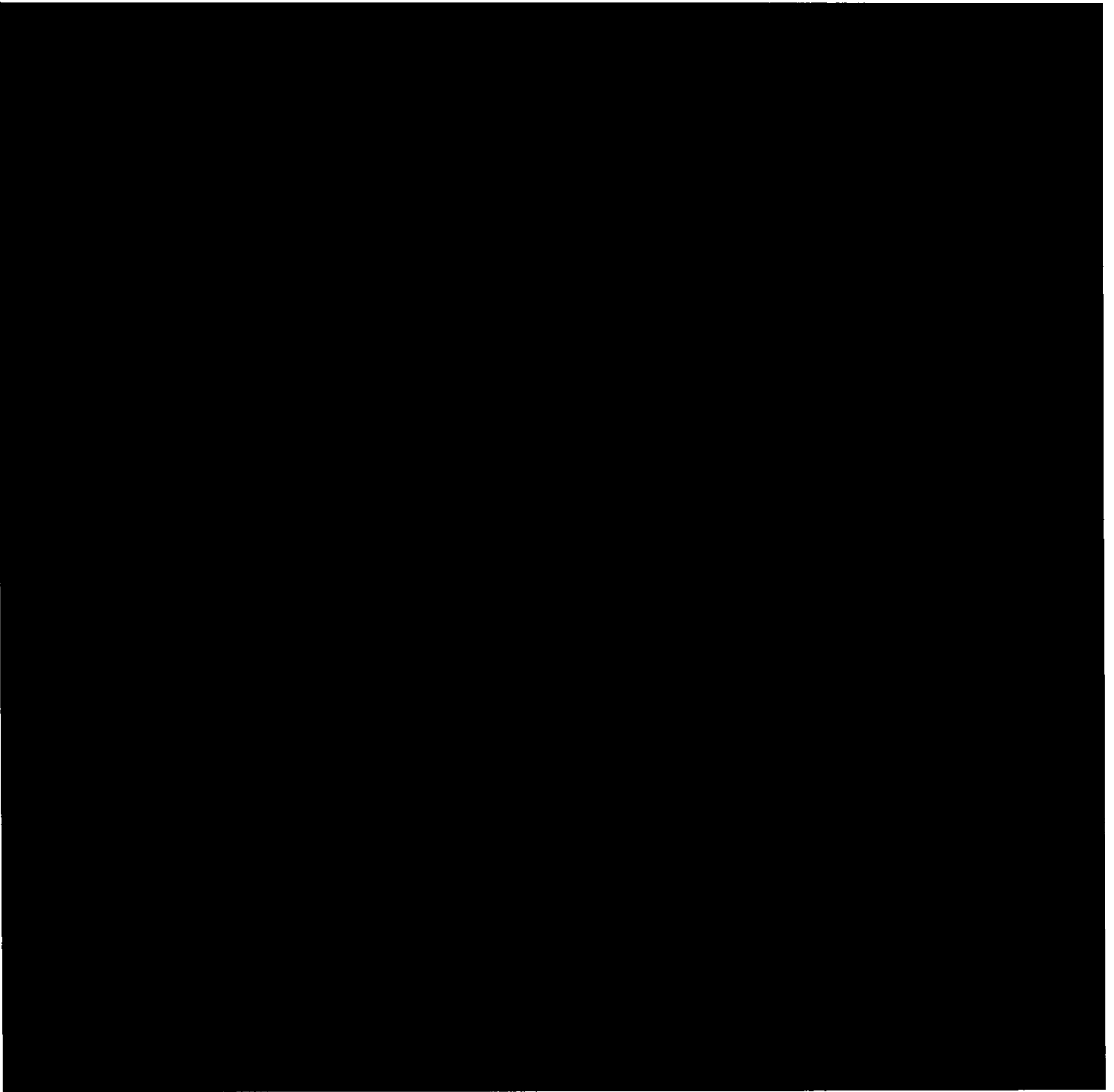


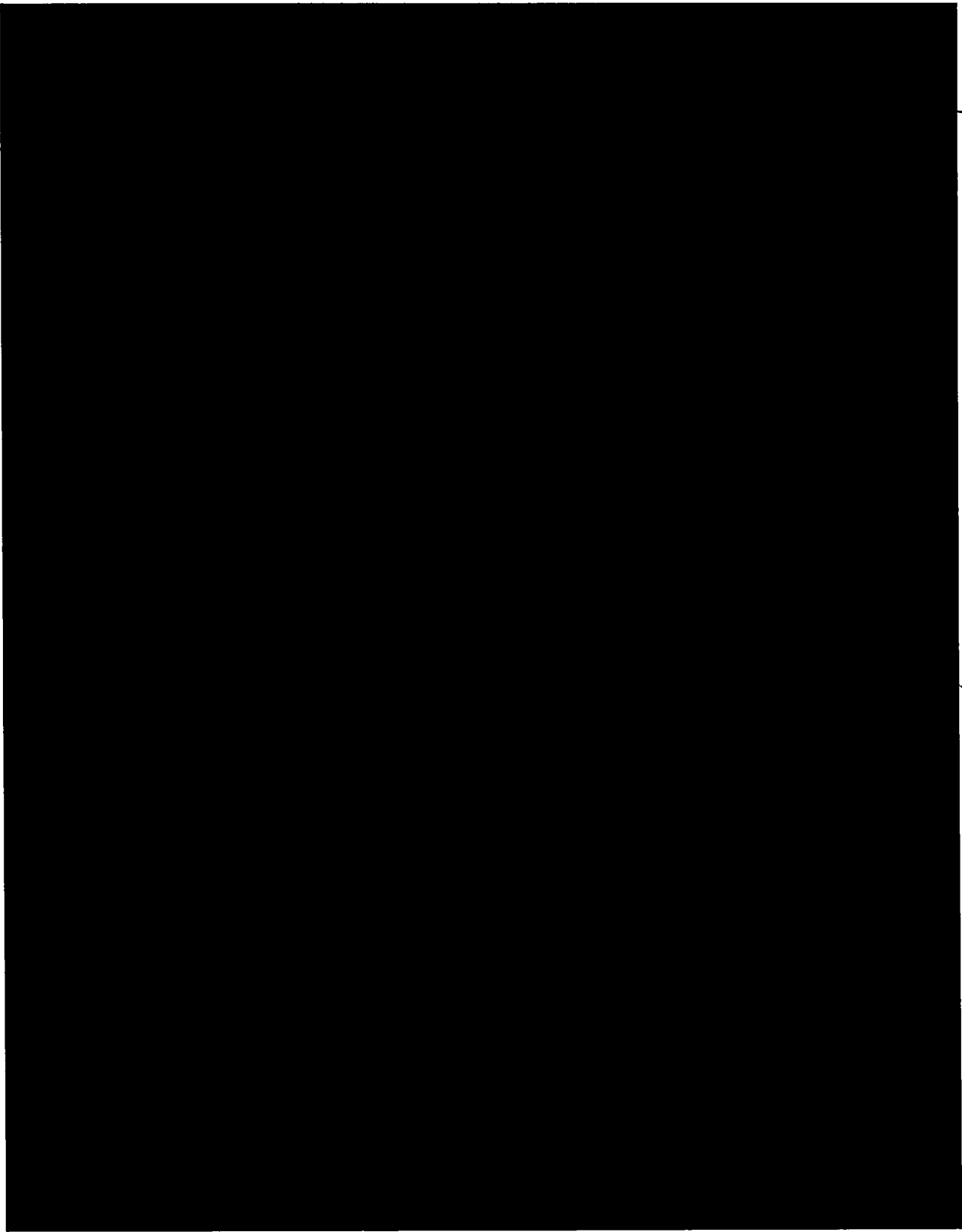


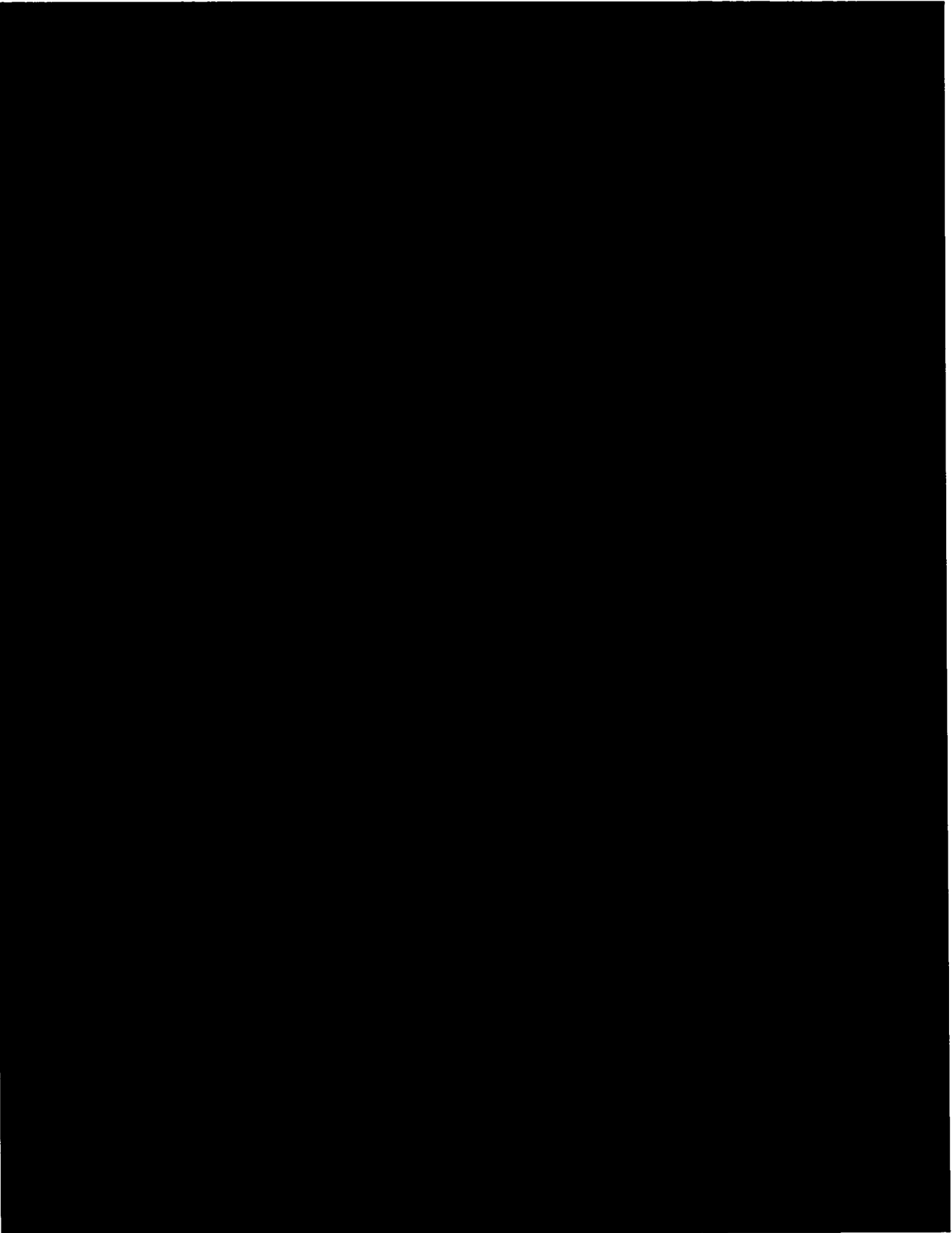


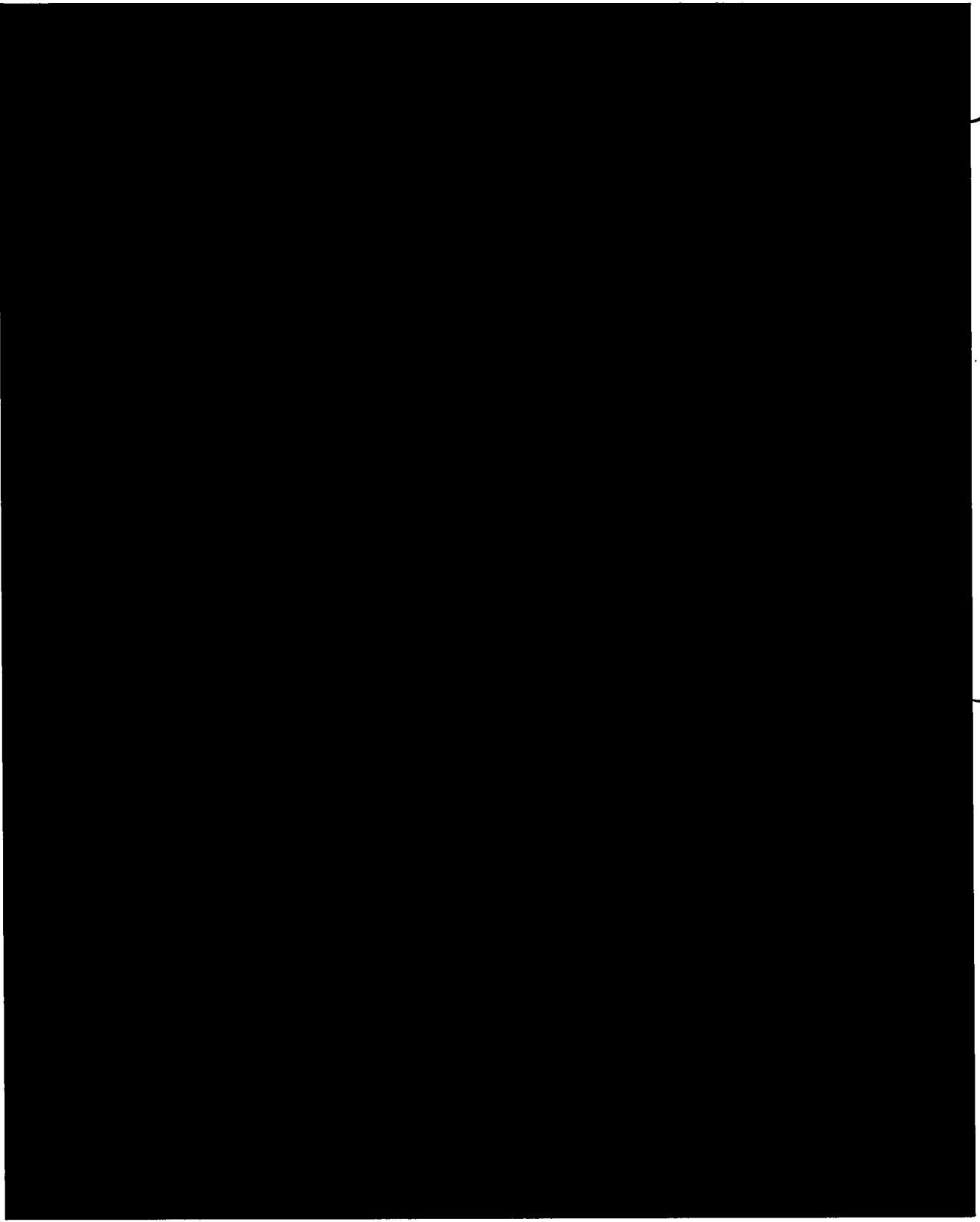


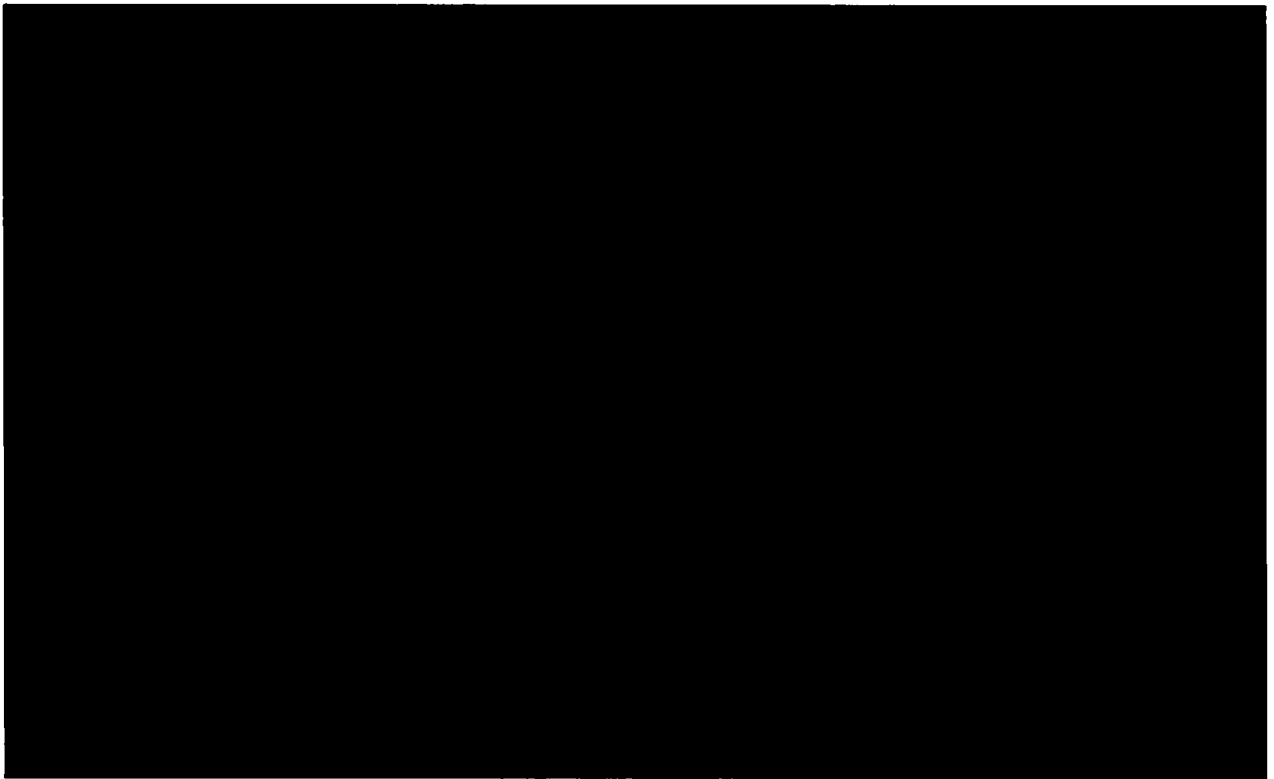


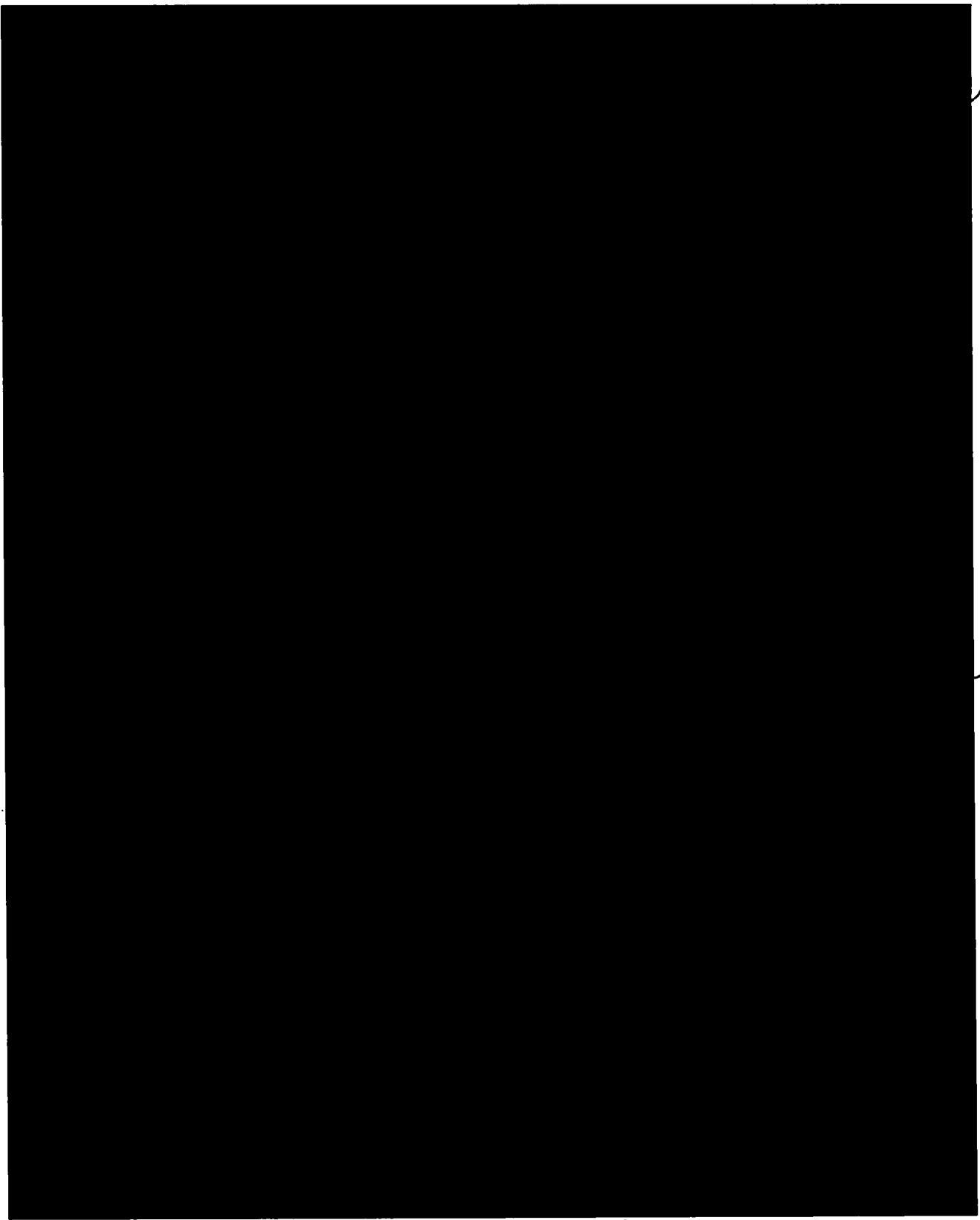


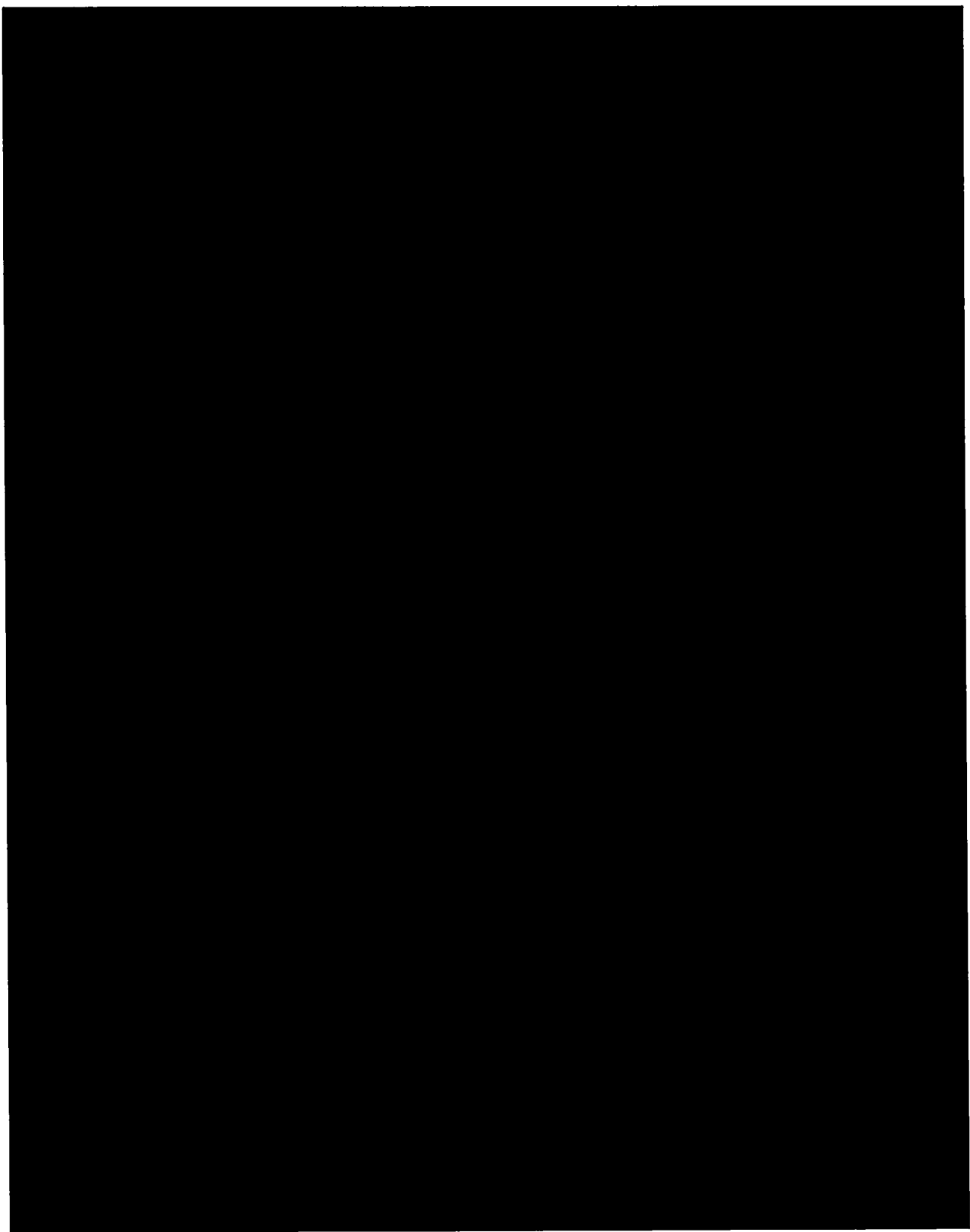


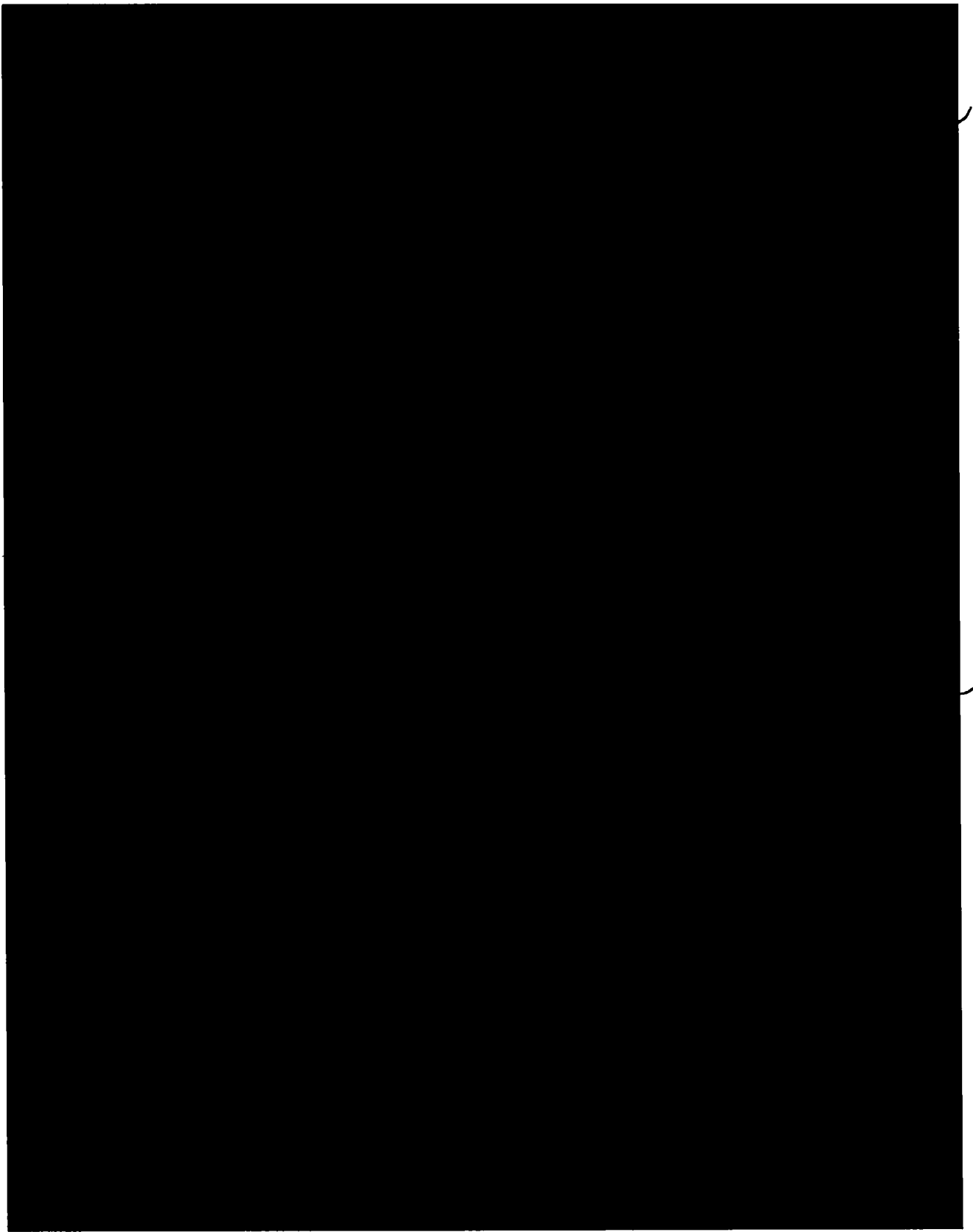


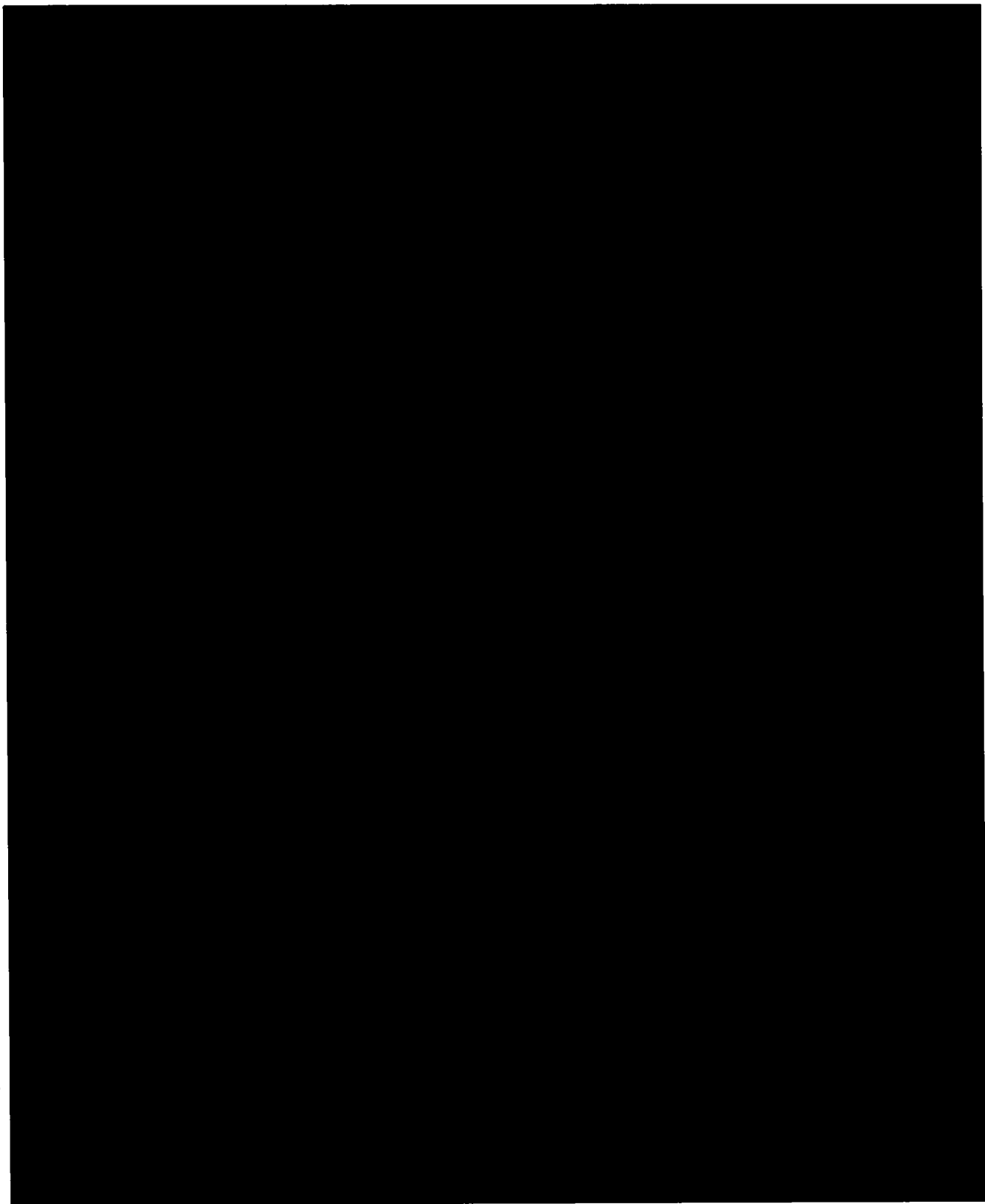


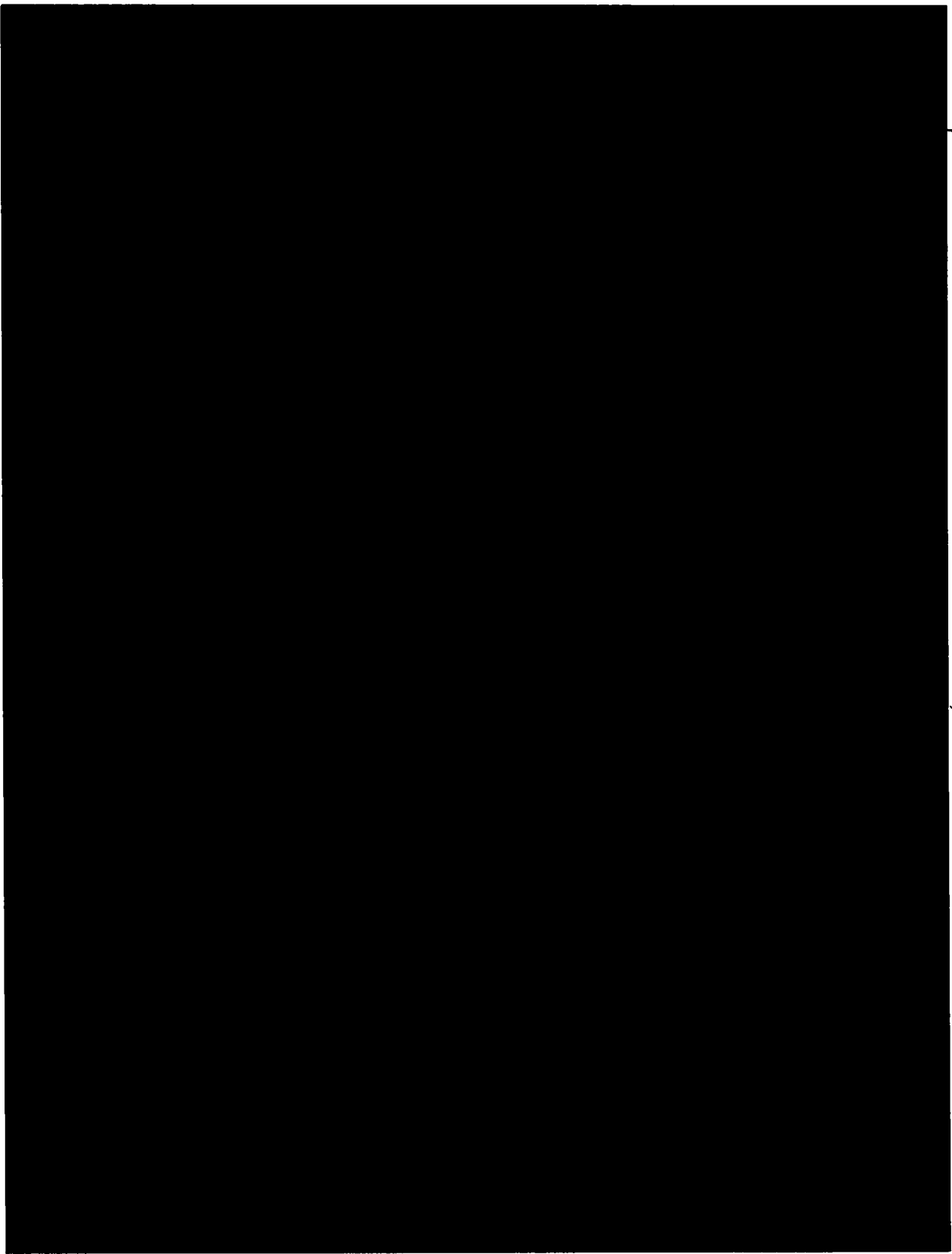


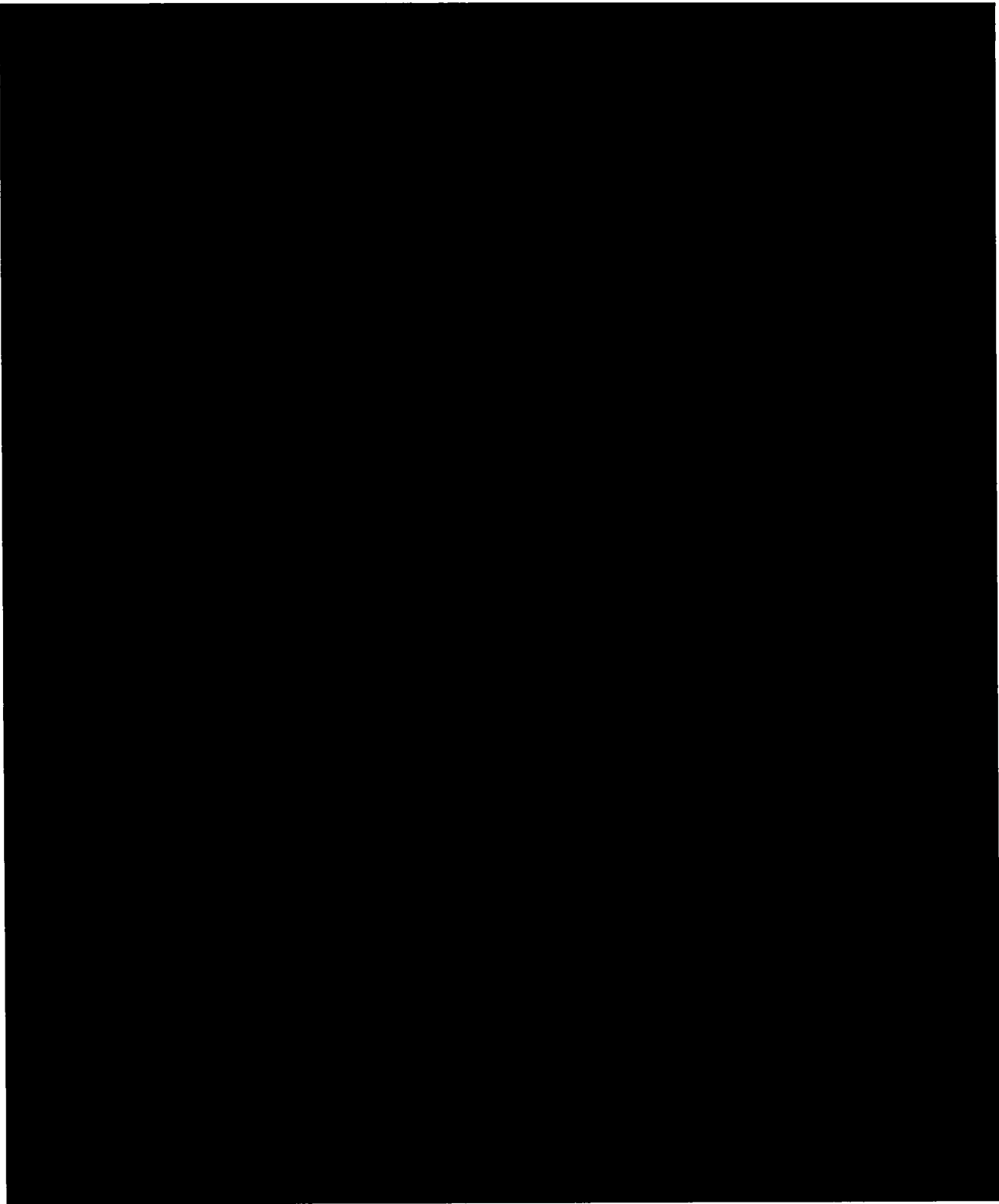


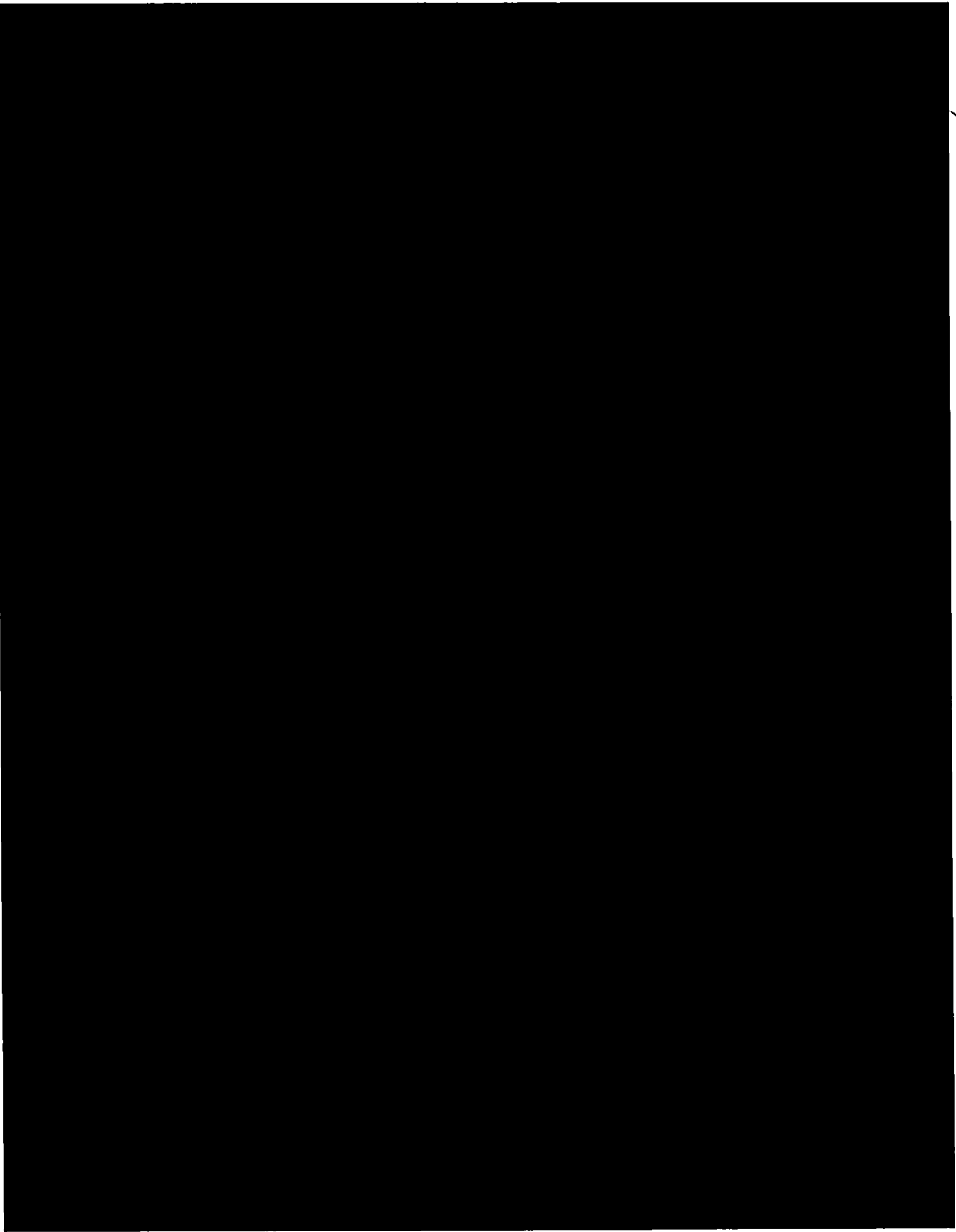


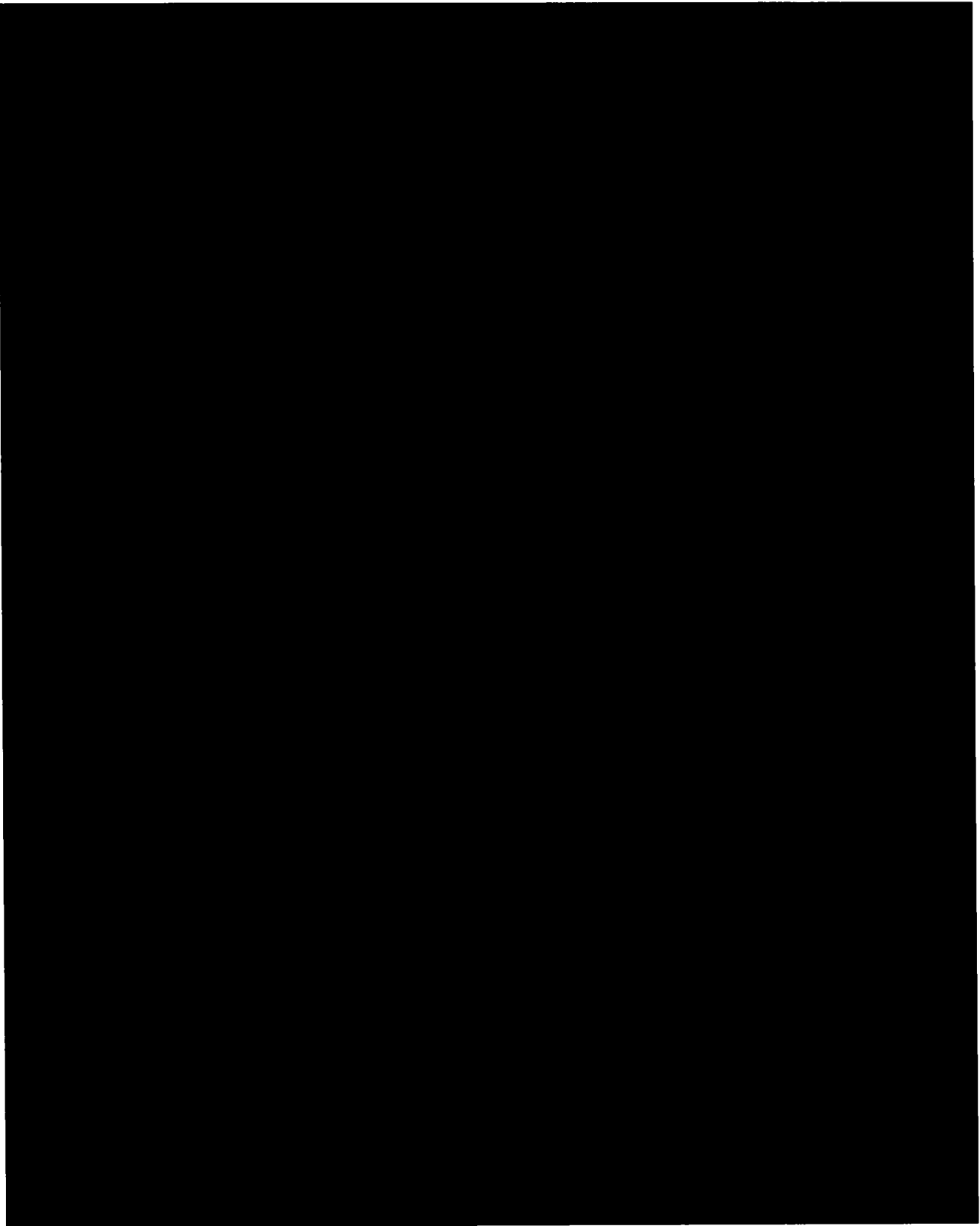


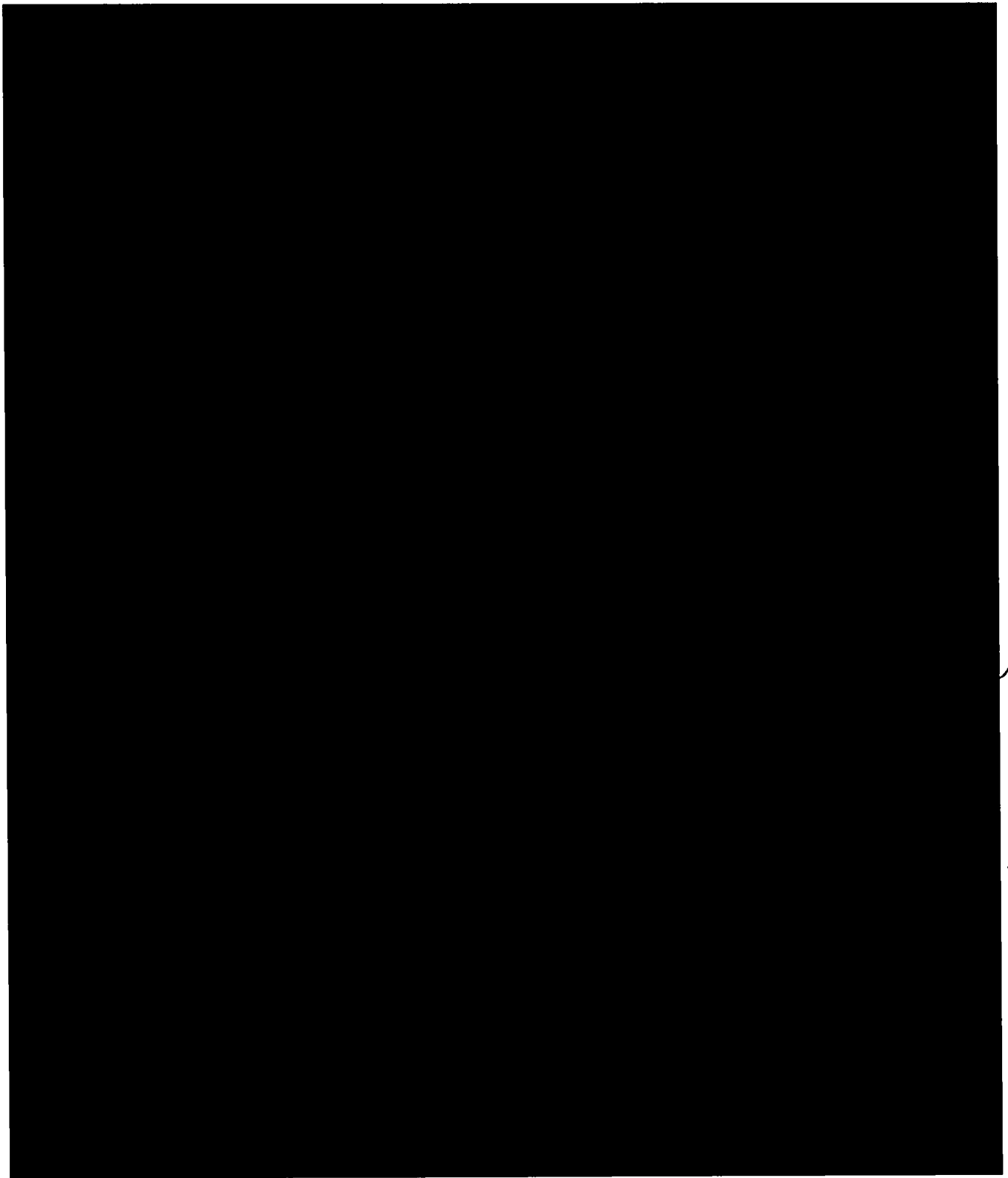


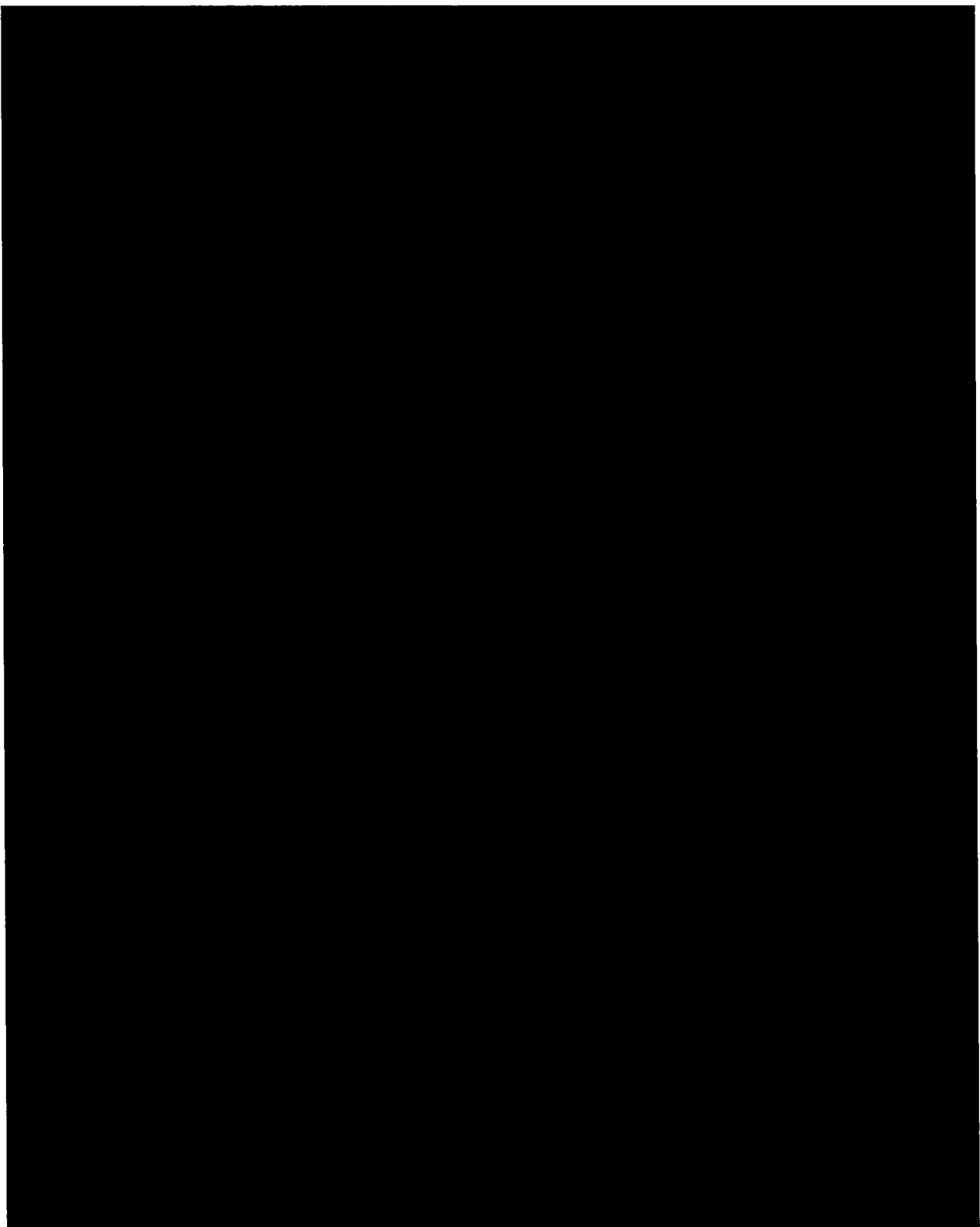


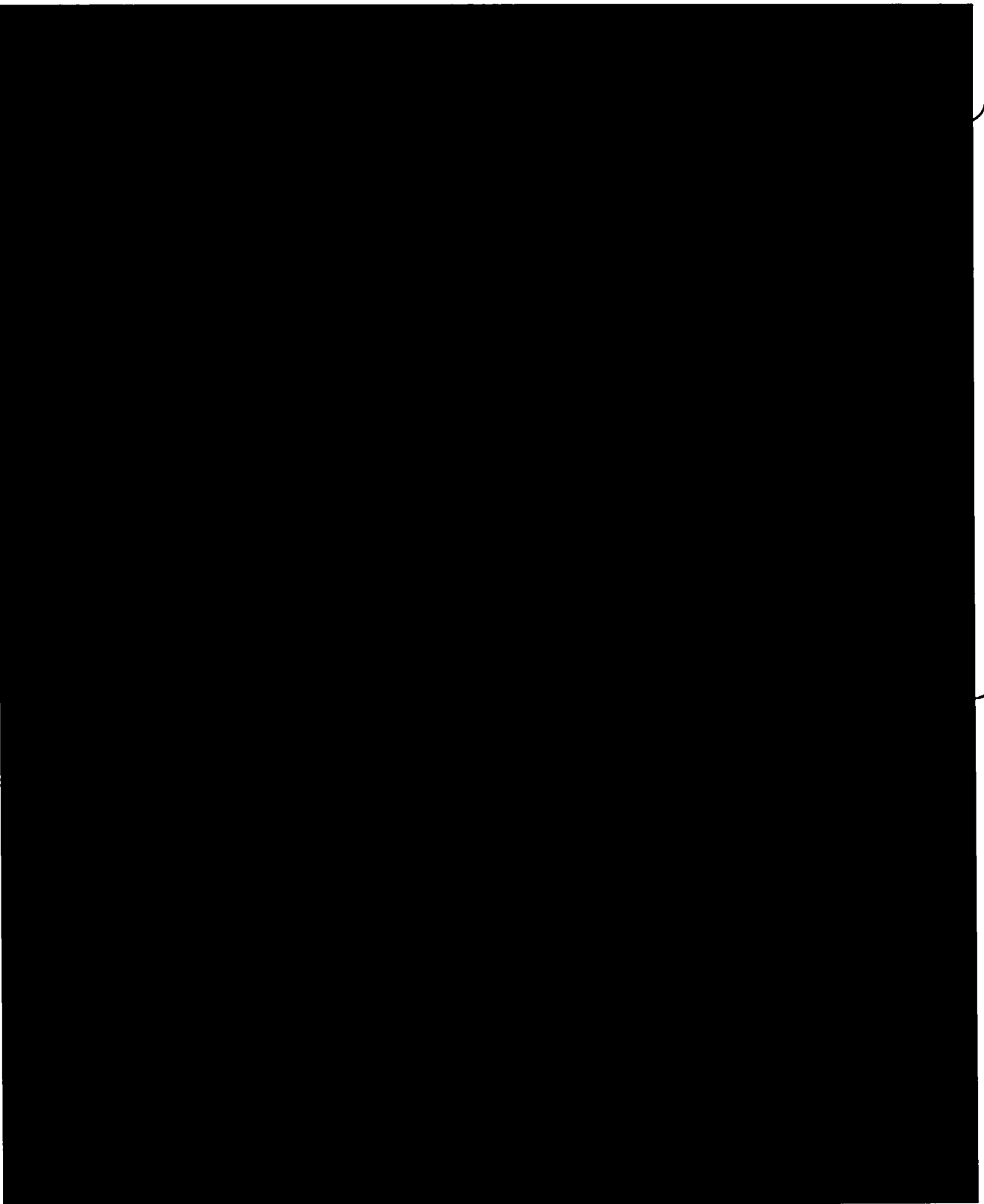


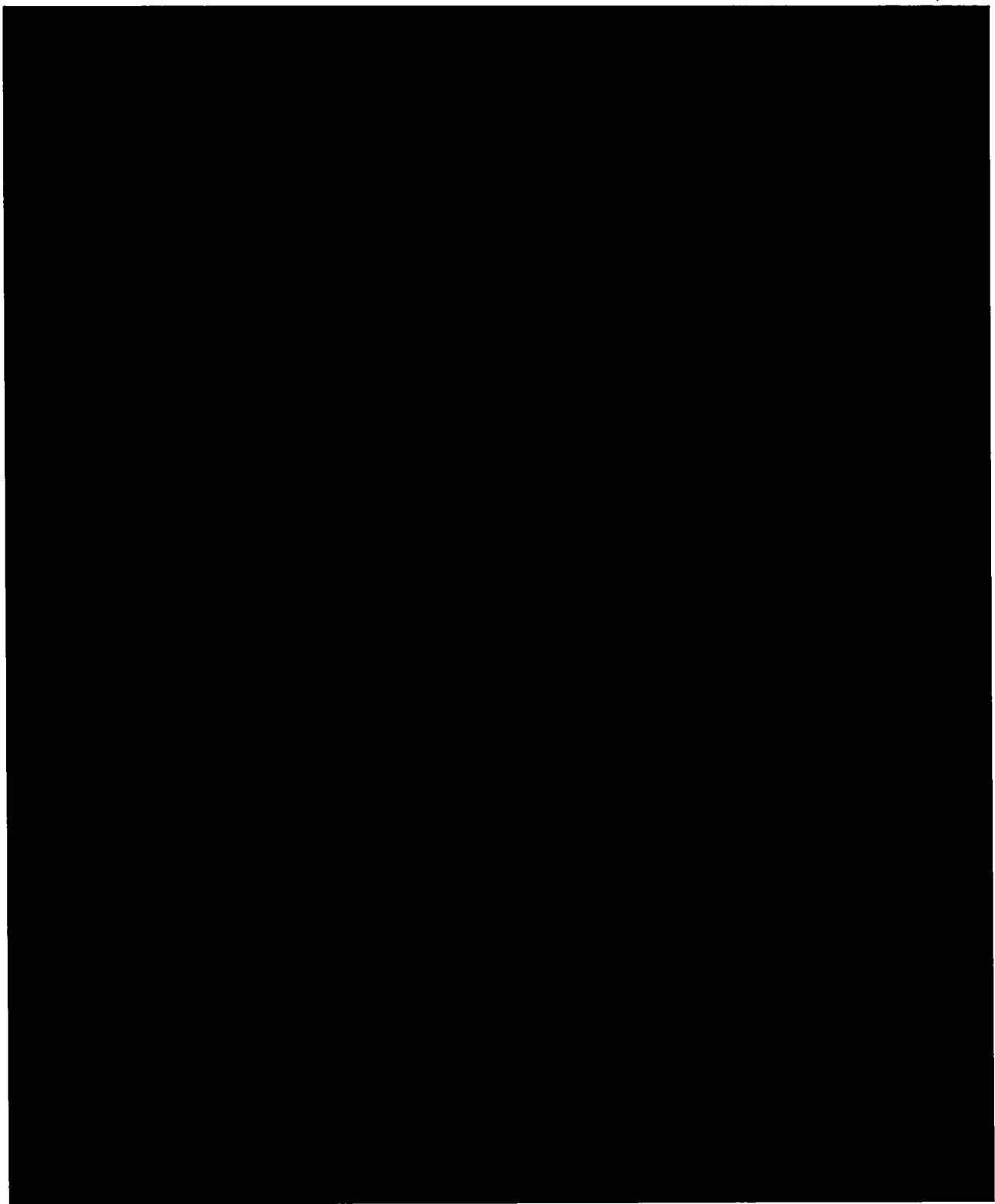


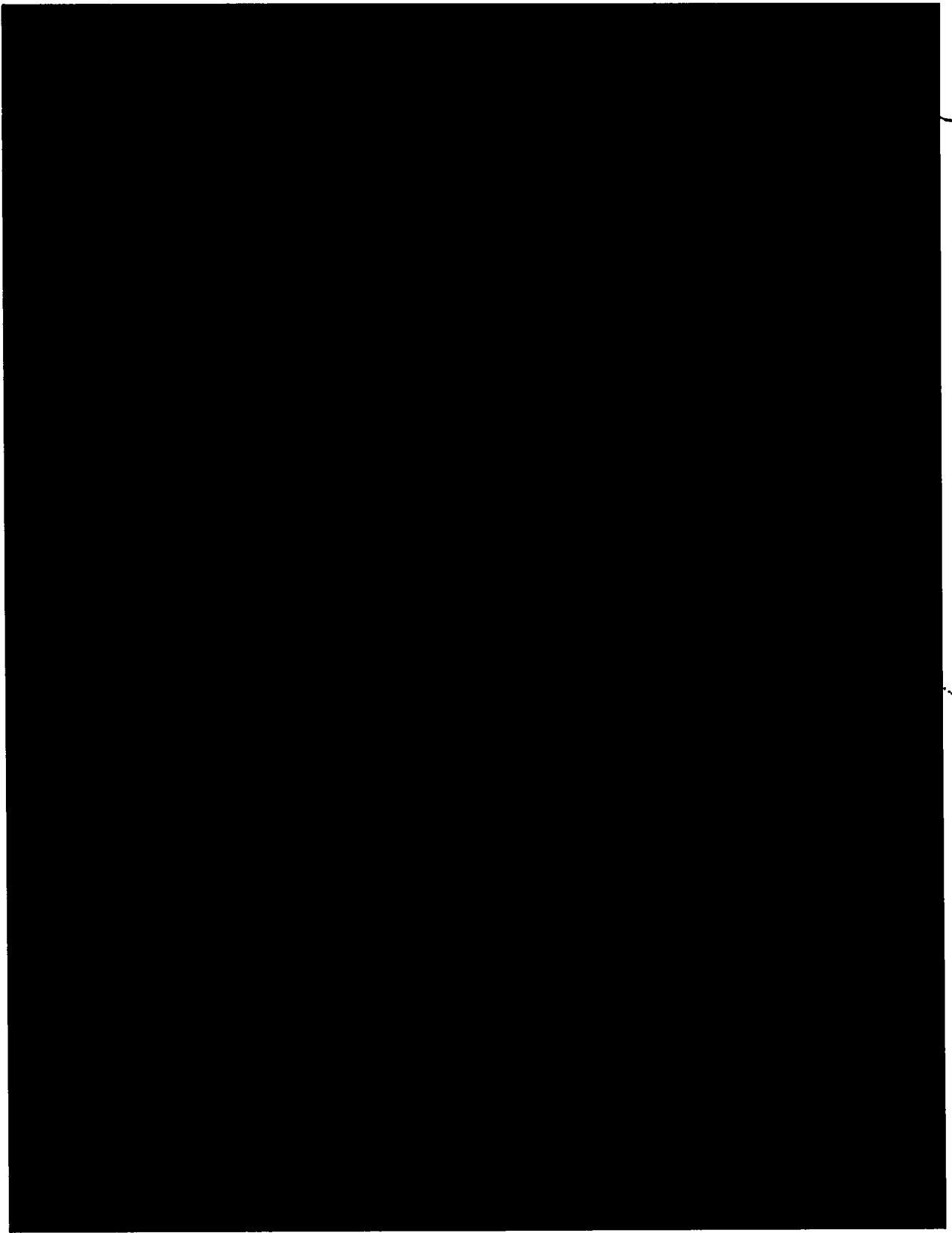


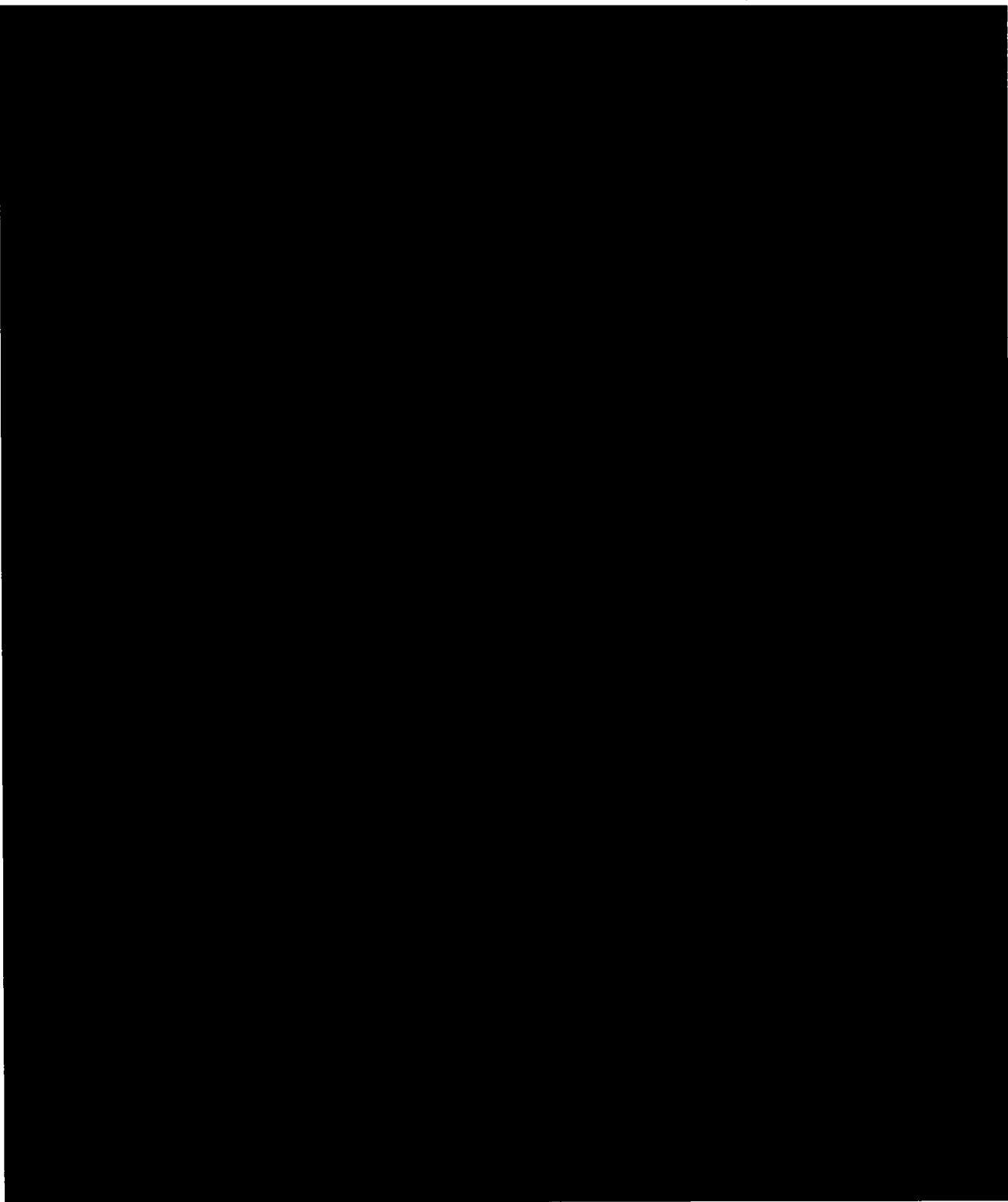


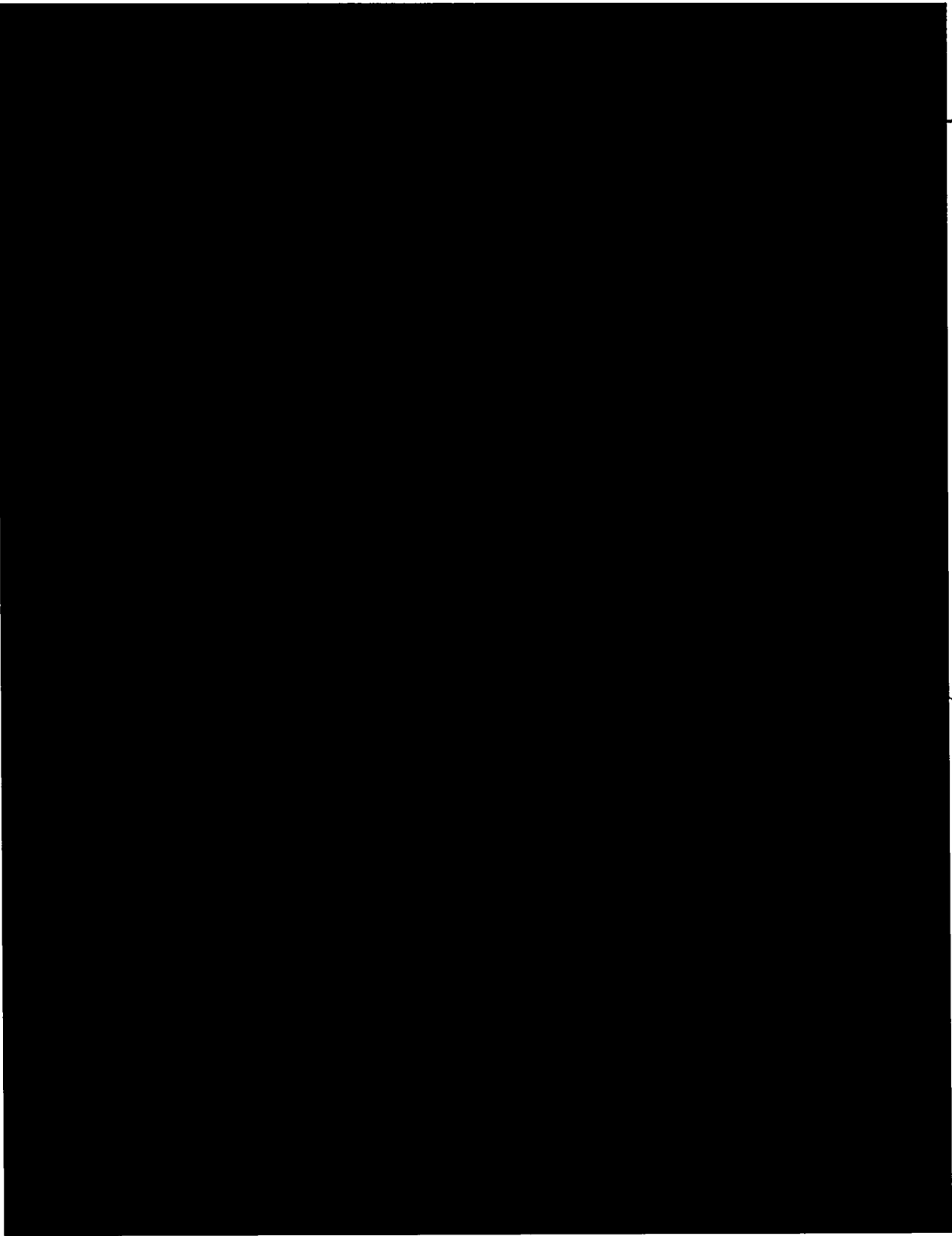


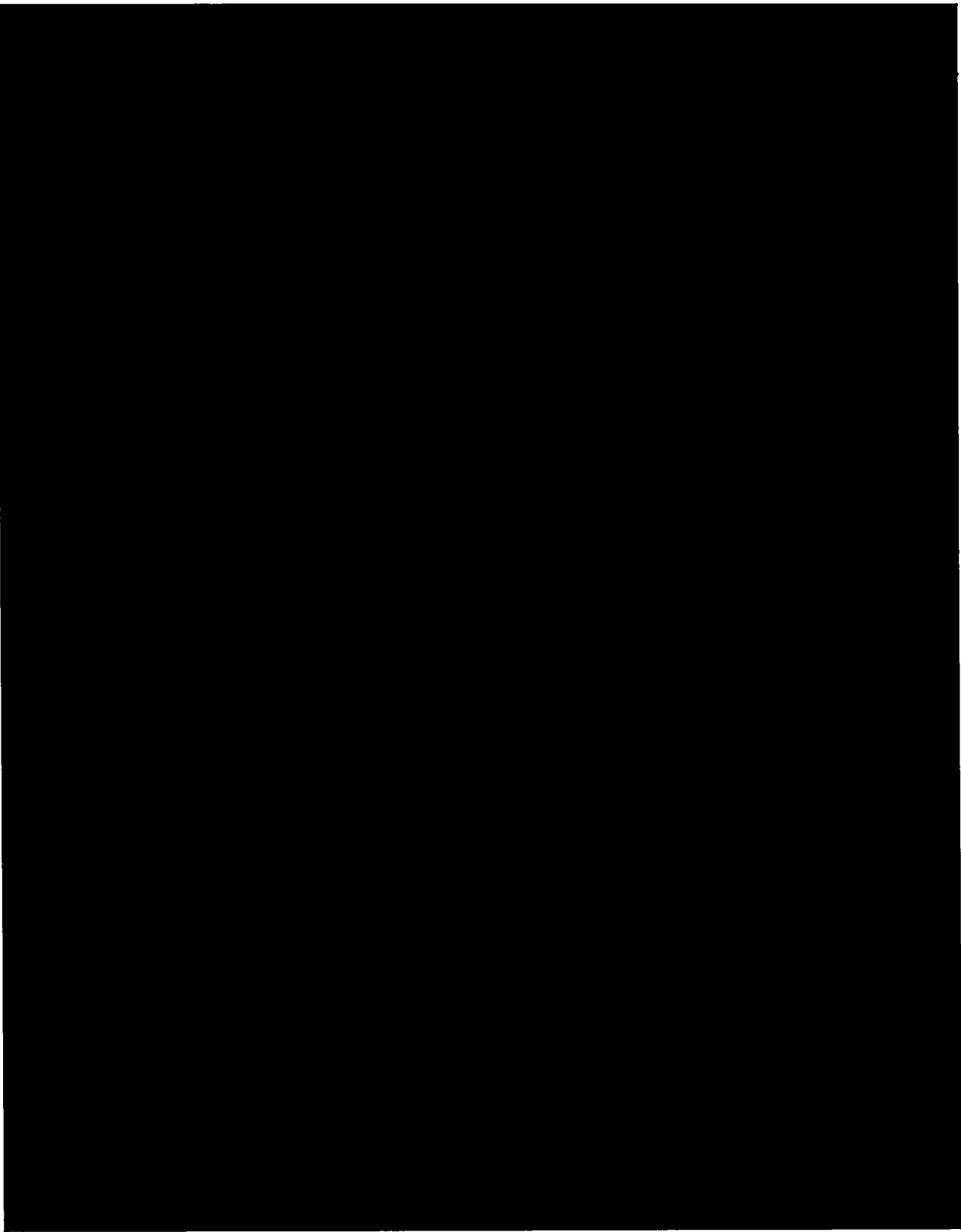


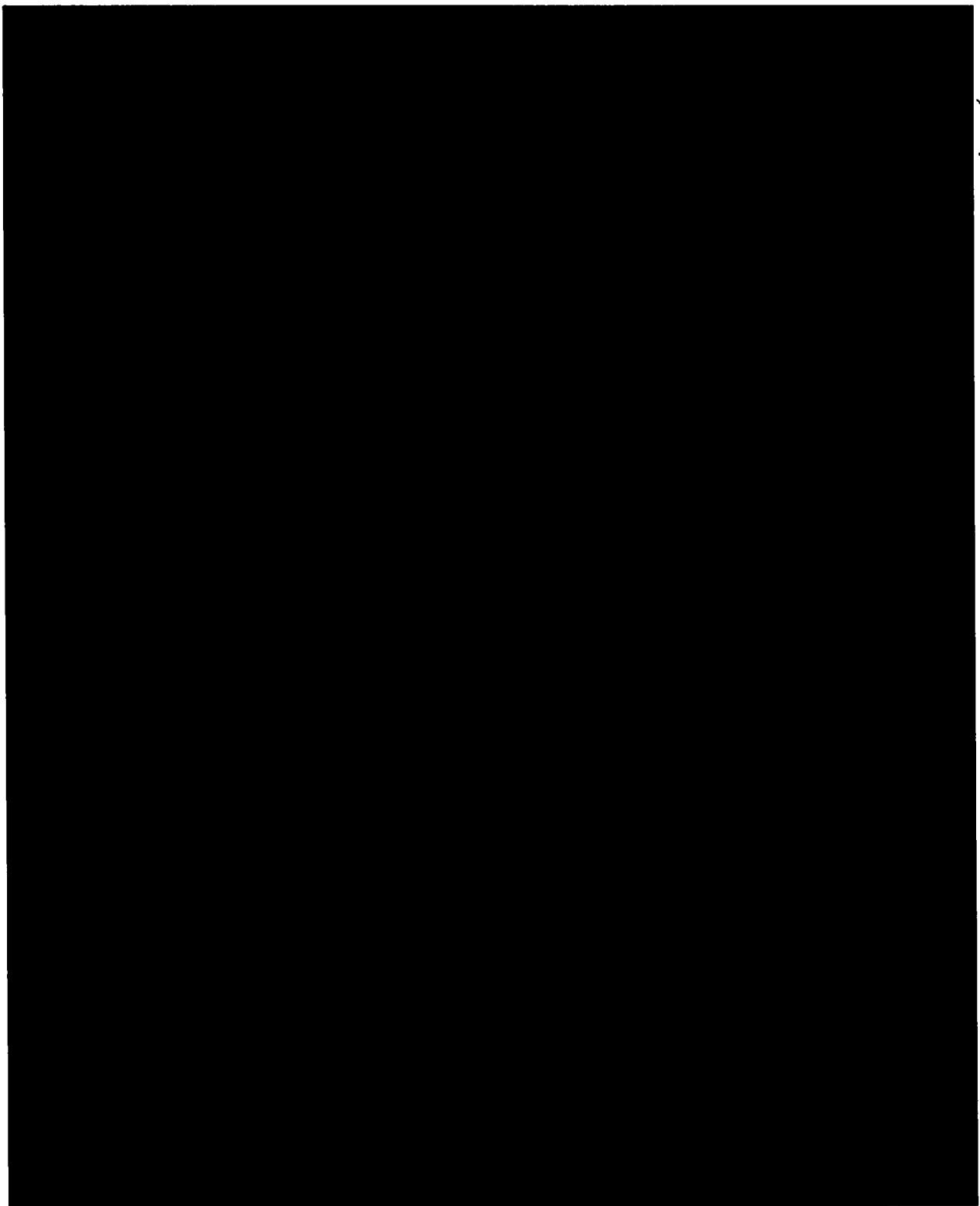


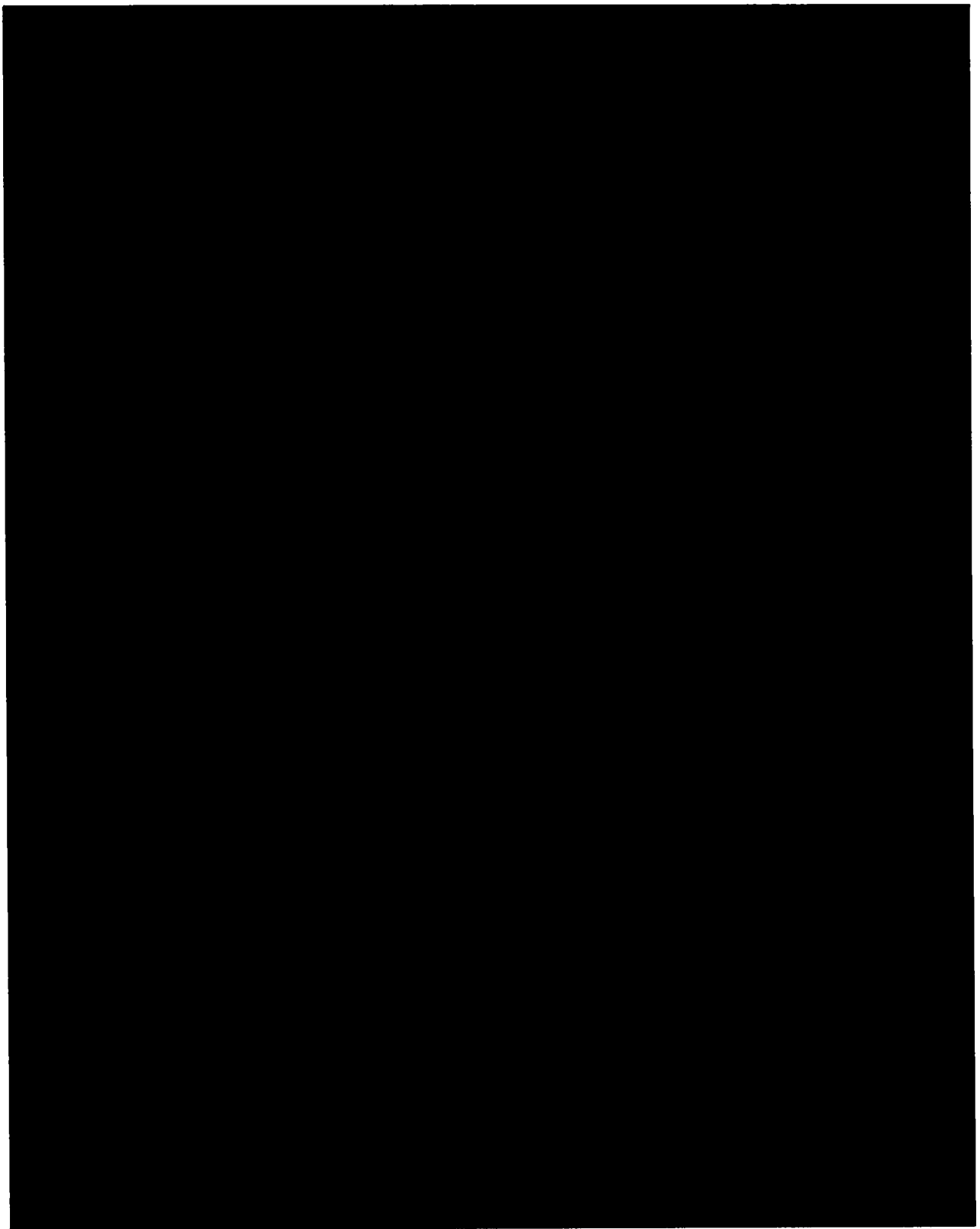


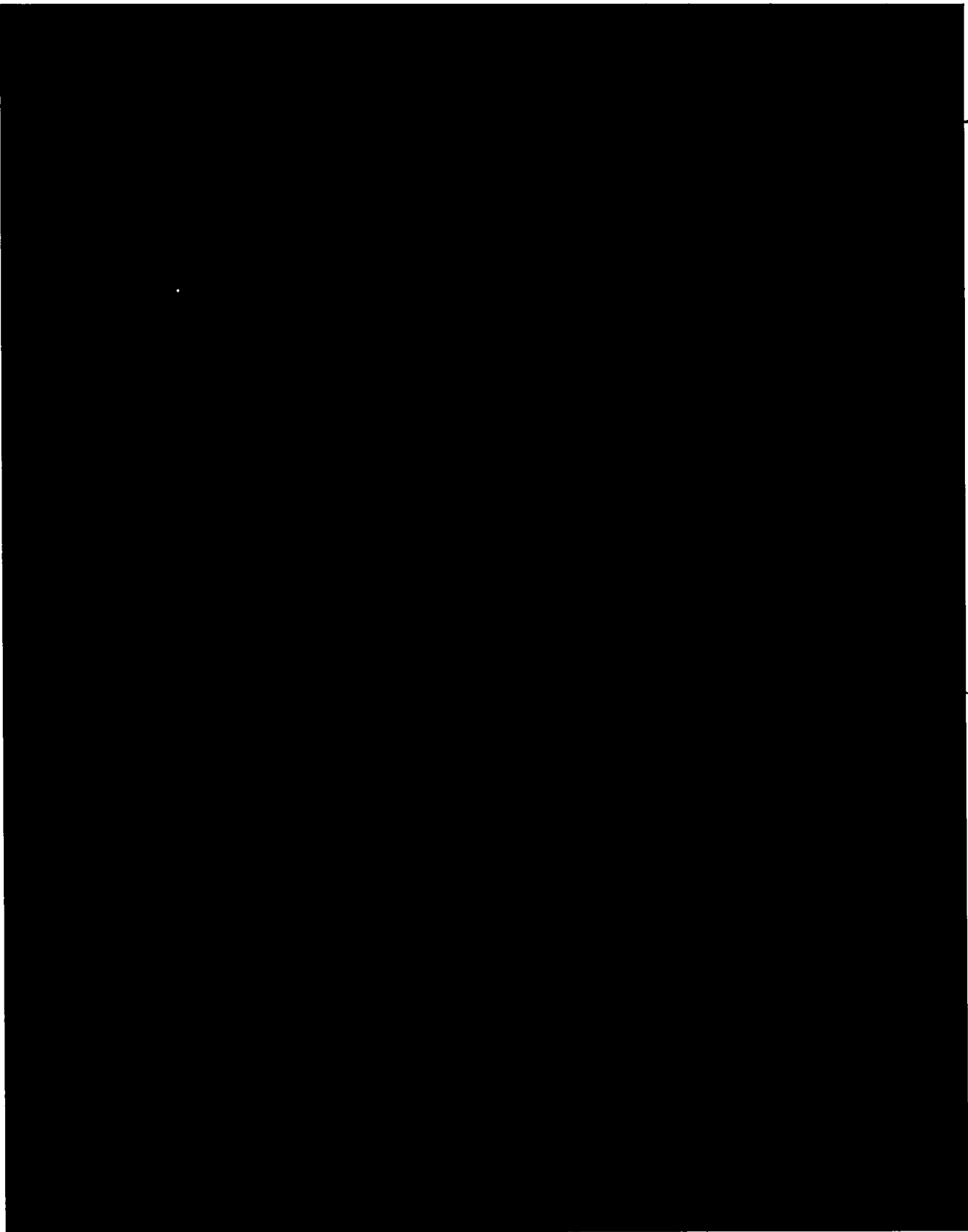


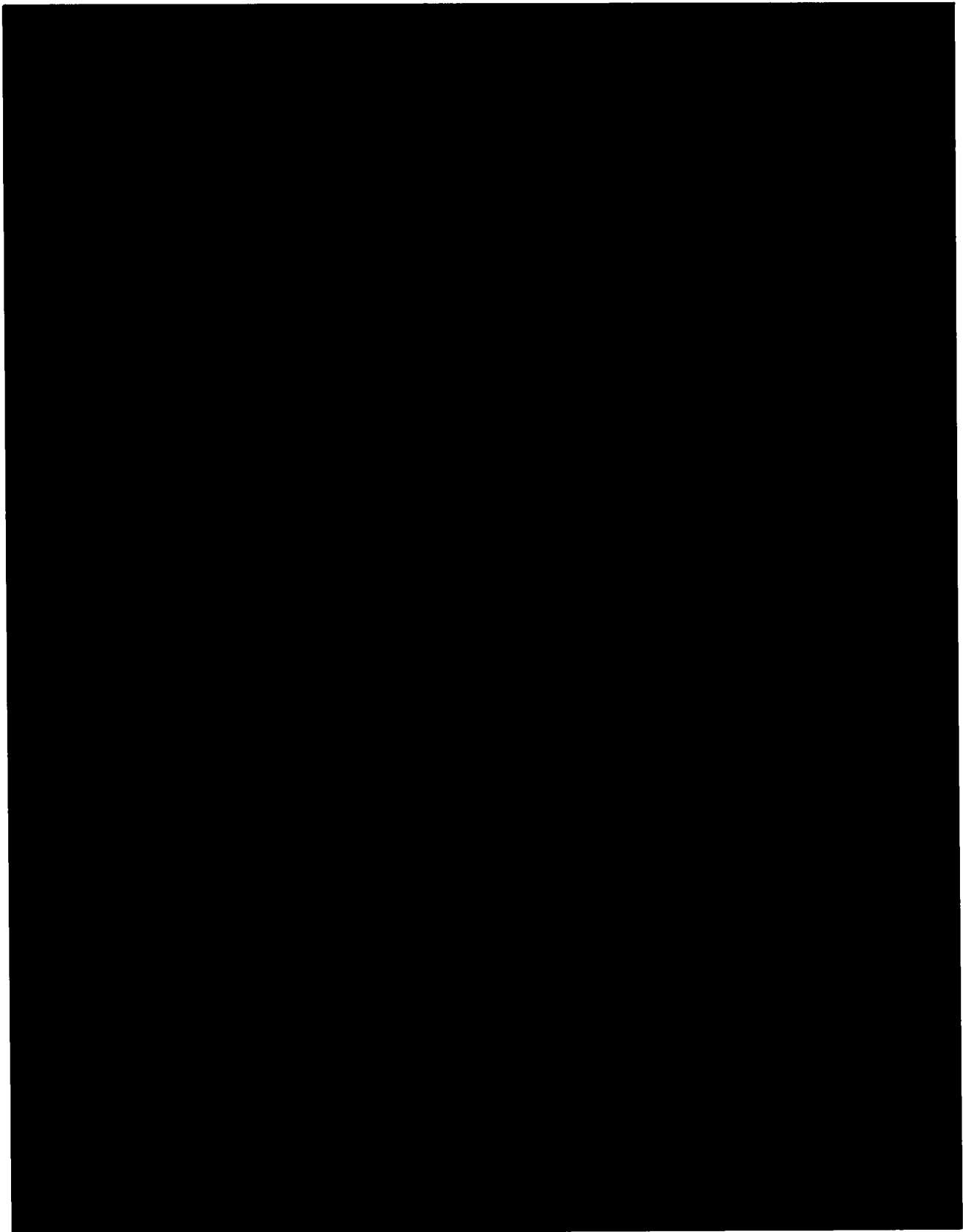


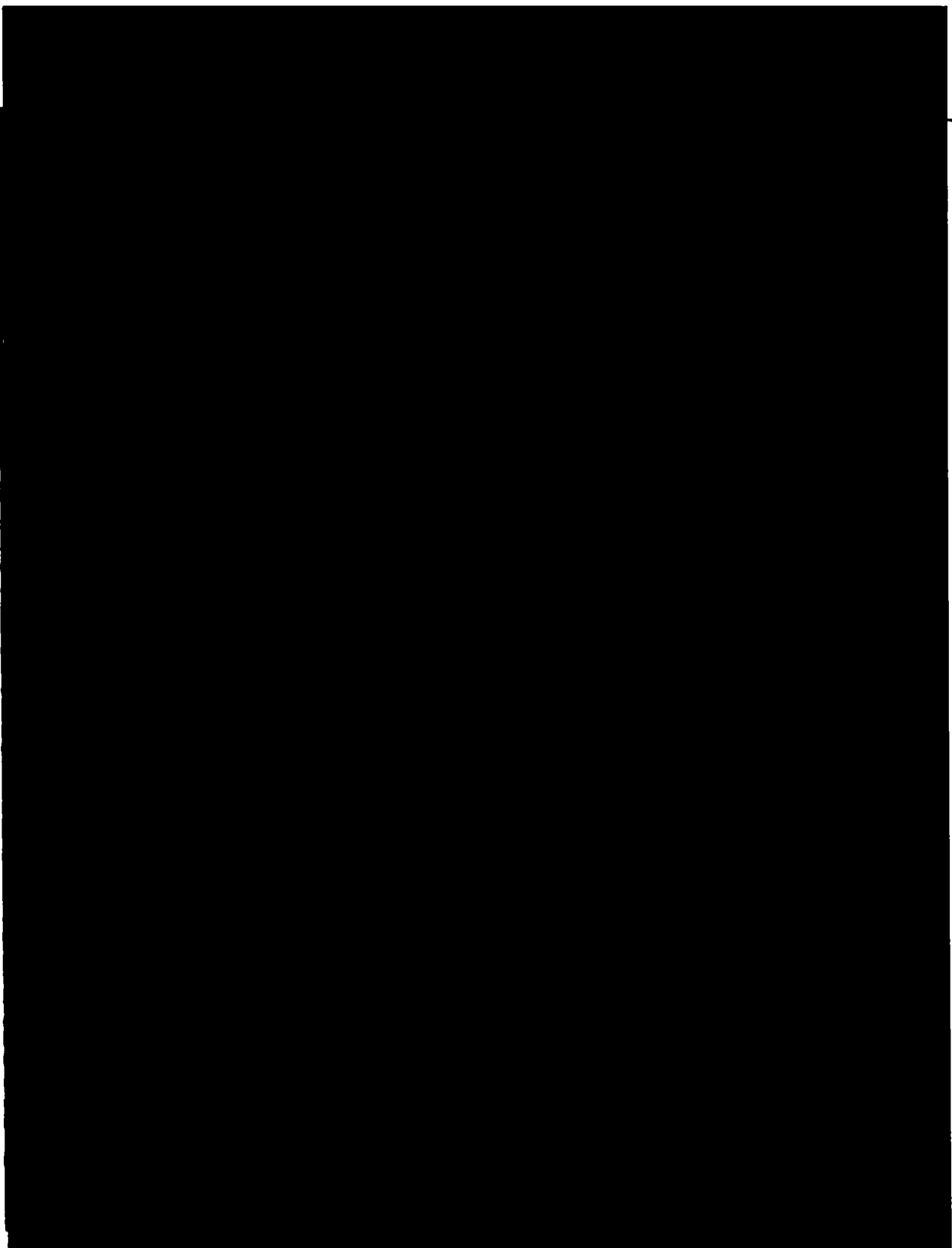




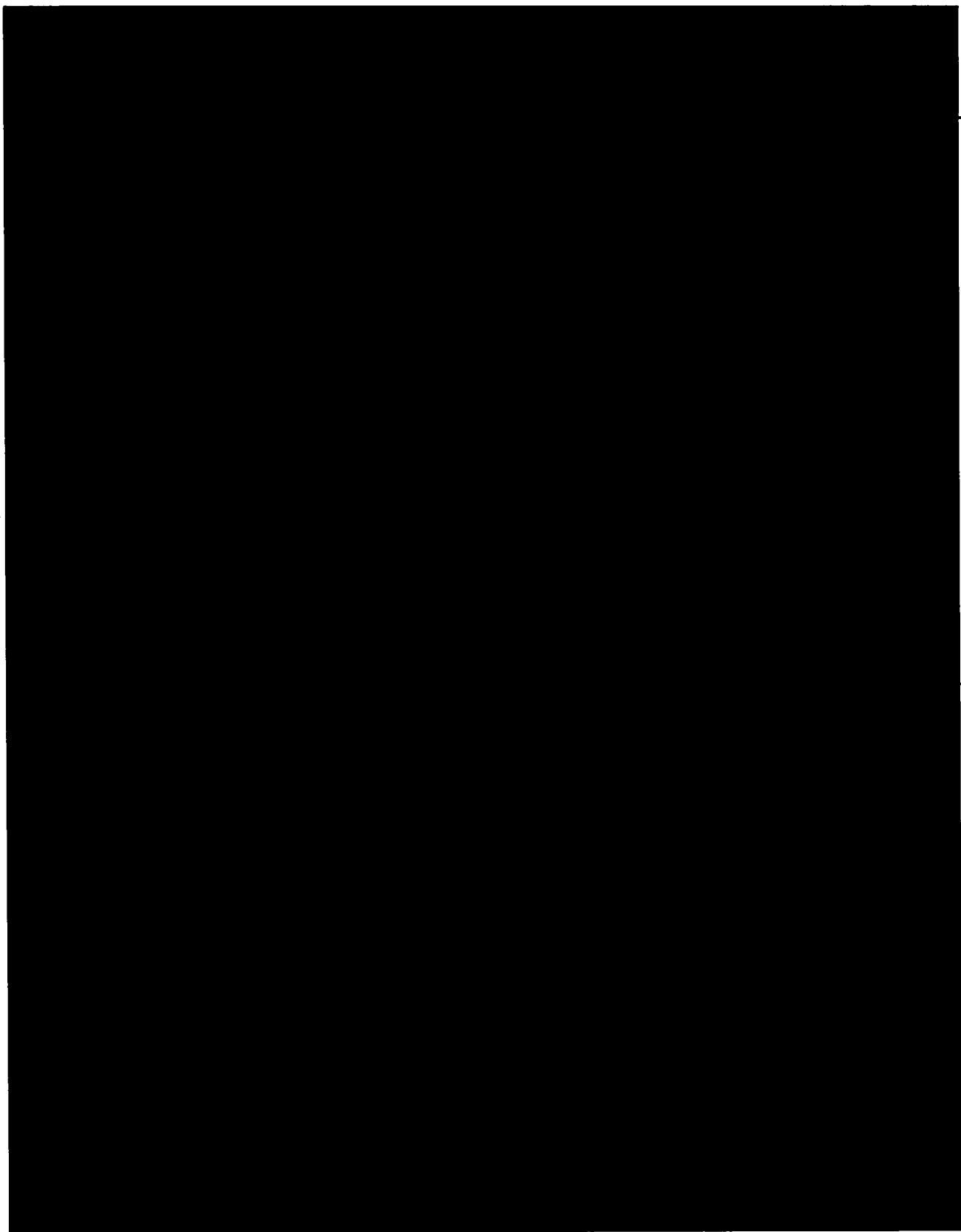


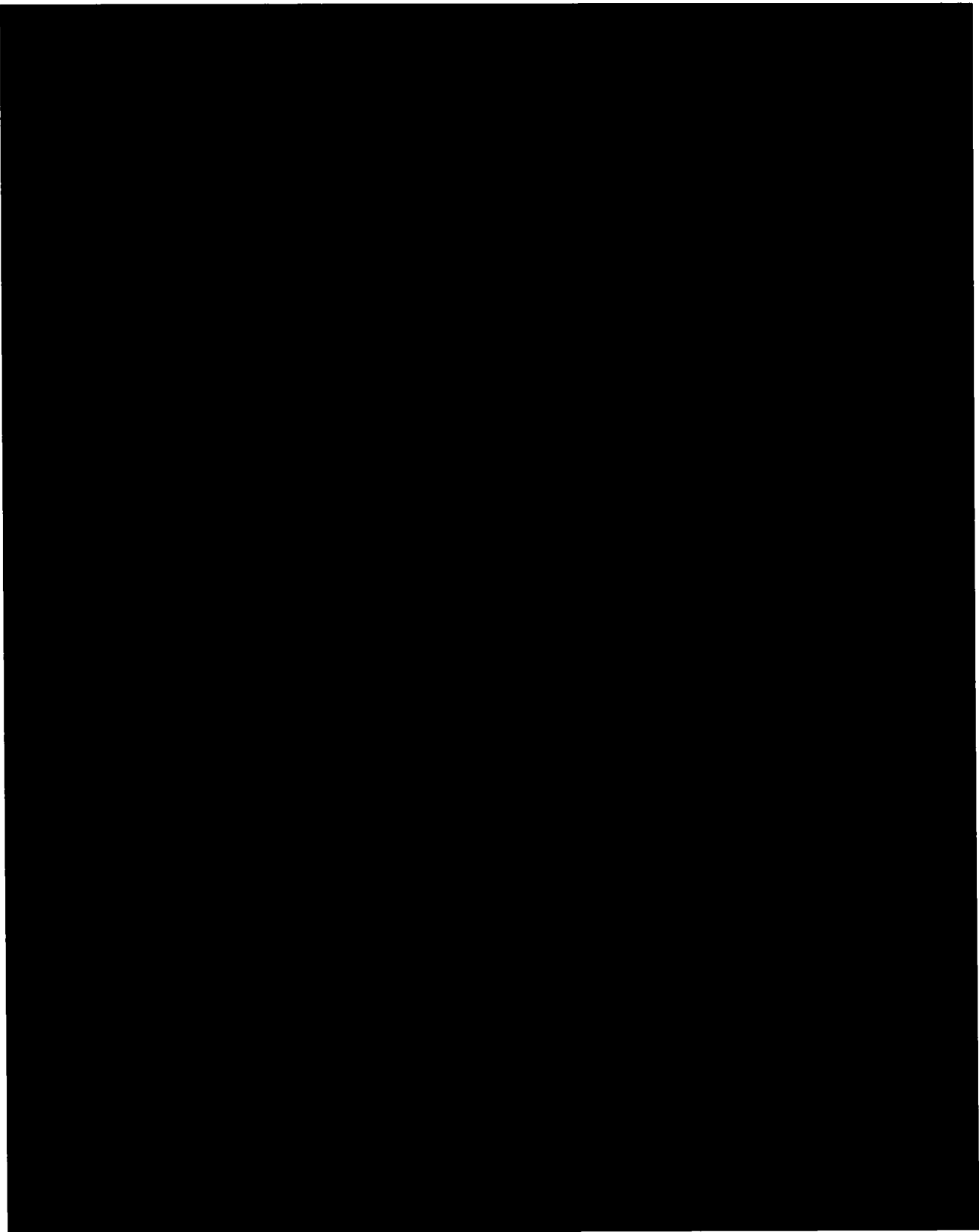


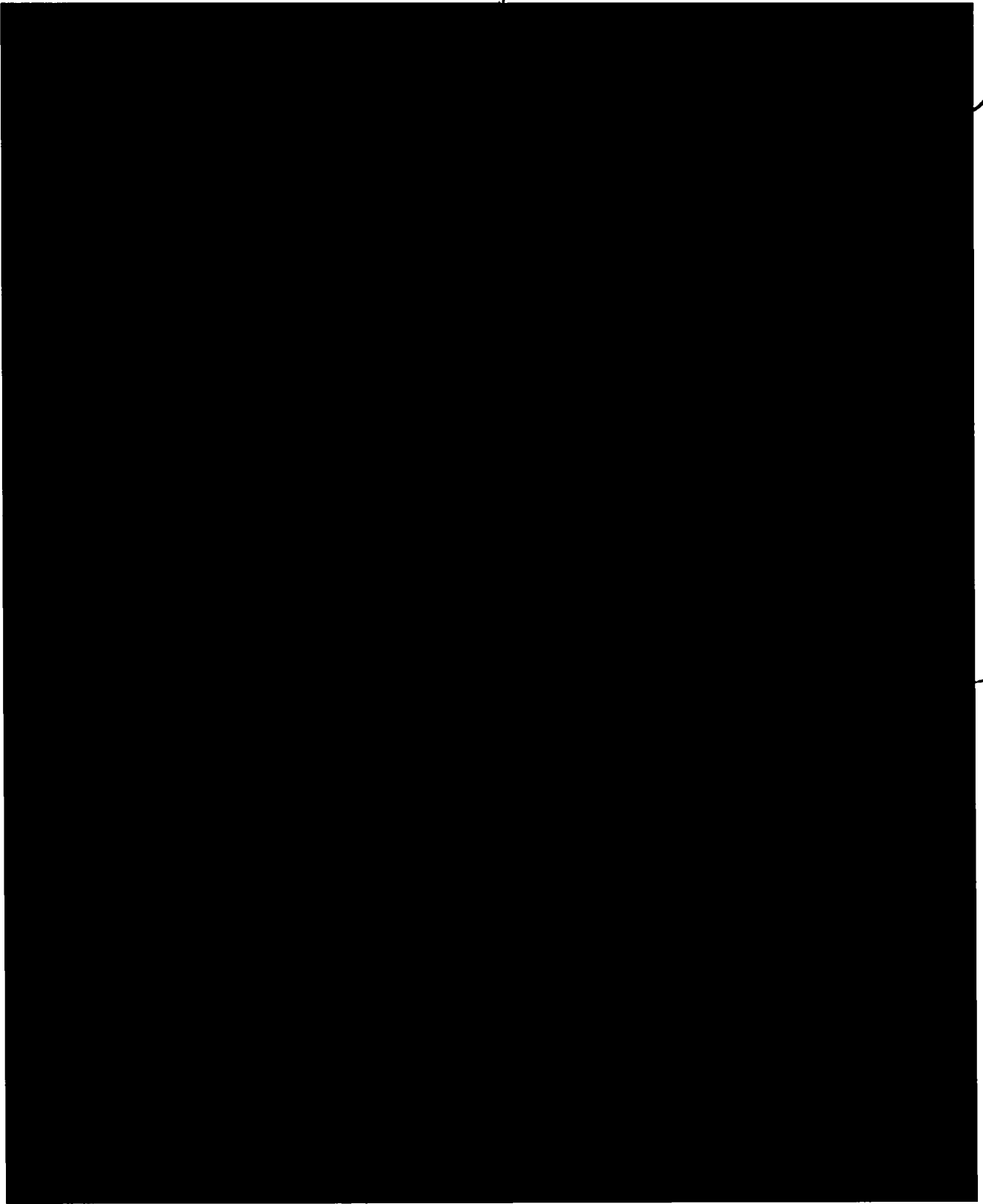


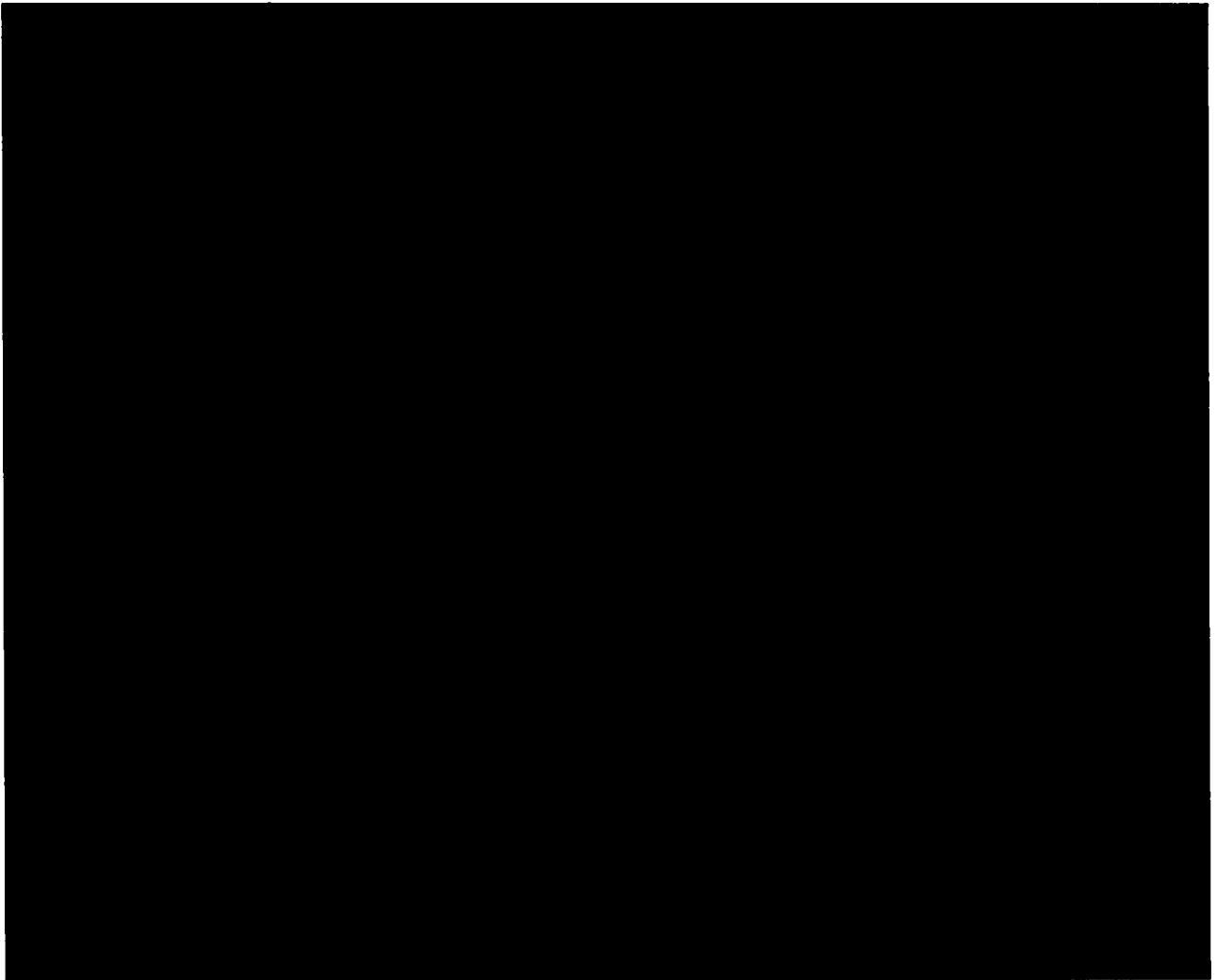


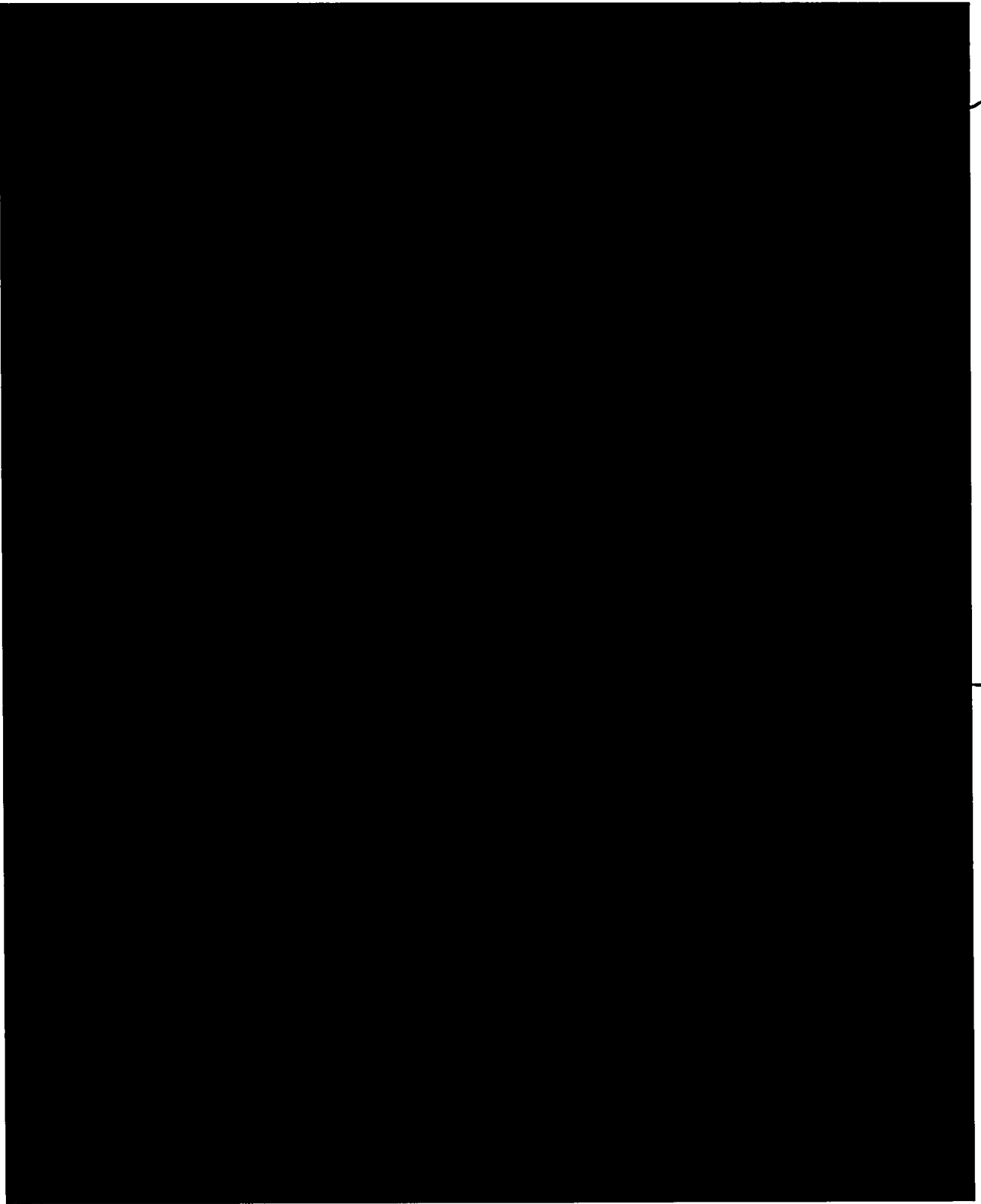


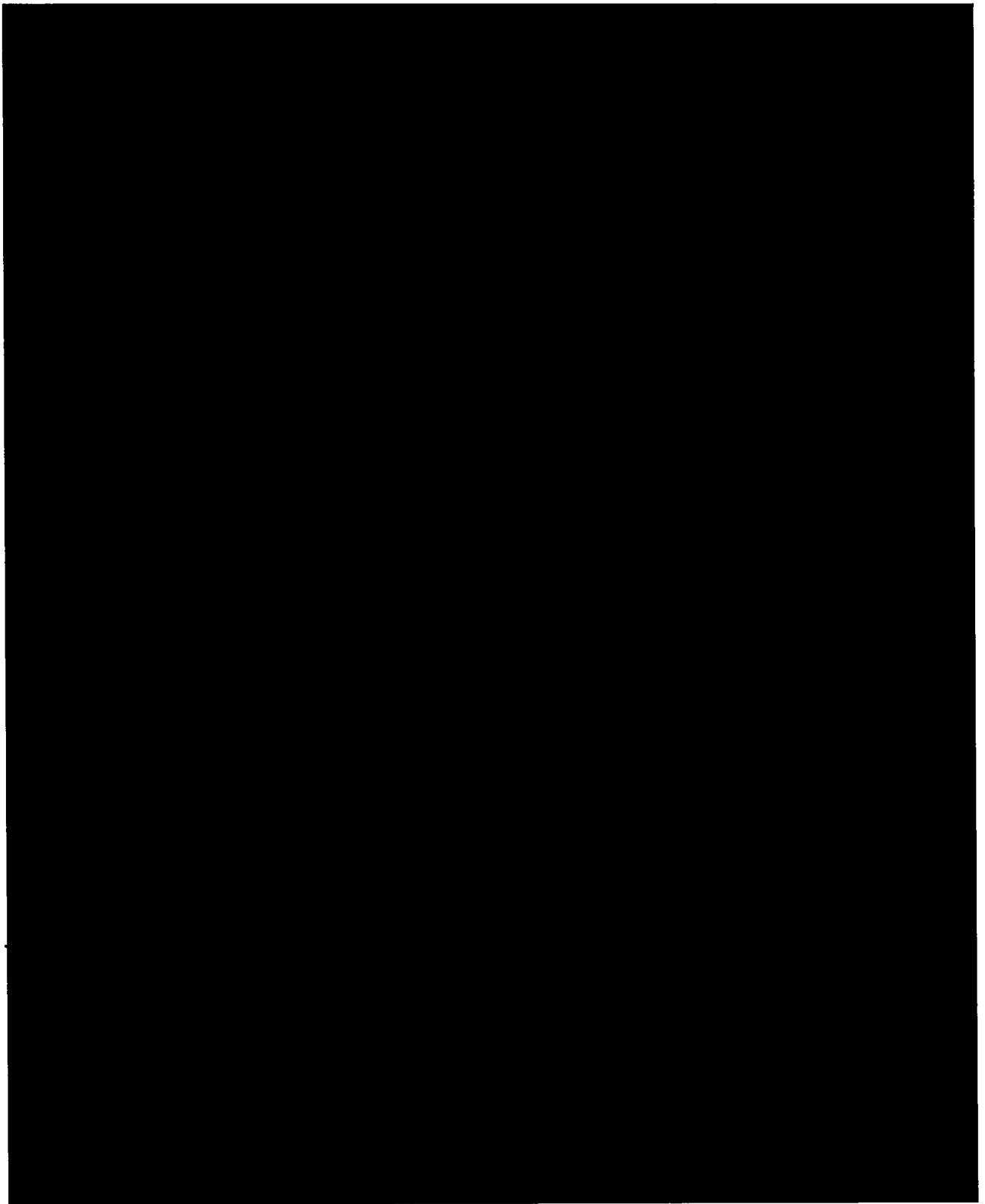


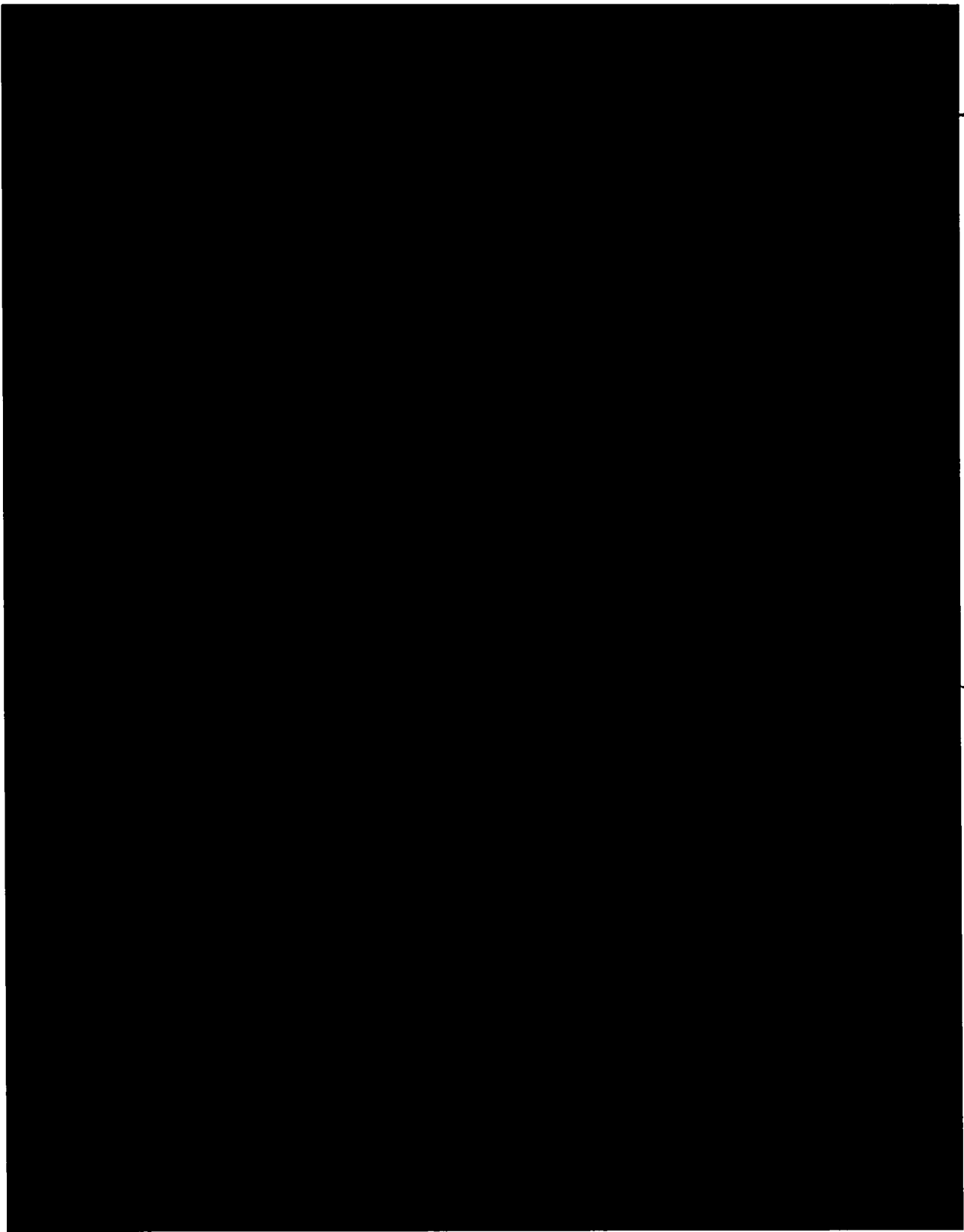


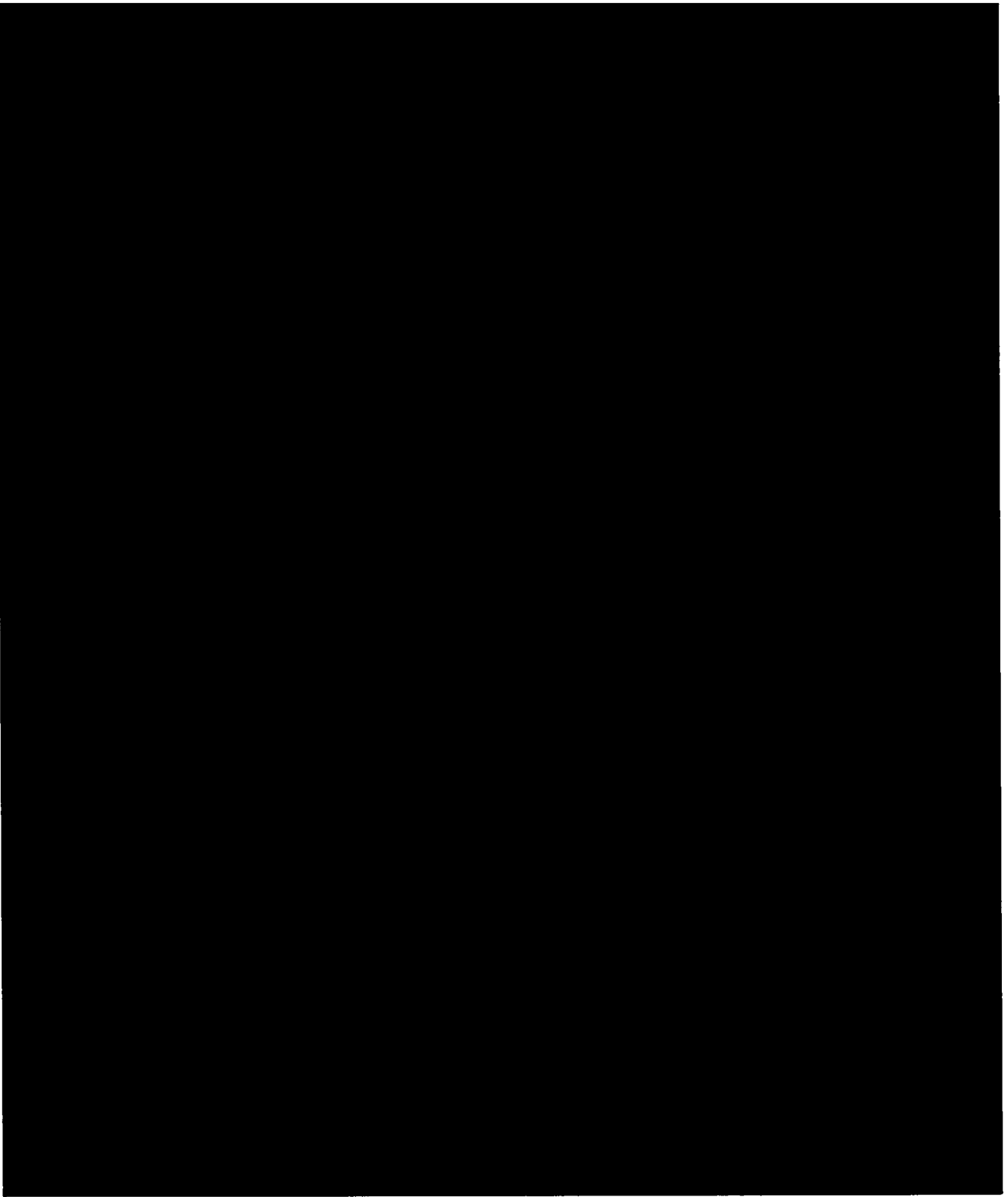


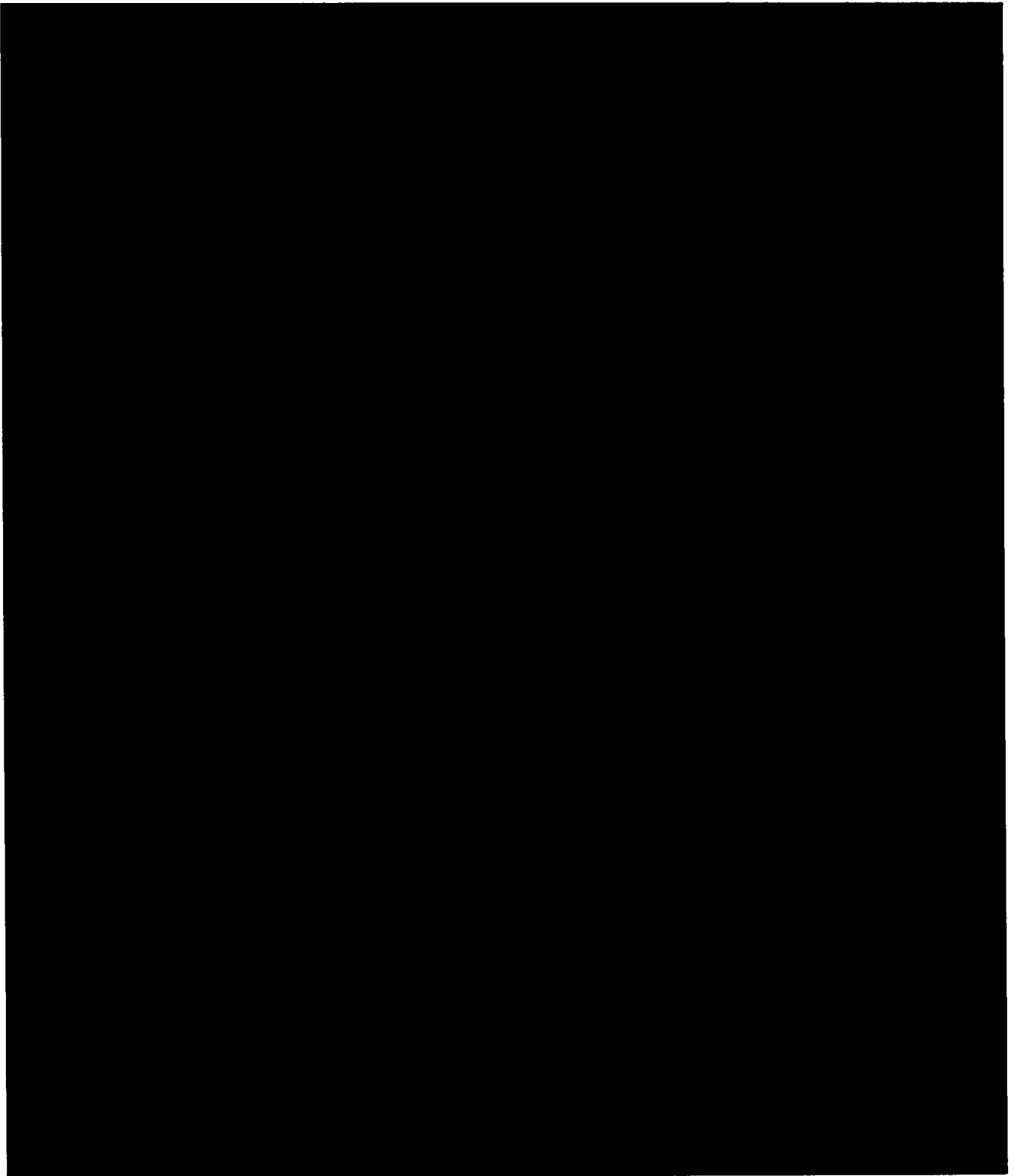


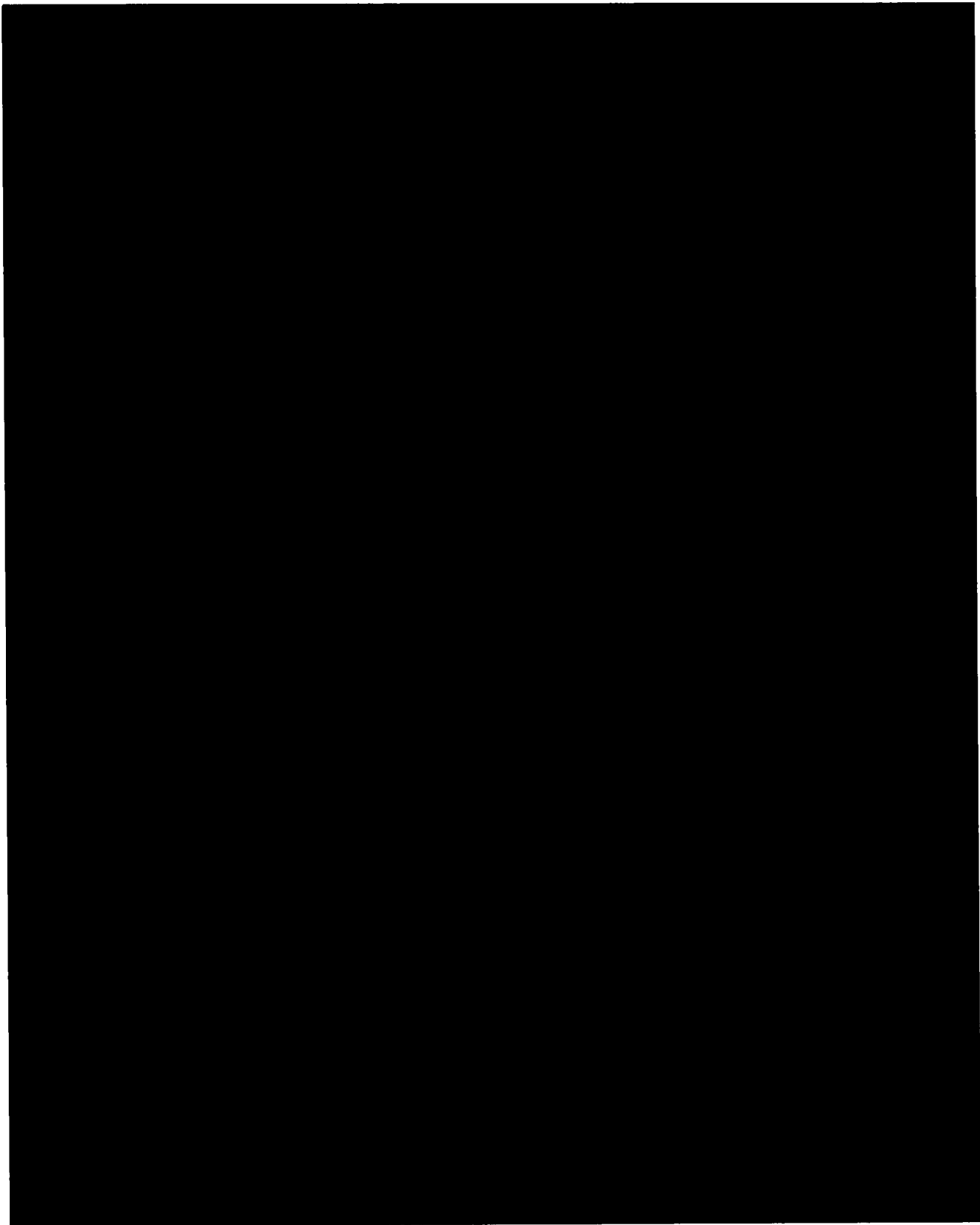


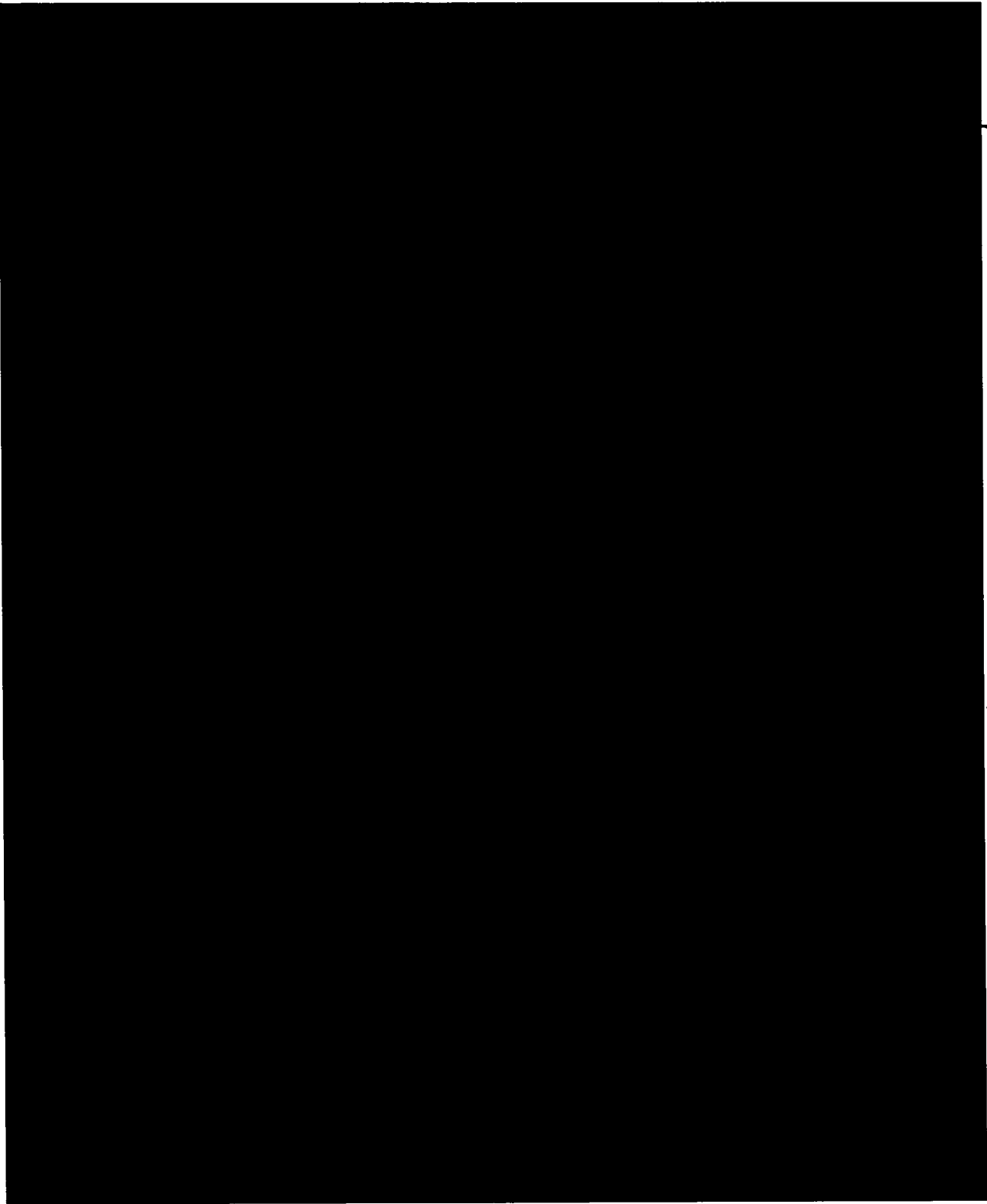


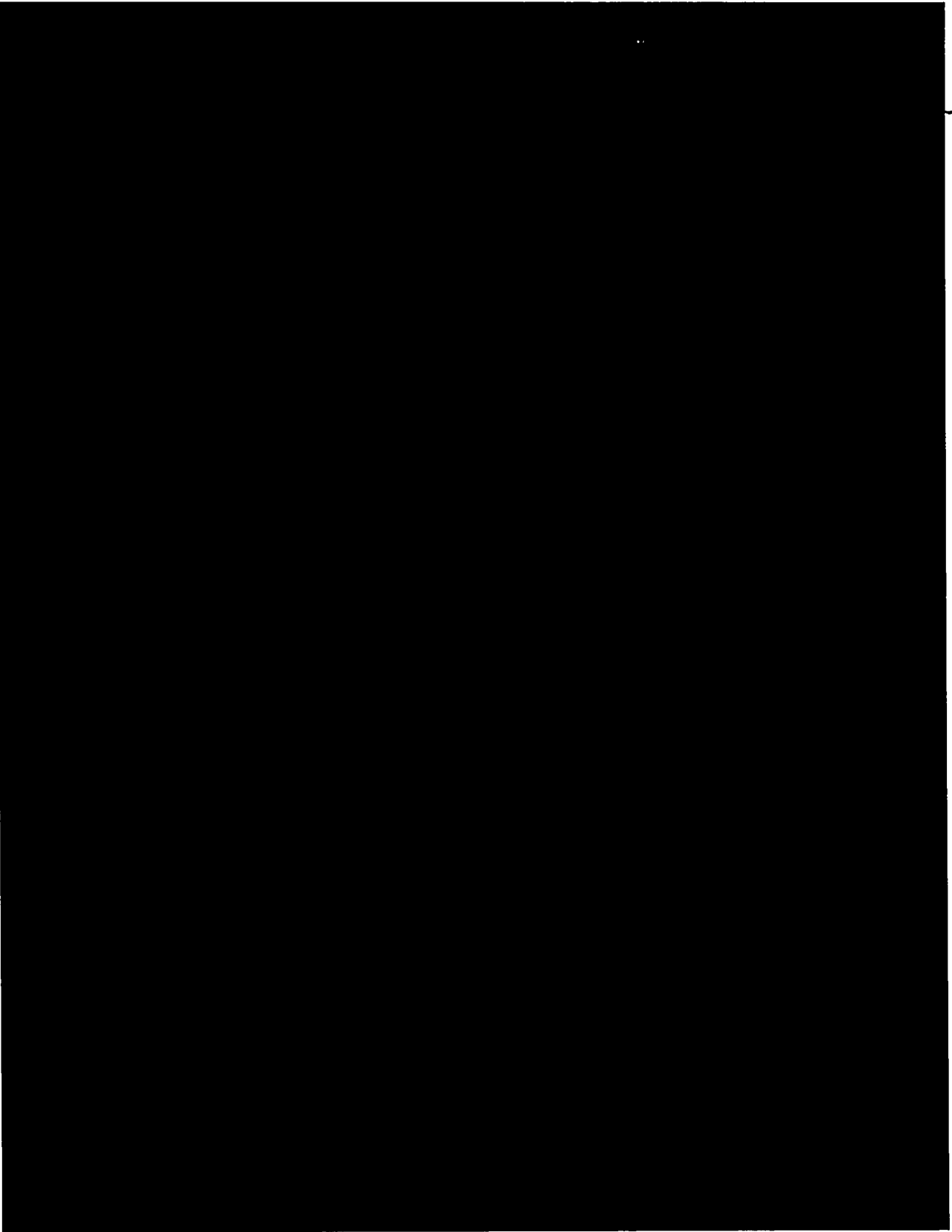


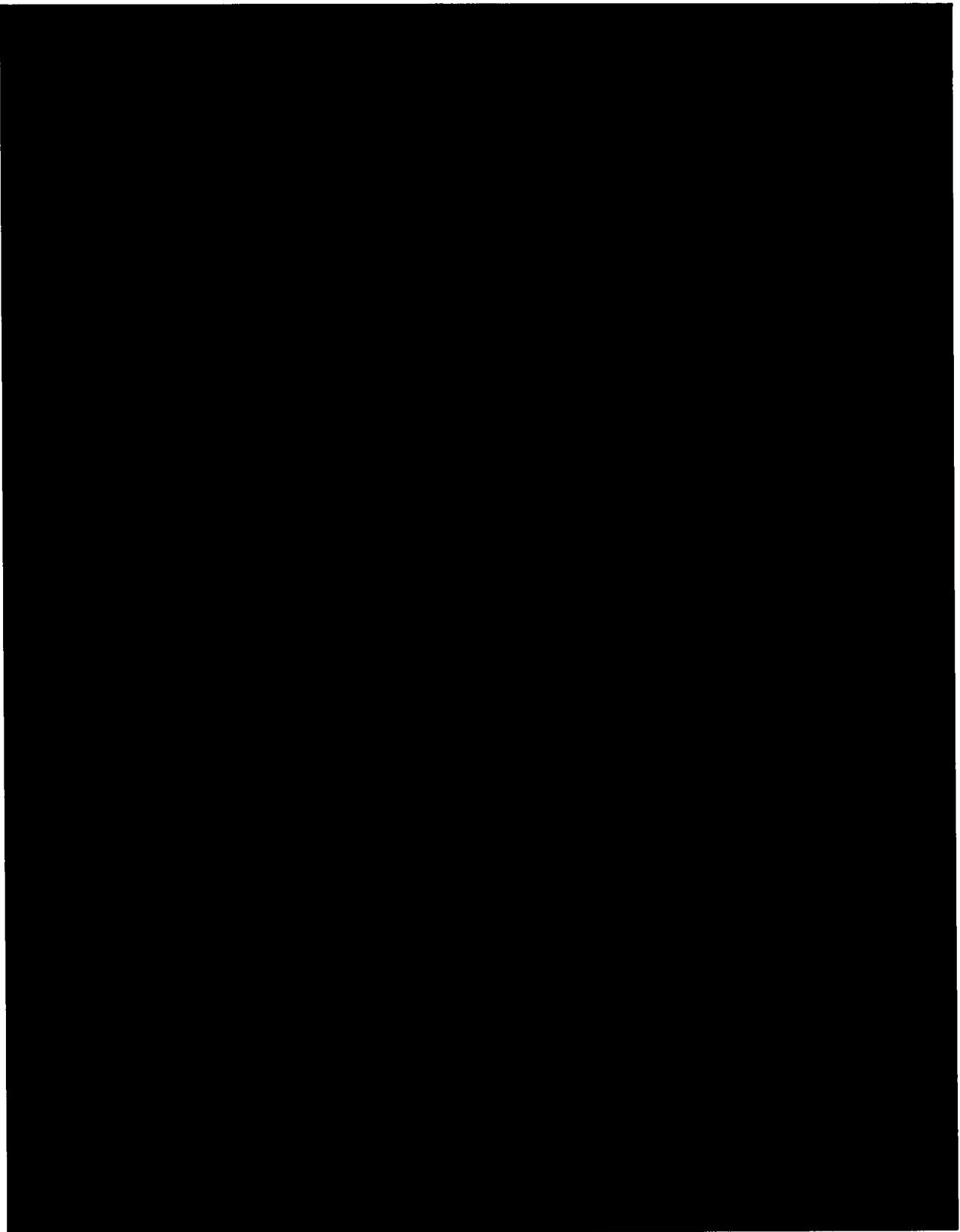


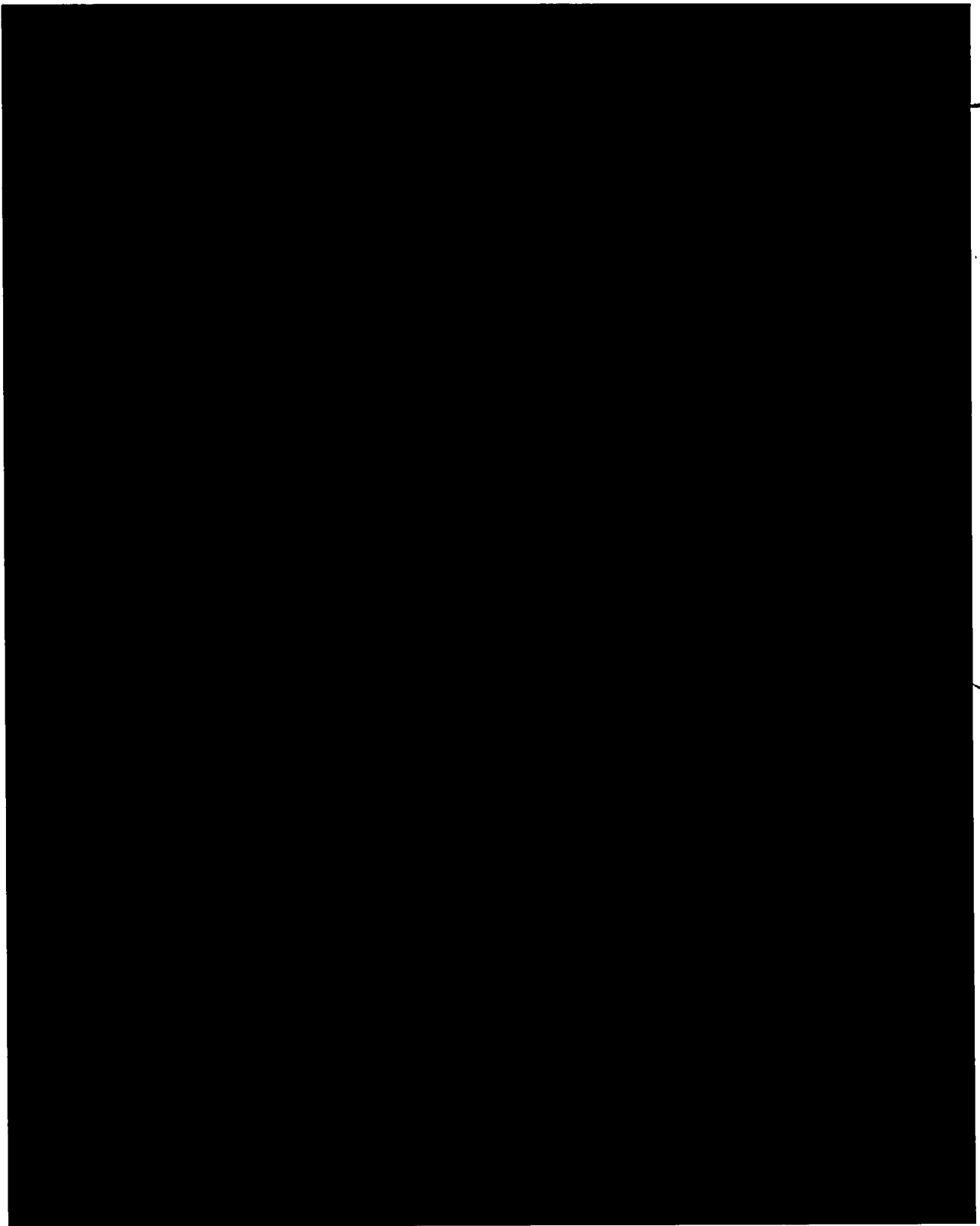


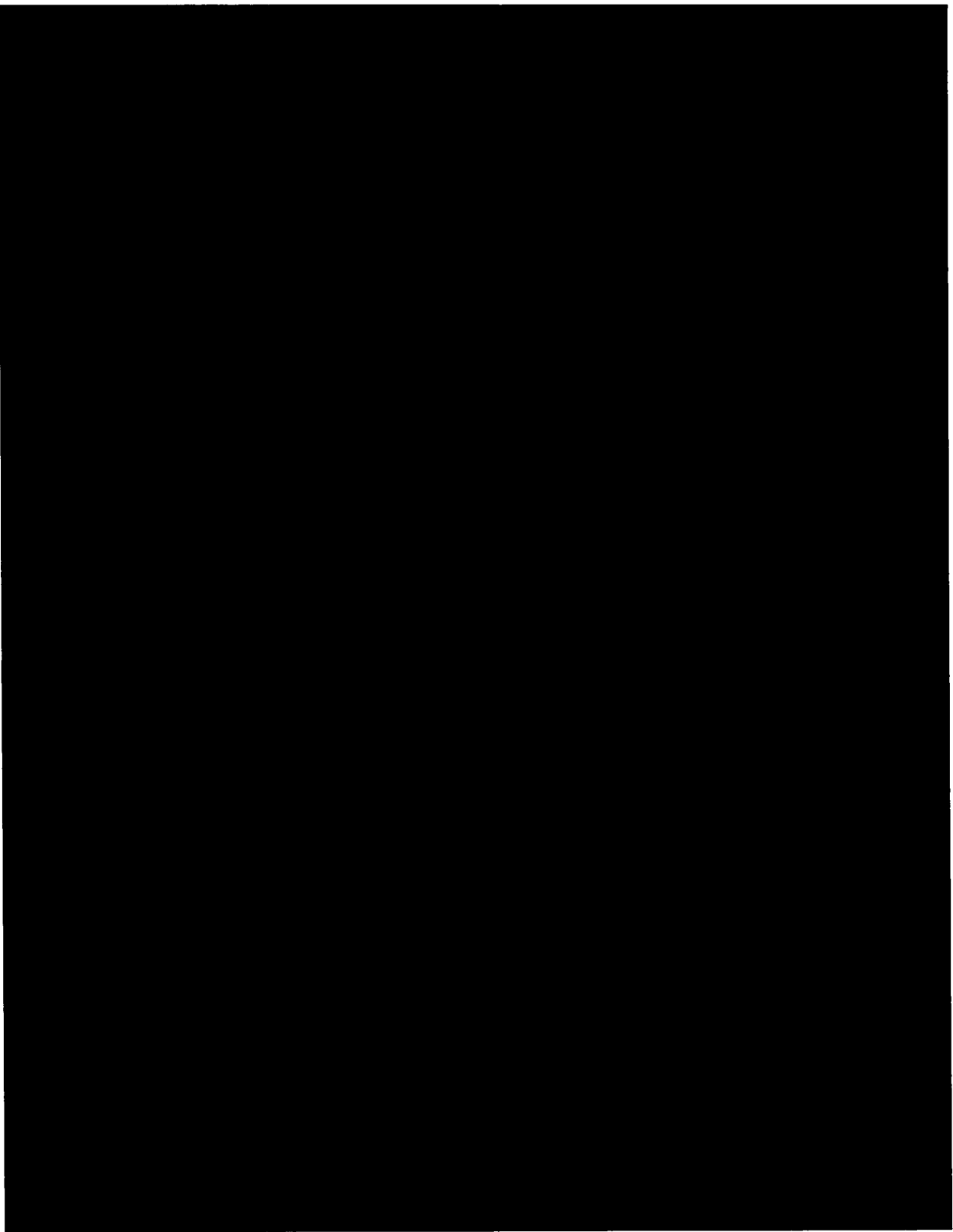


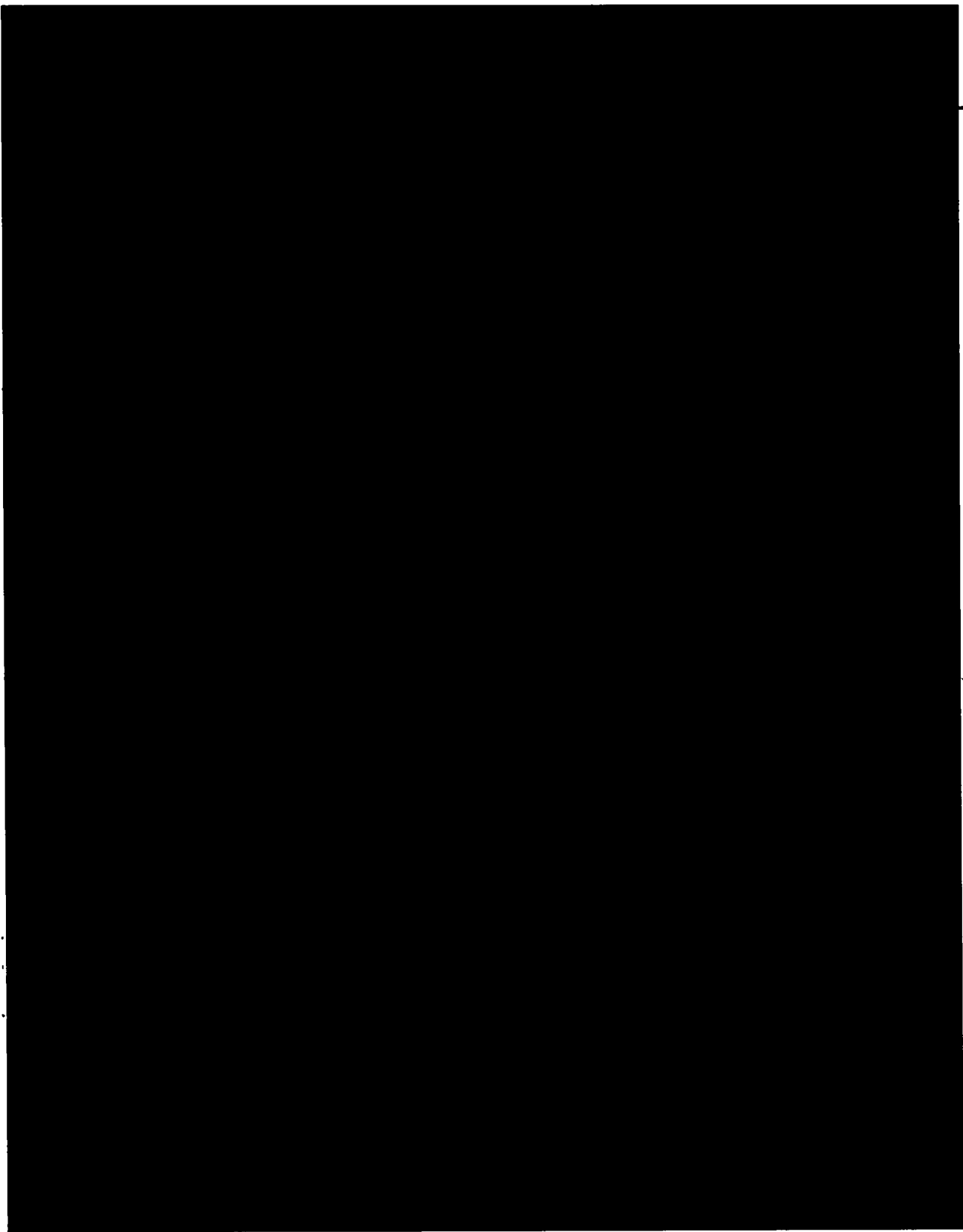


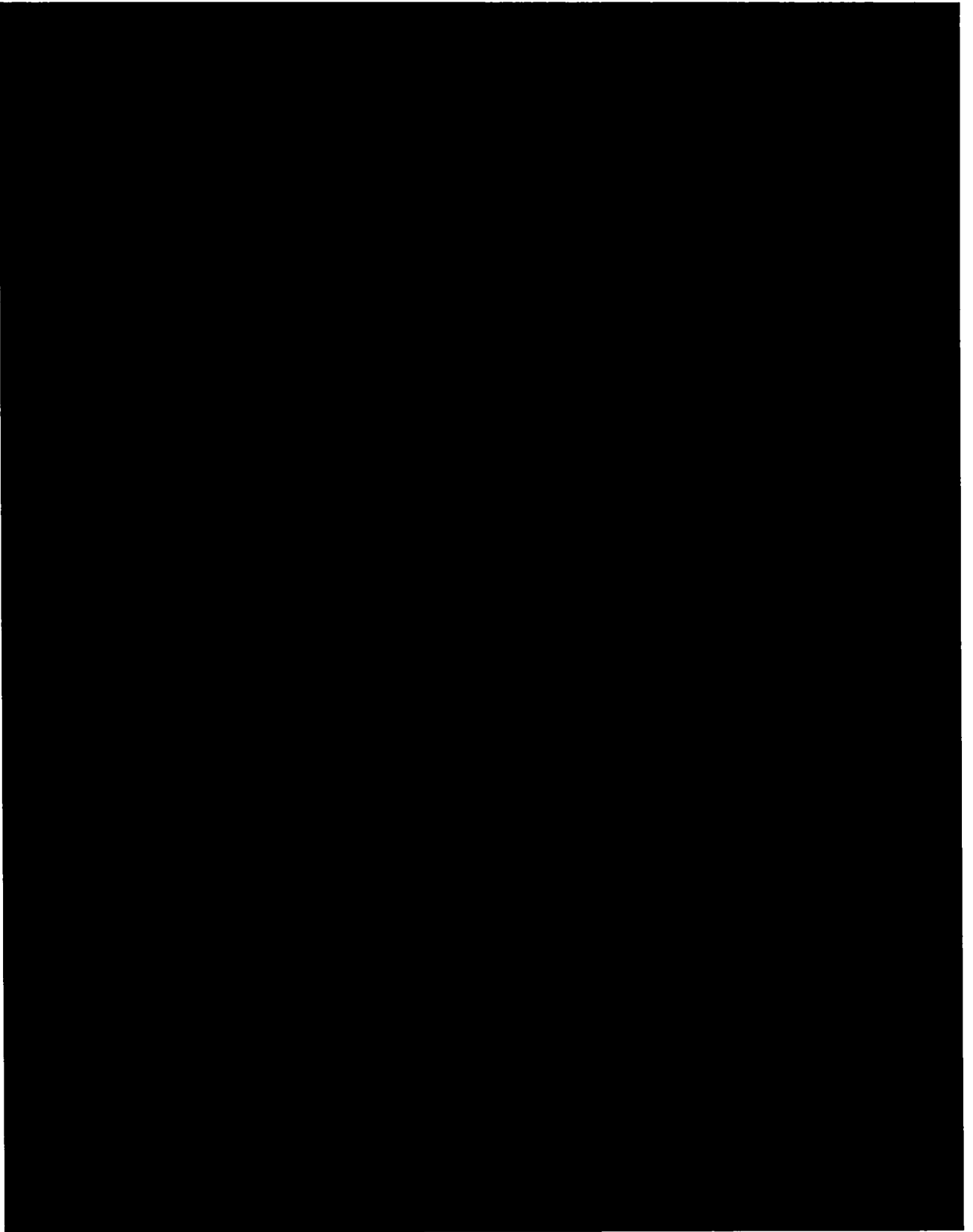


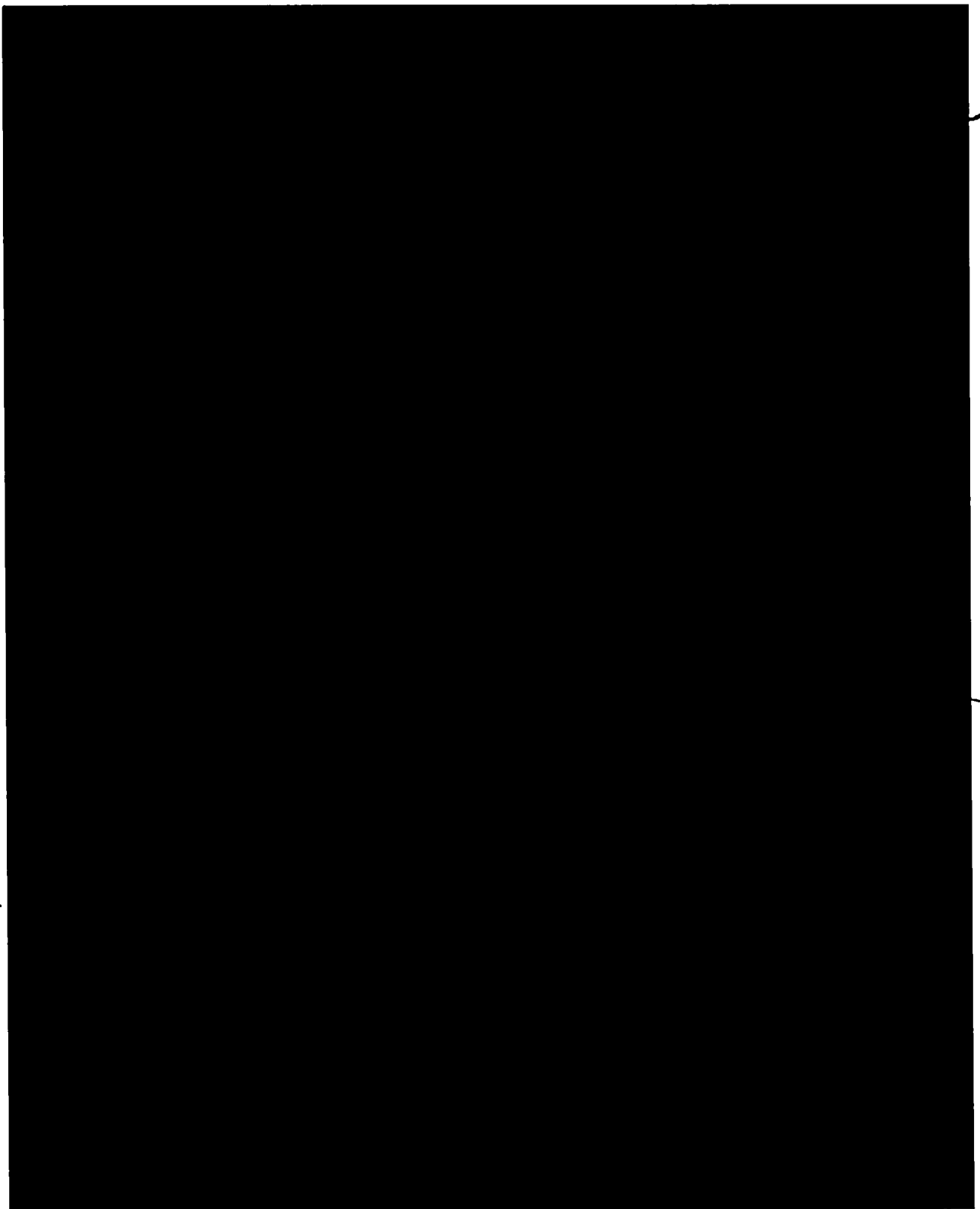


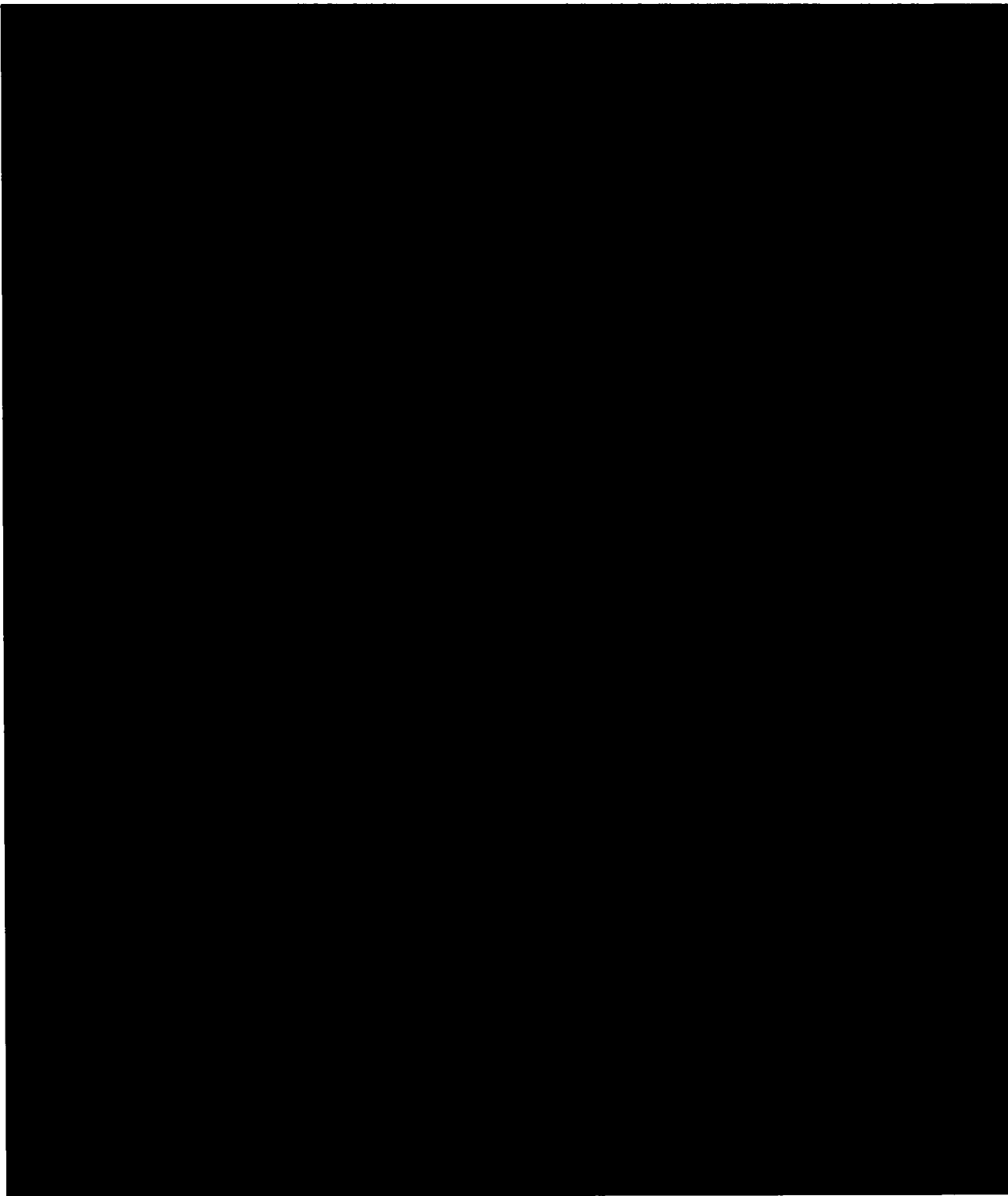


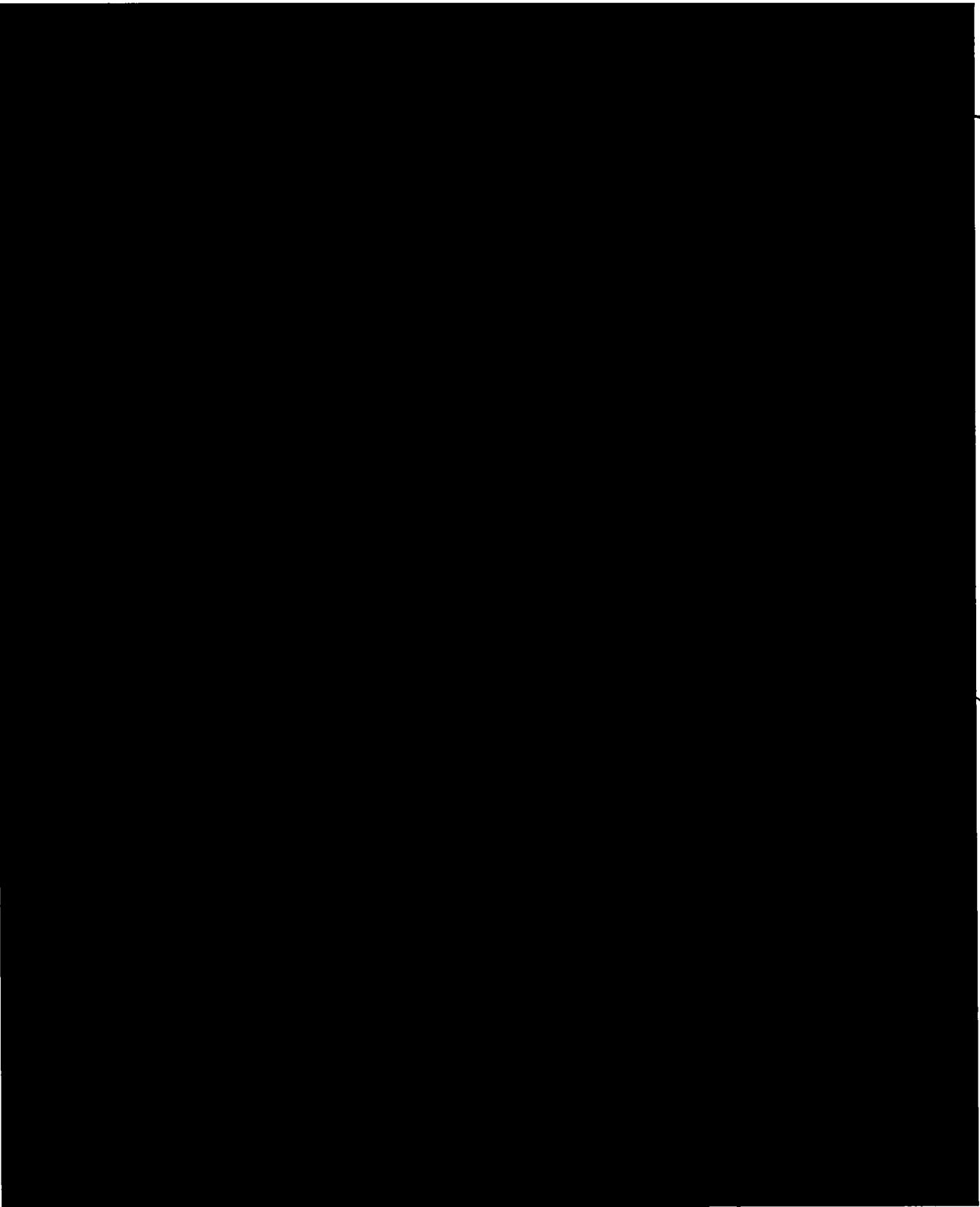


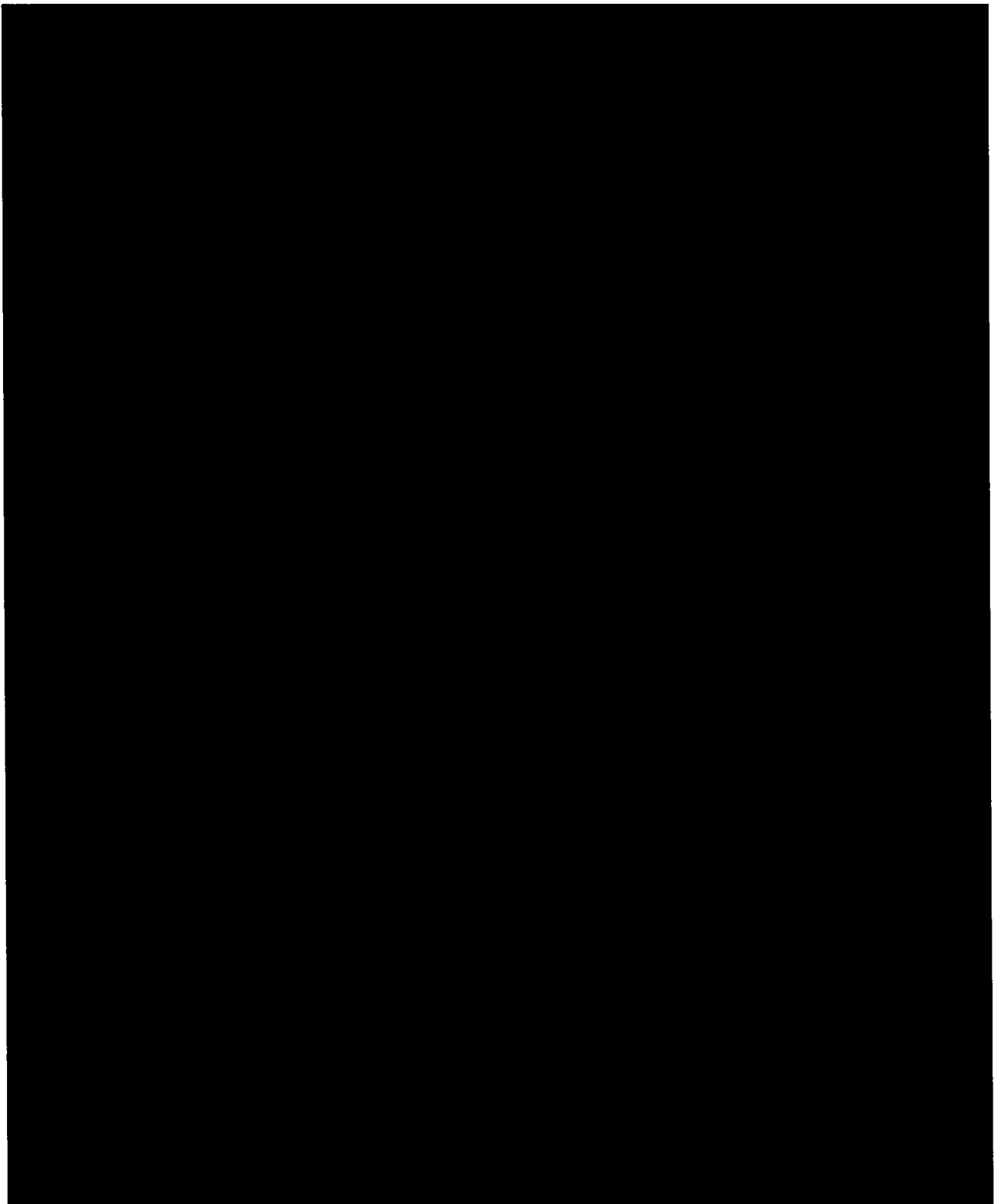


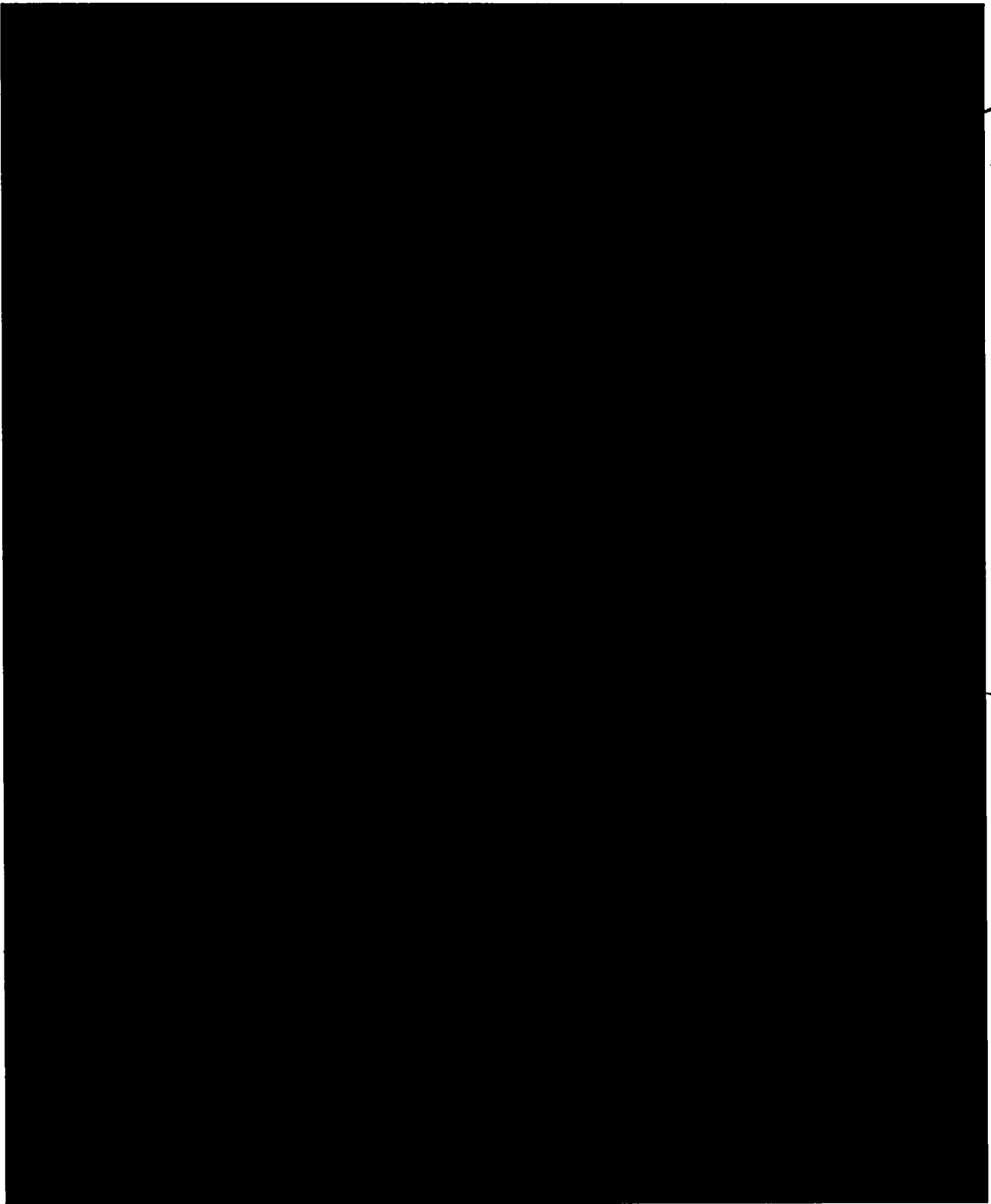


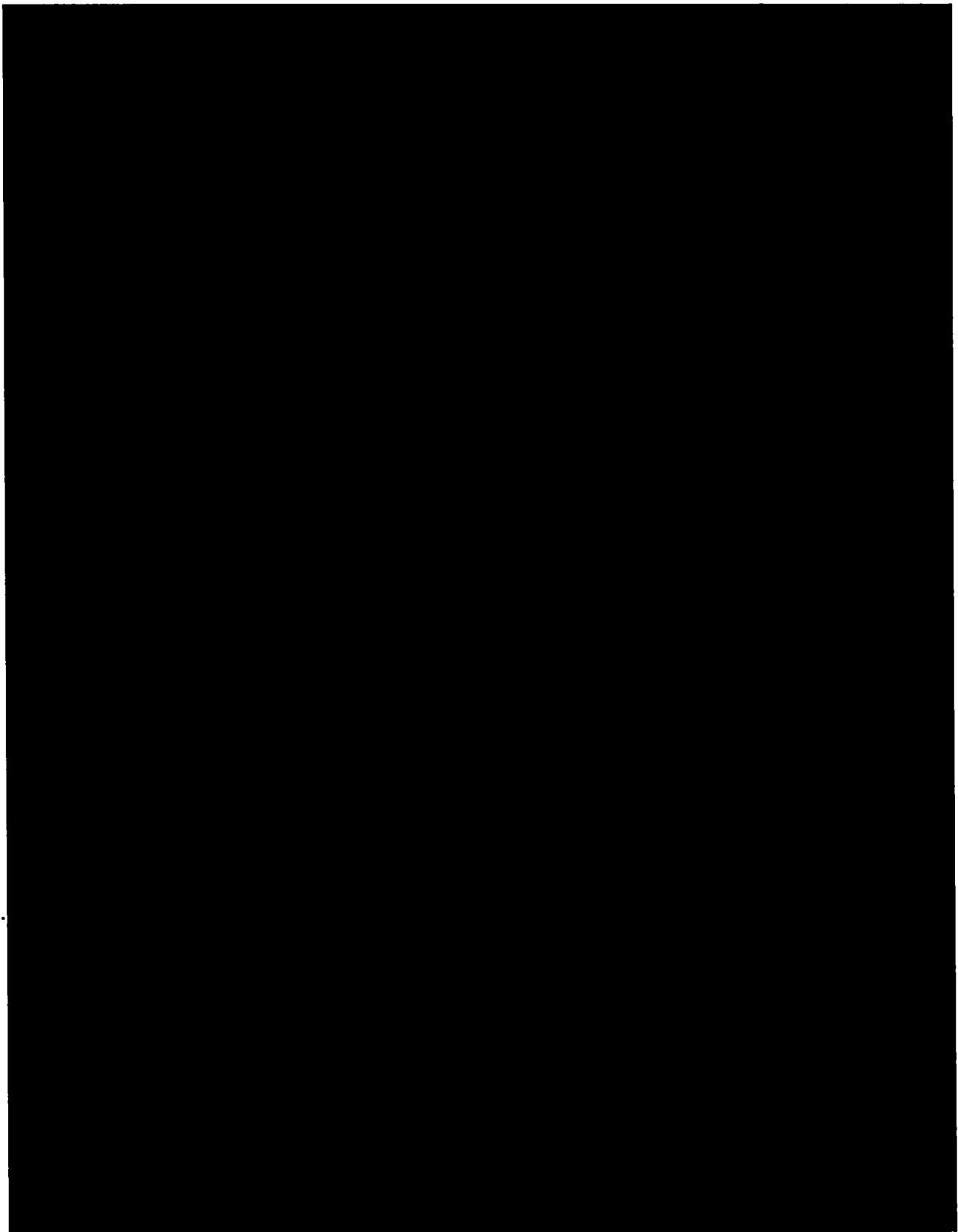


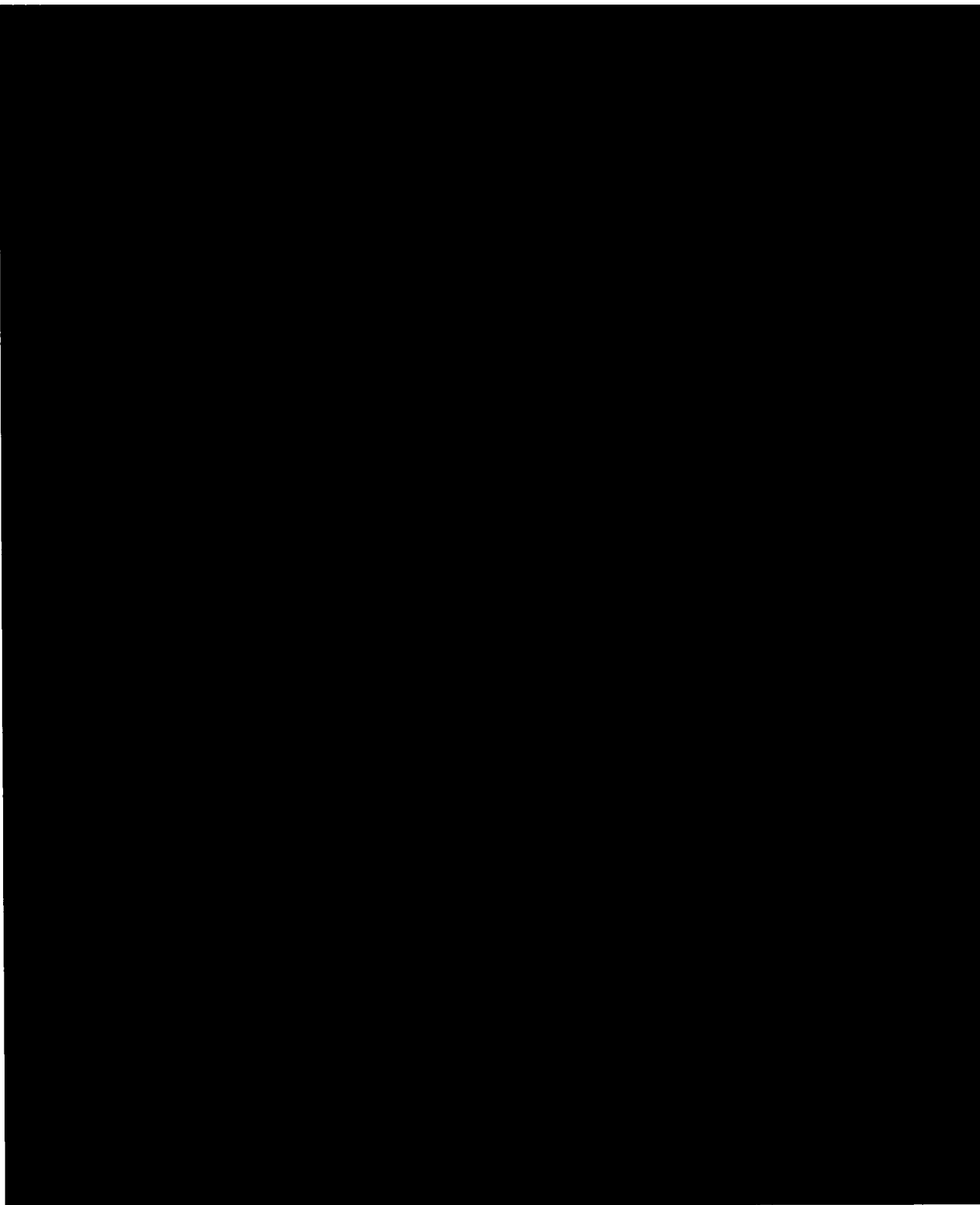


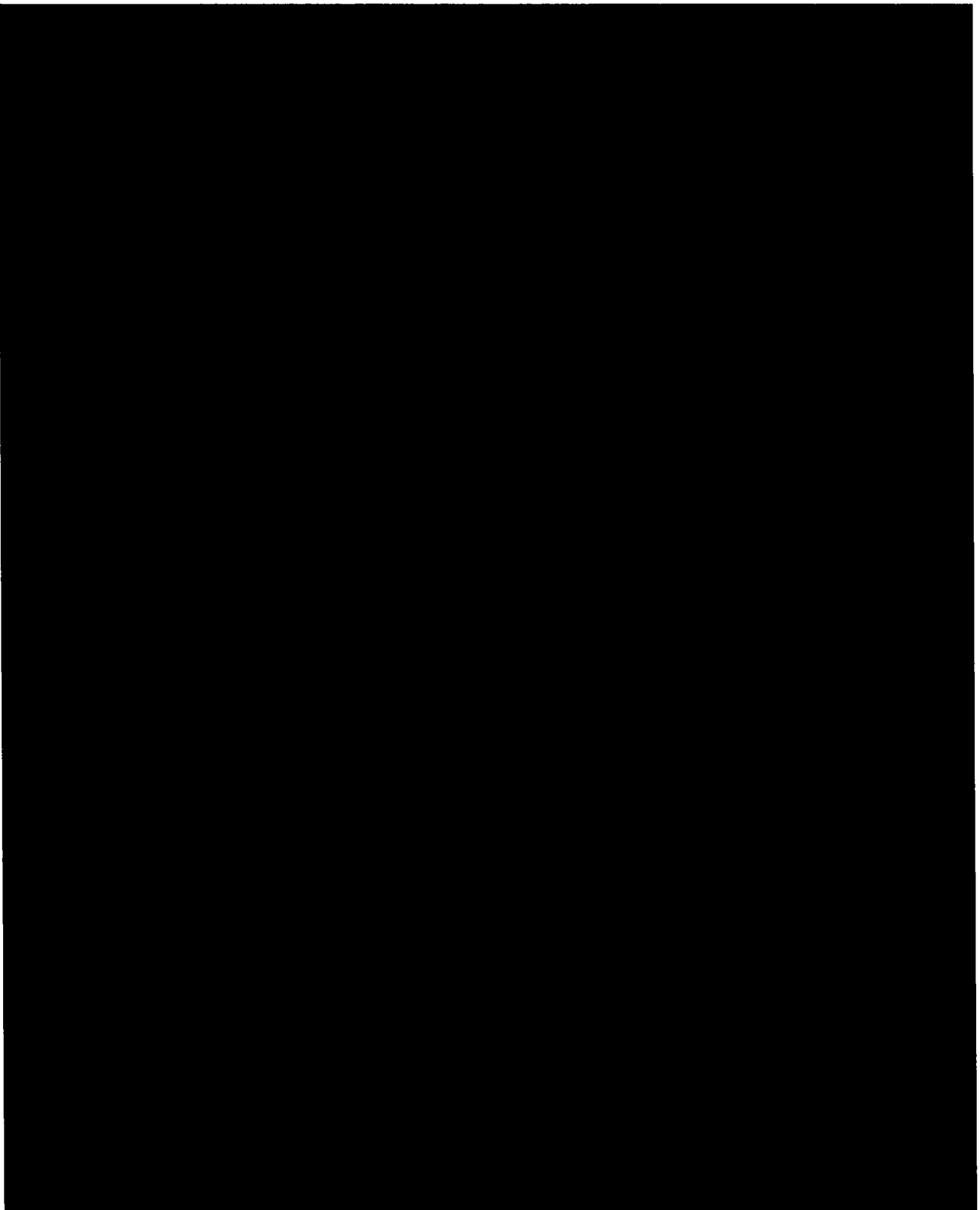


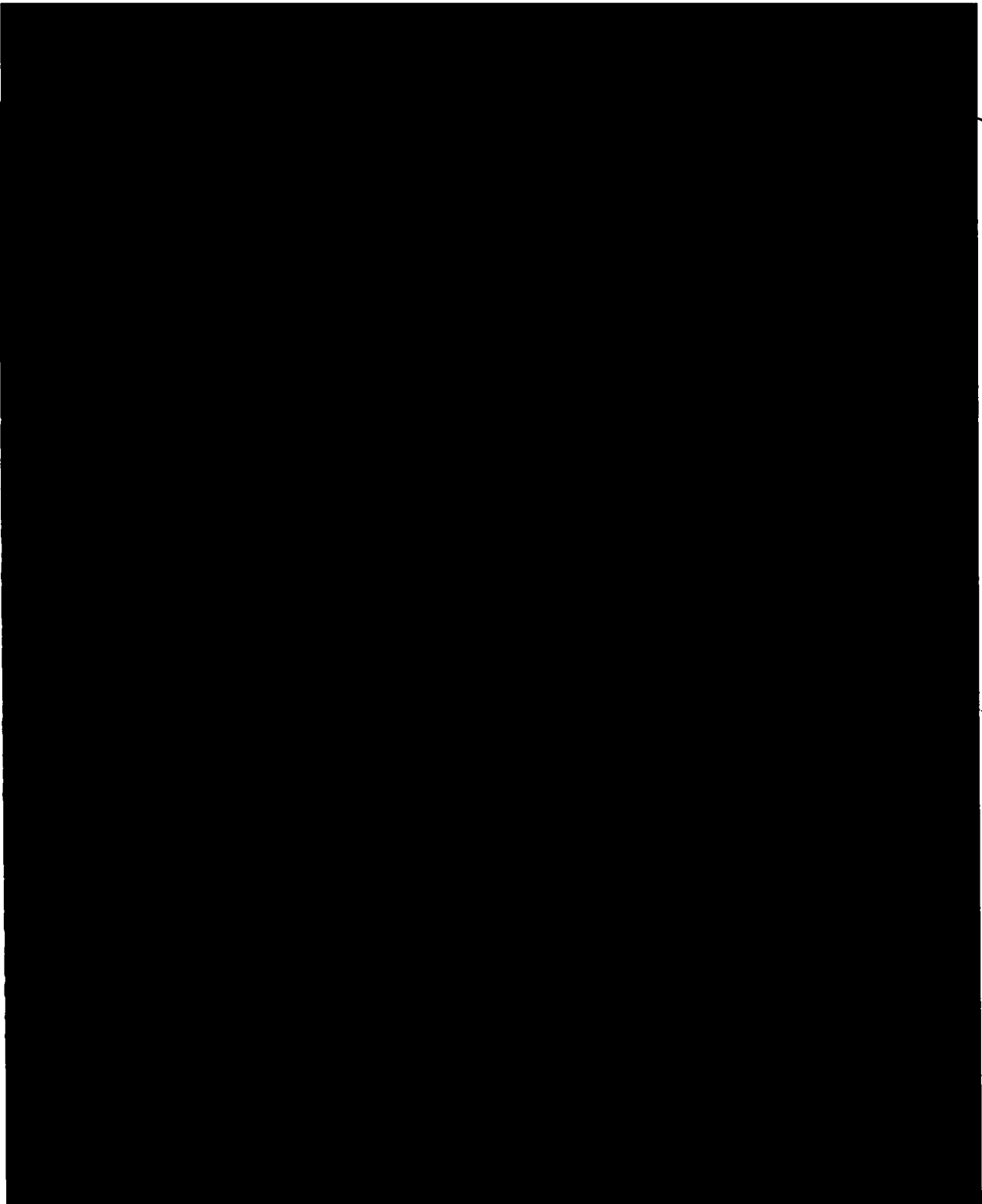


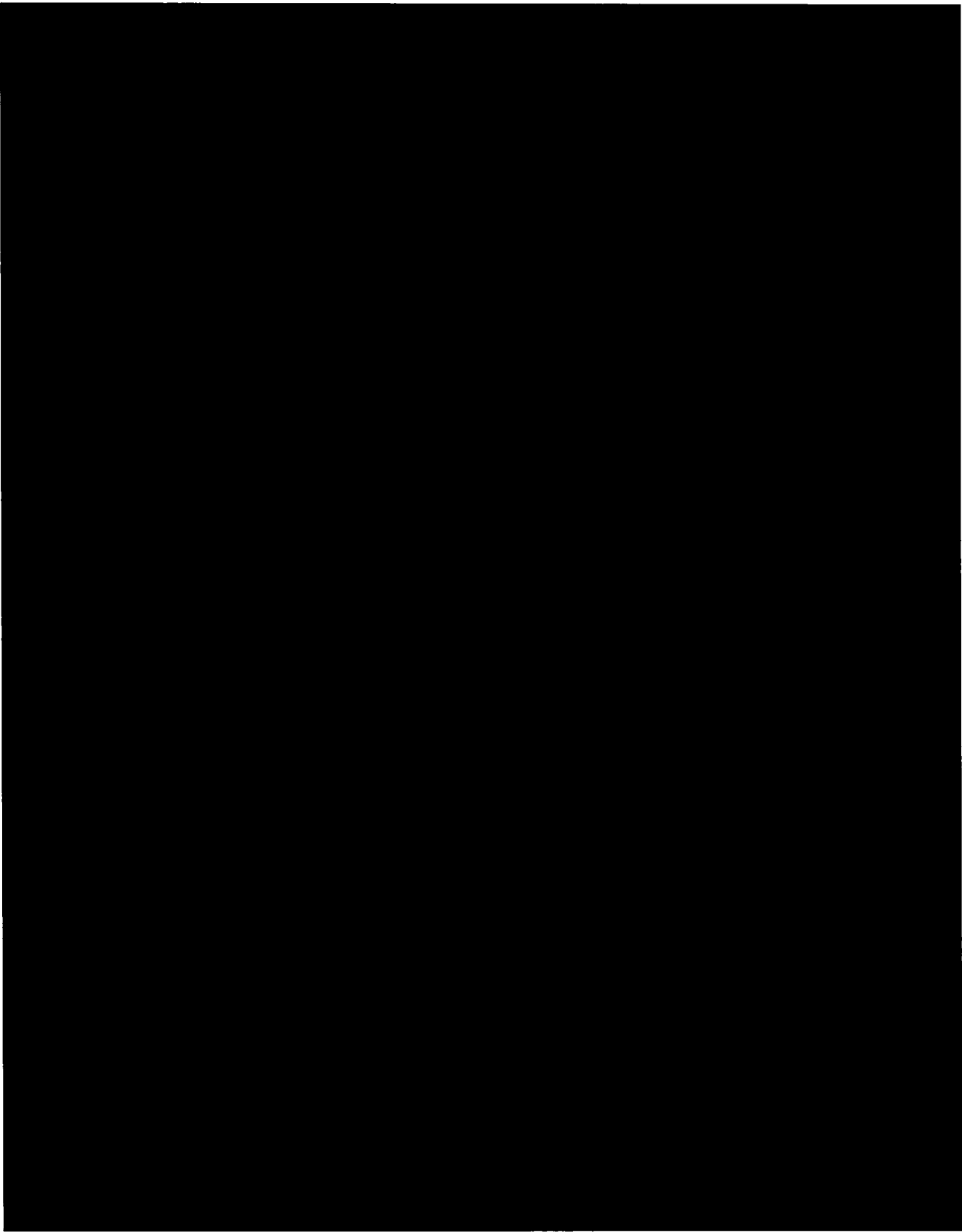


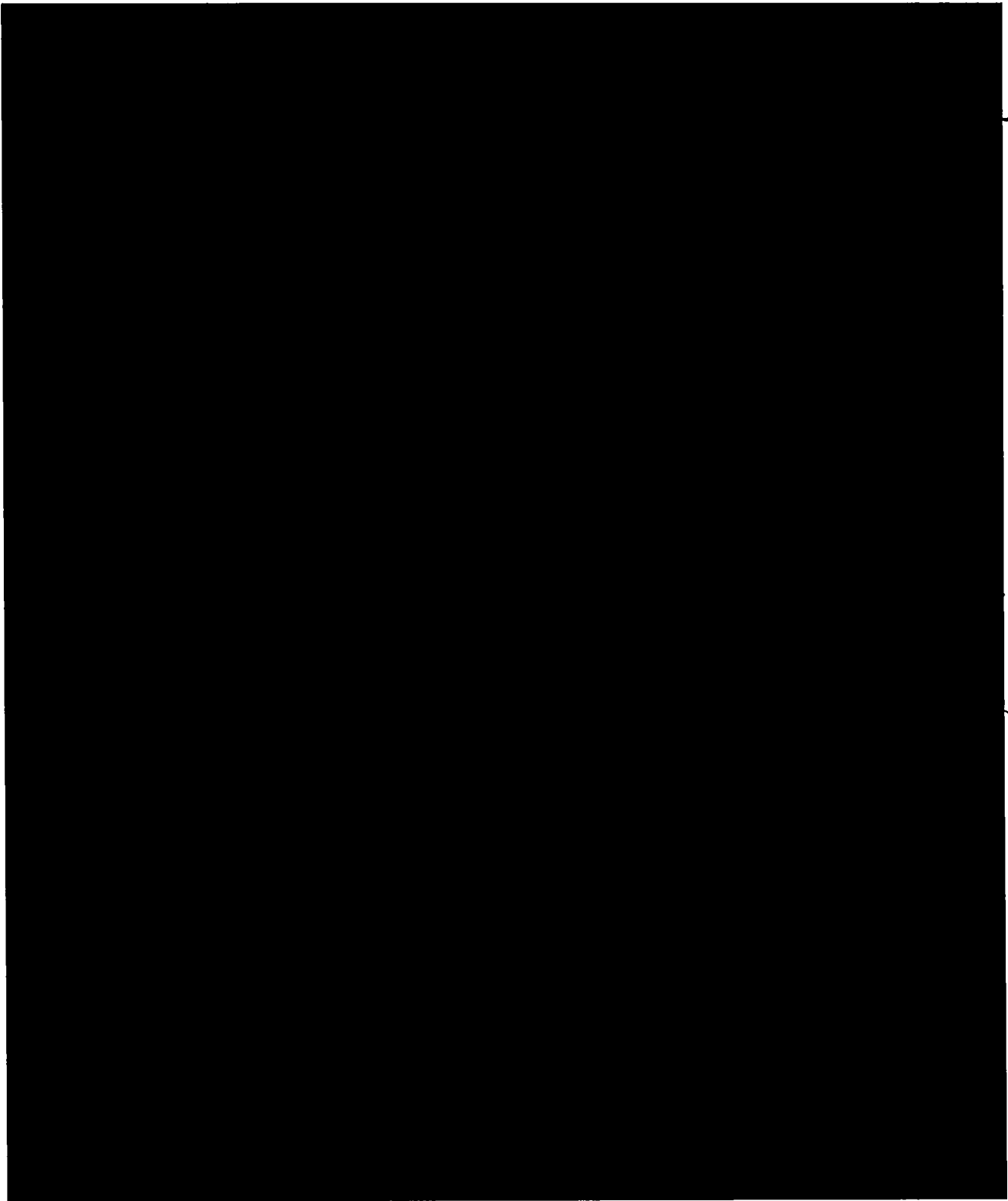


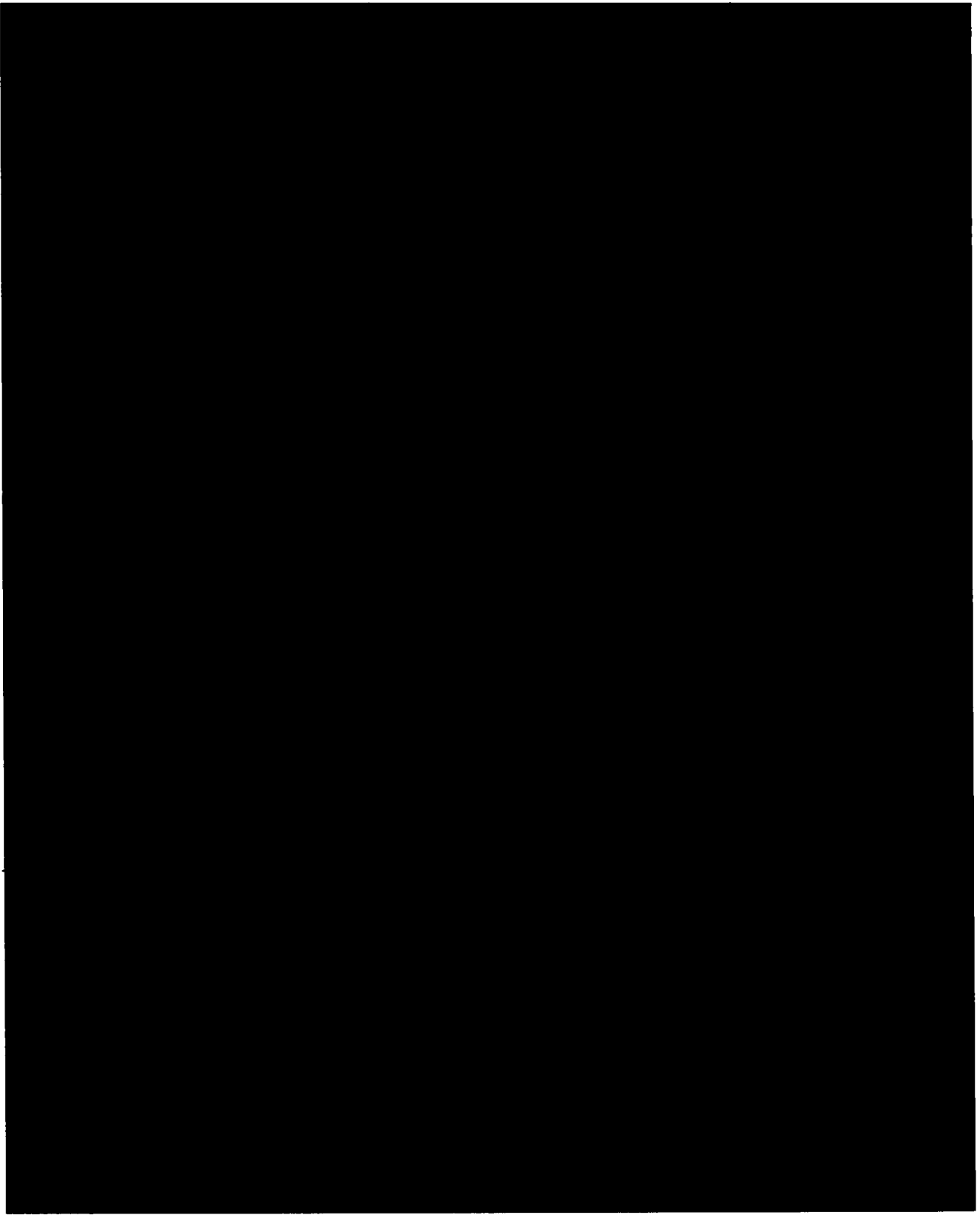


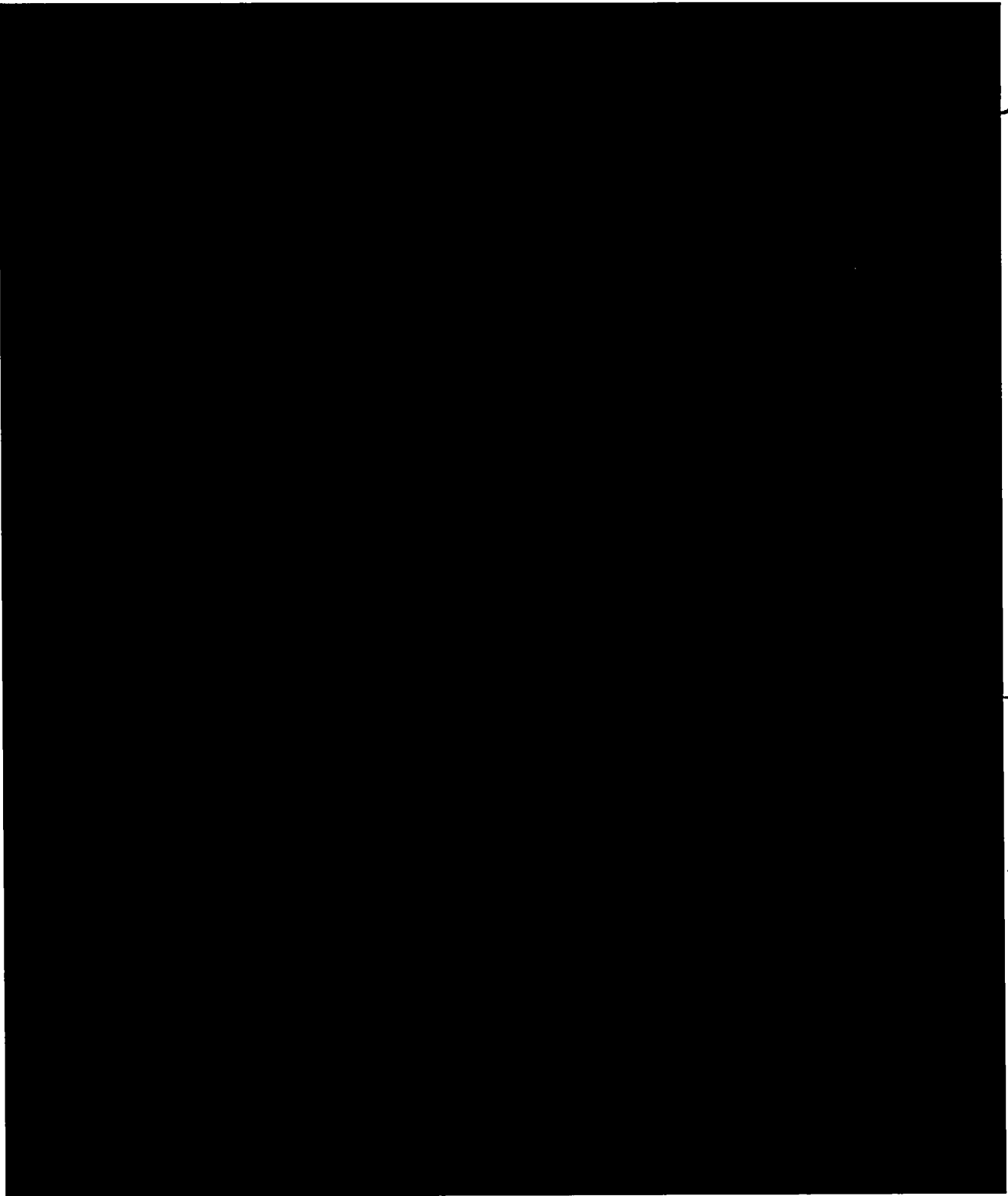


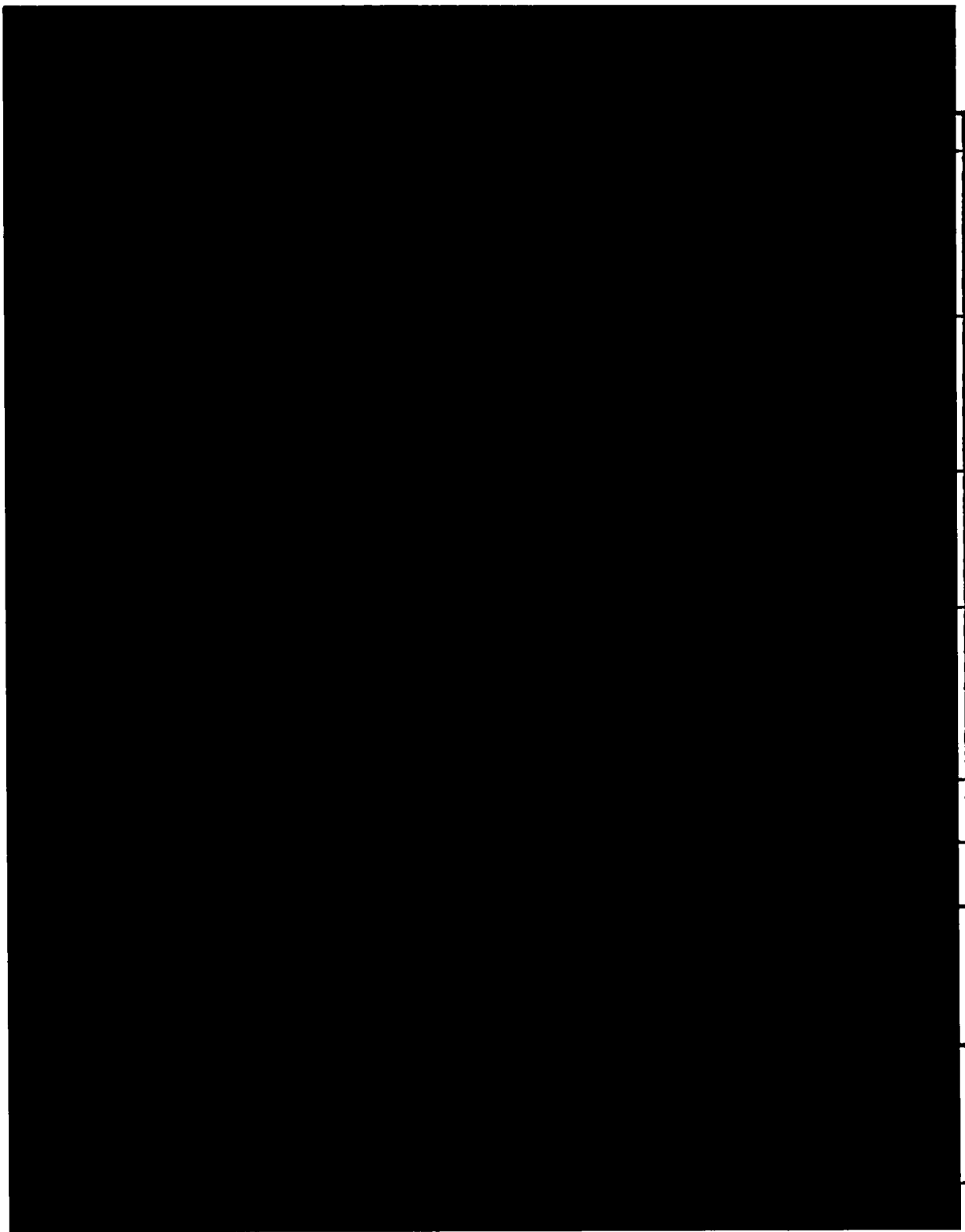












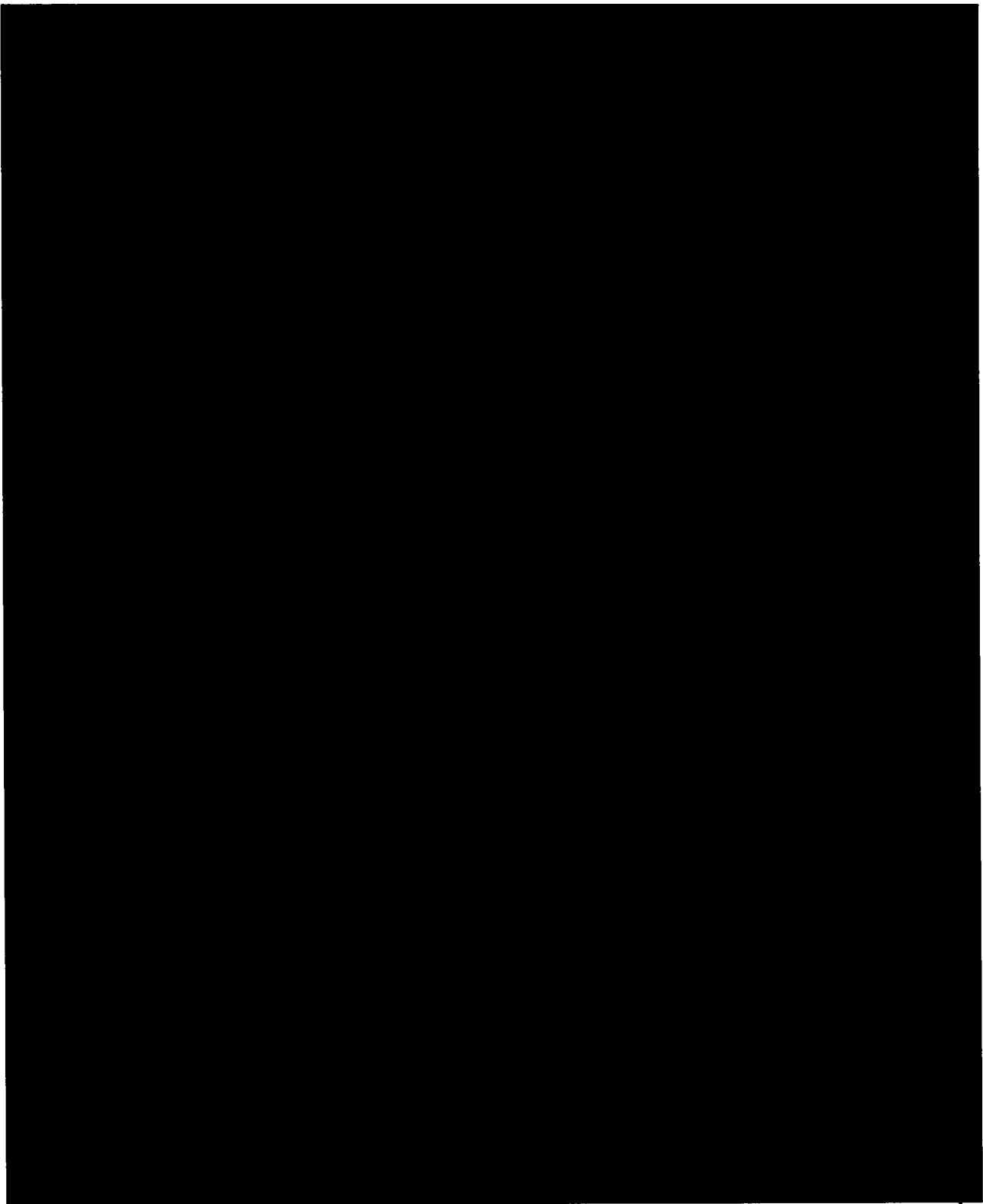
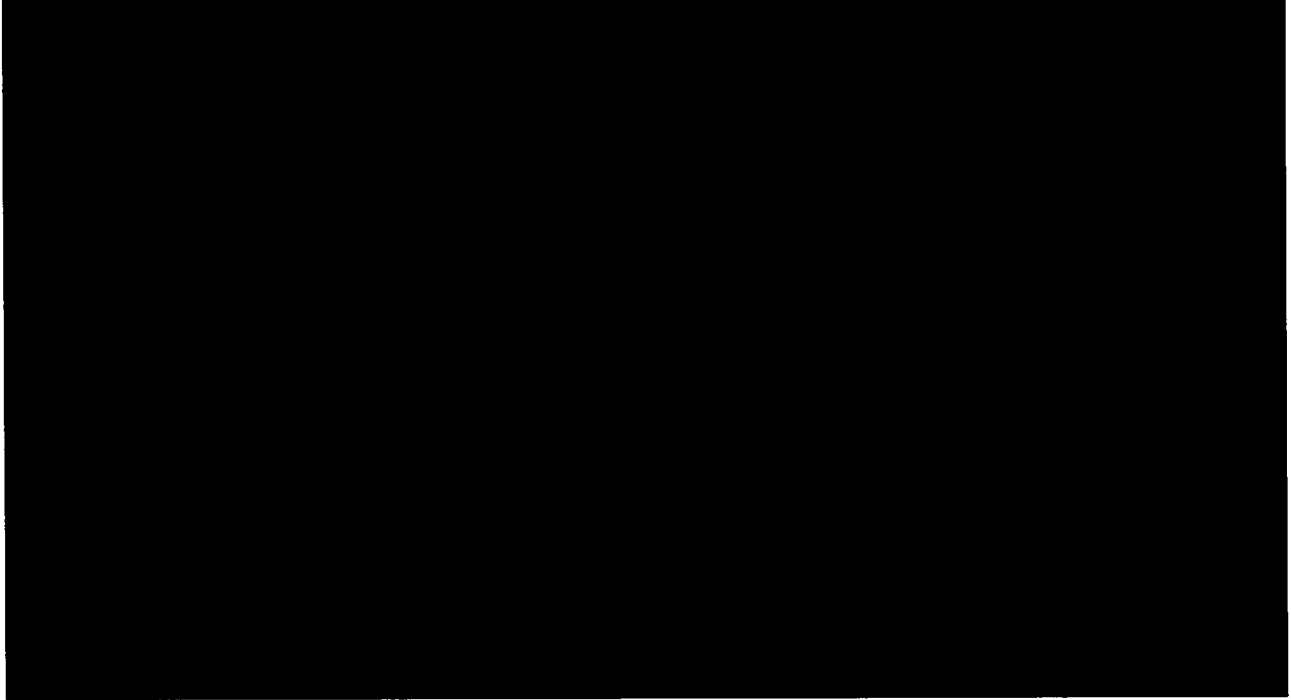
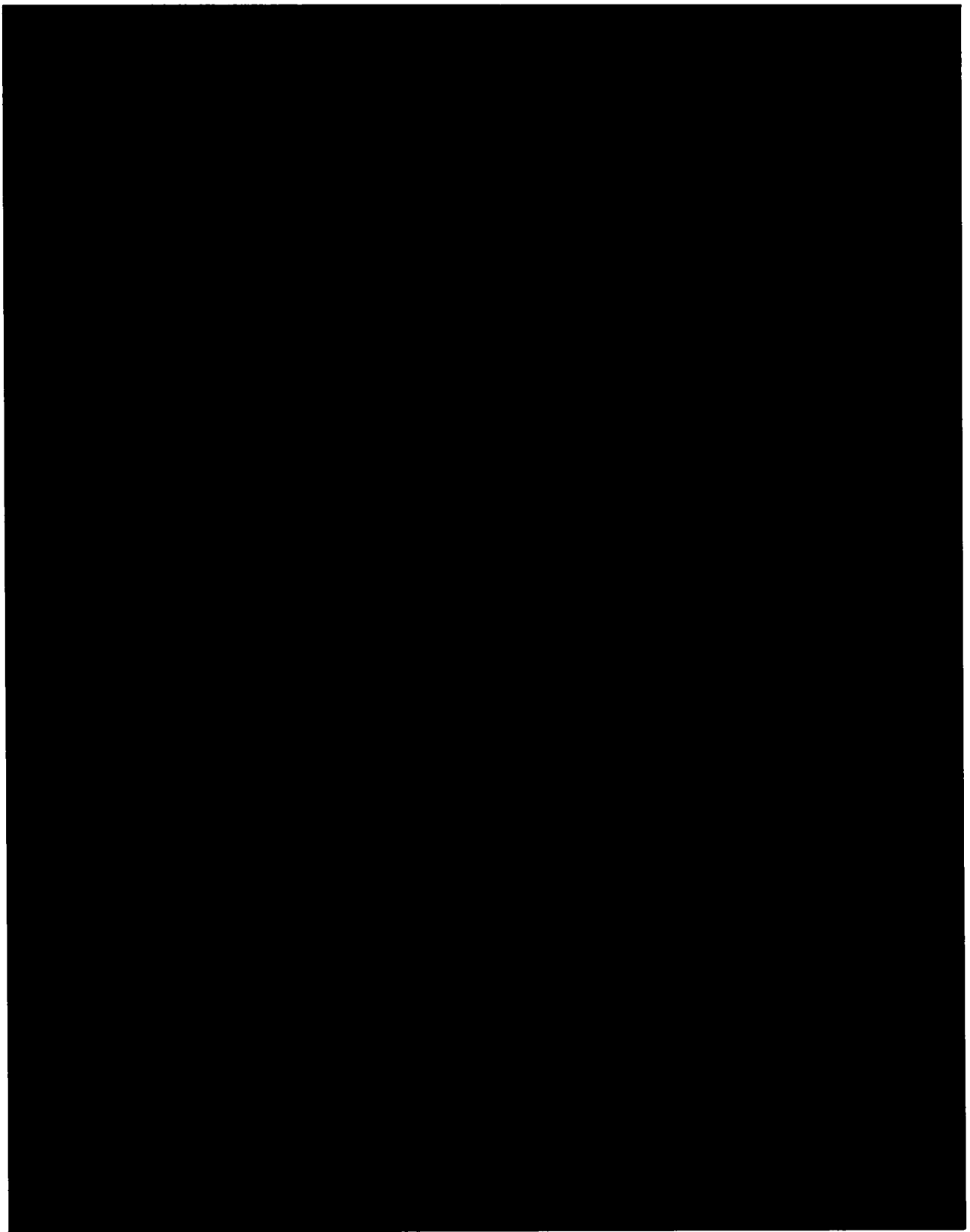


Table 3.7-19 Chemical Laboratory

Page 7 of 7





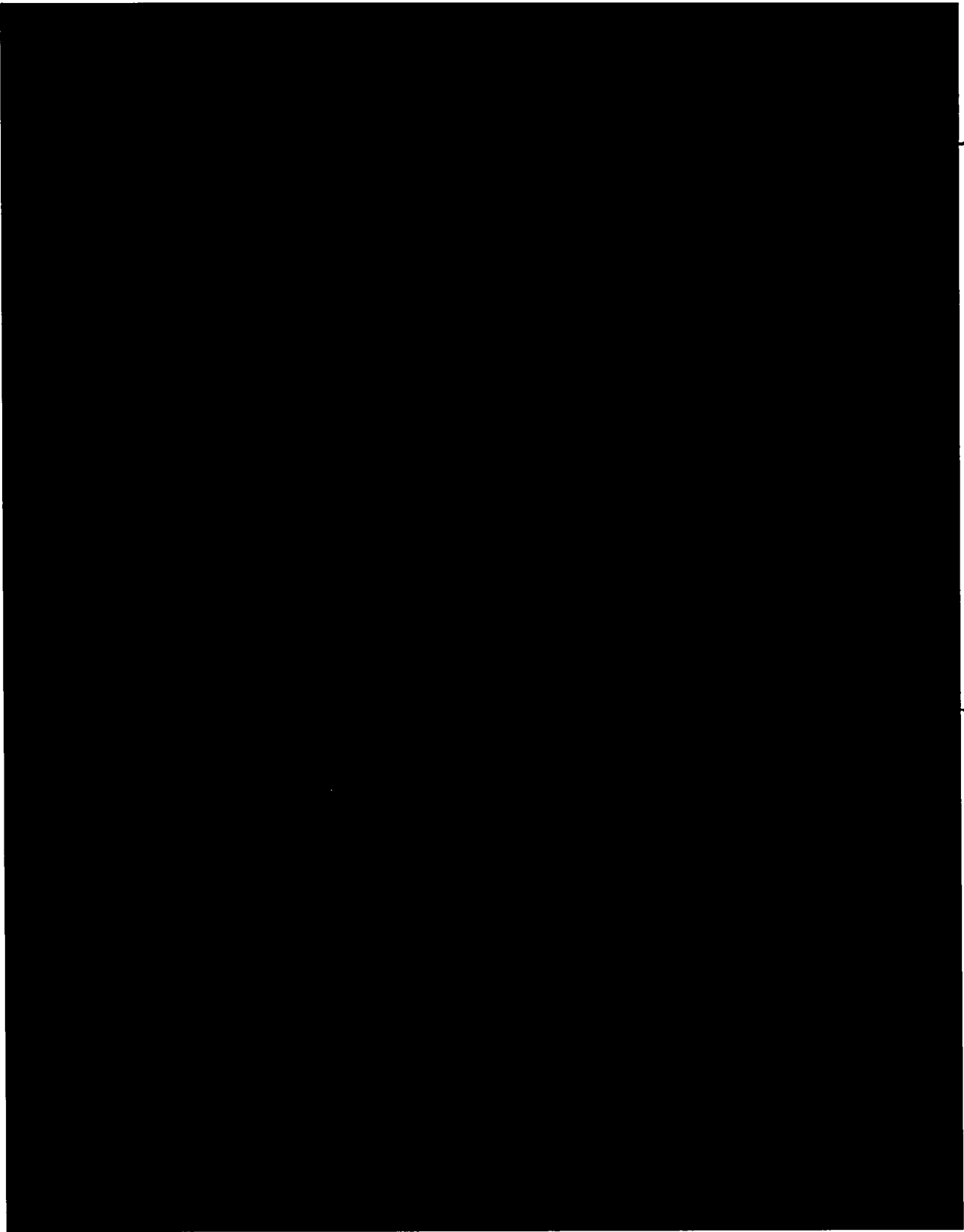


Table 3.7-20 Mass Spectrometry

Page 3 of 3

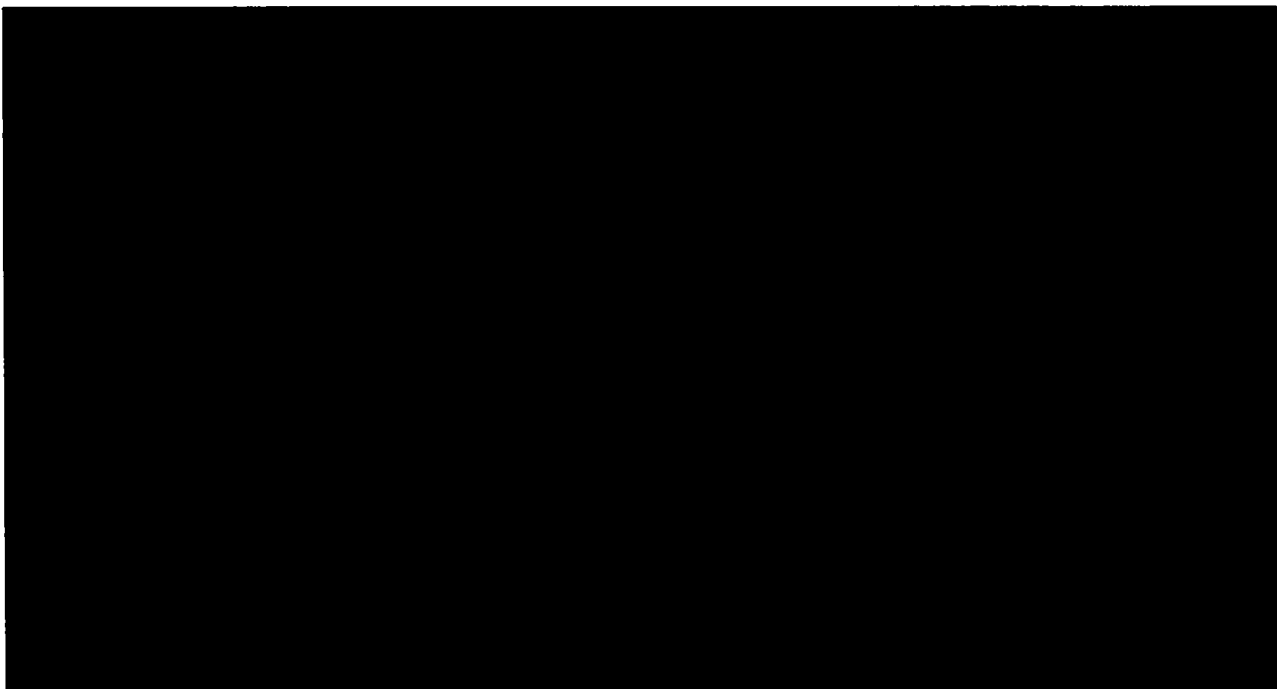


Table 3.7-21 Cylinder Preparation System
Page 1 of 14

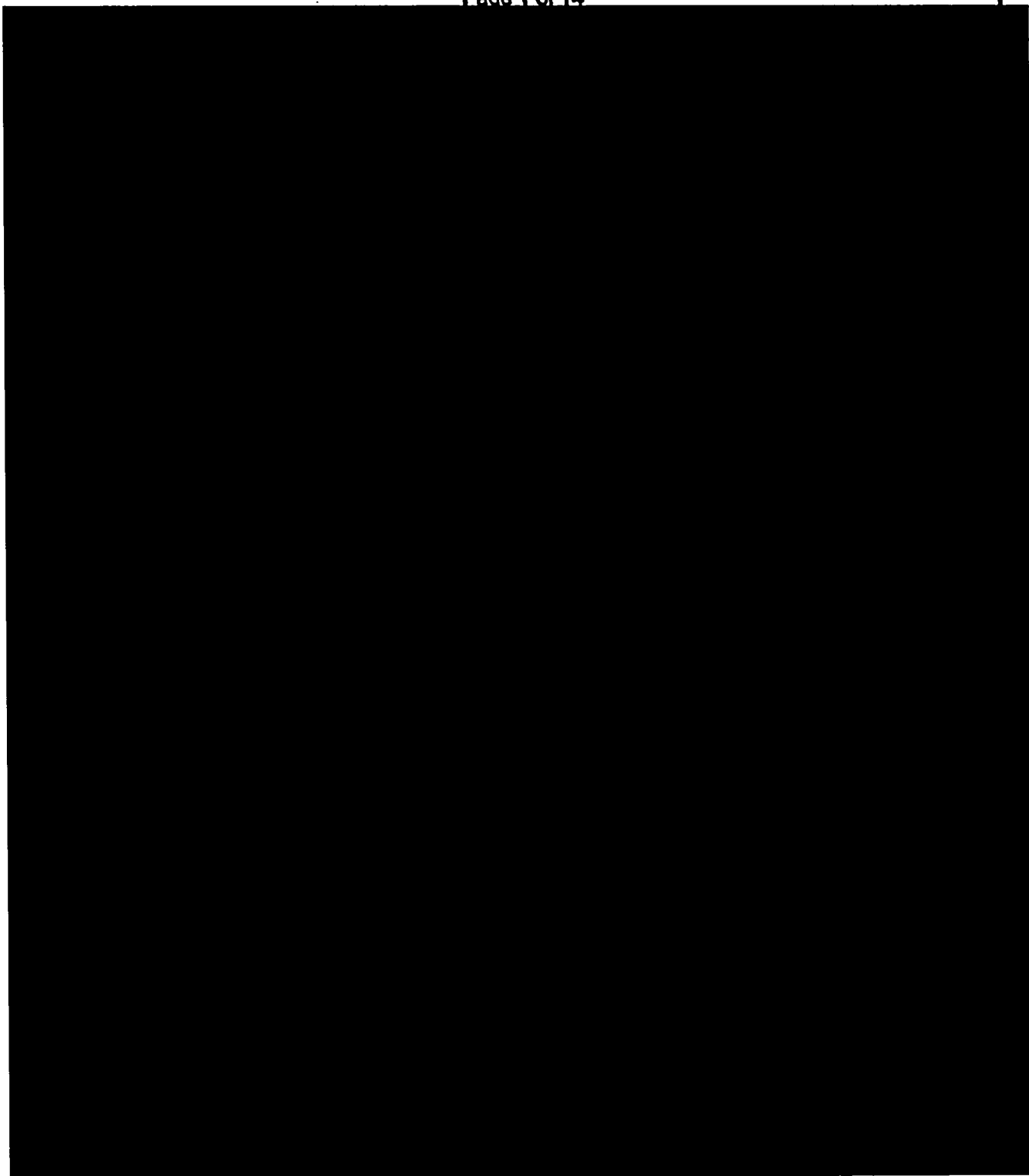


Table 3.7-21 Cylinder Preparation System

Page 2 of 14

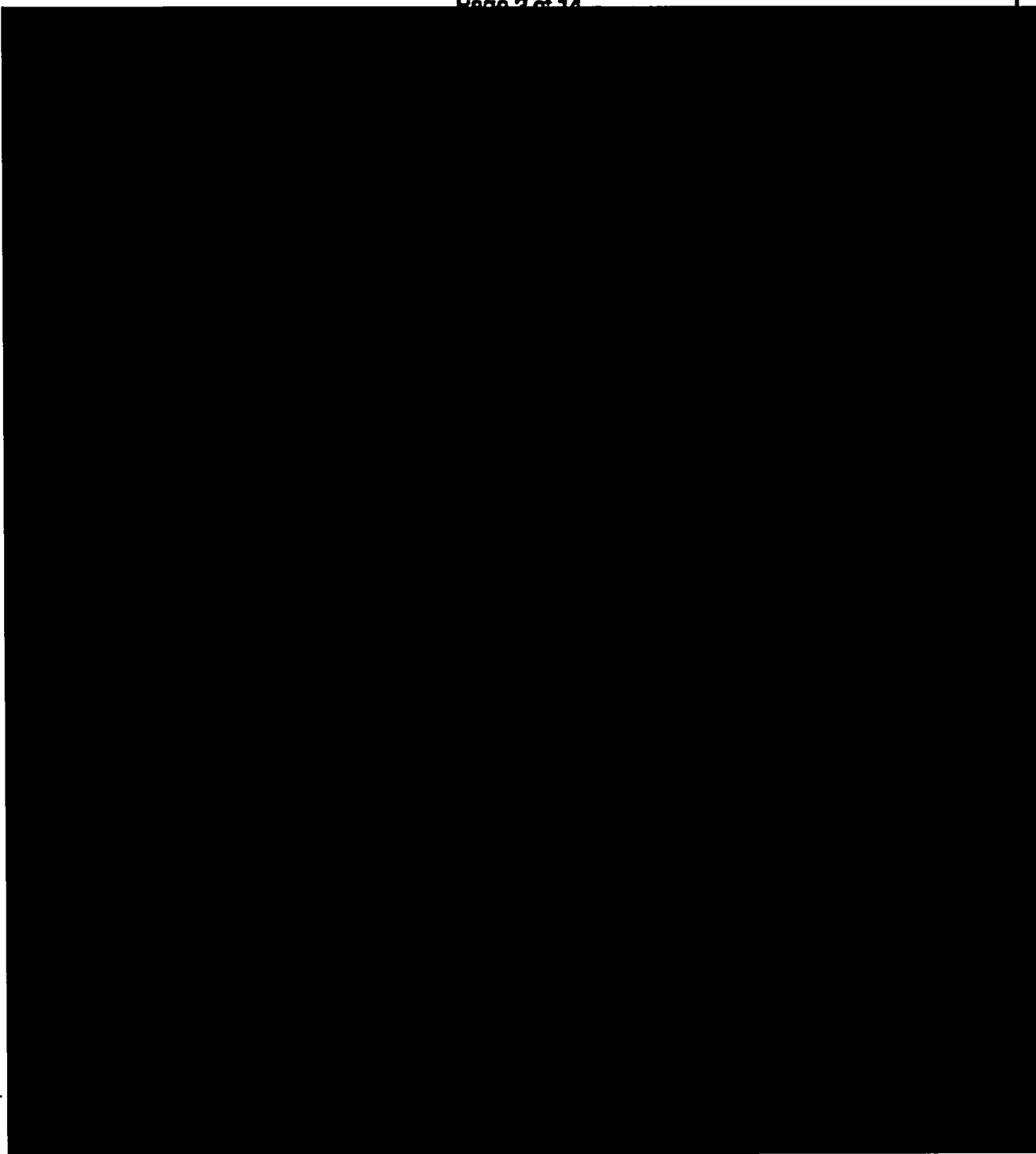


Table 3.7-21 Cylinder Preparation System

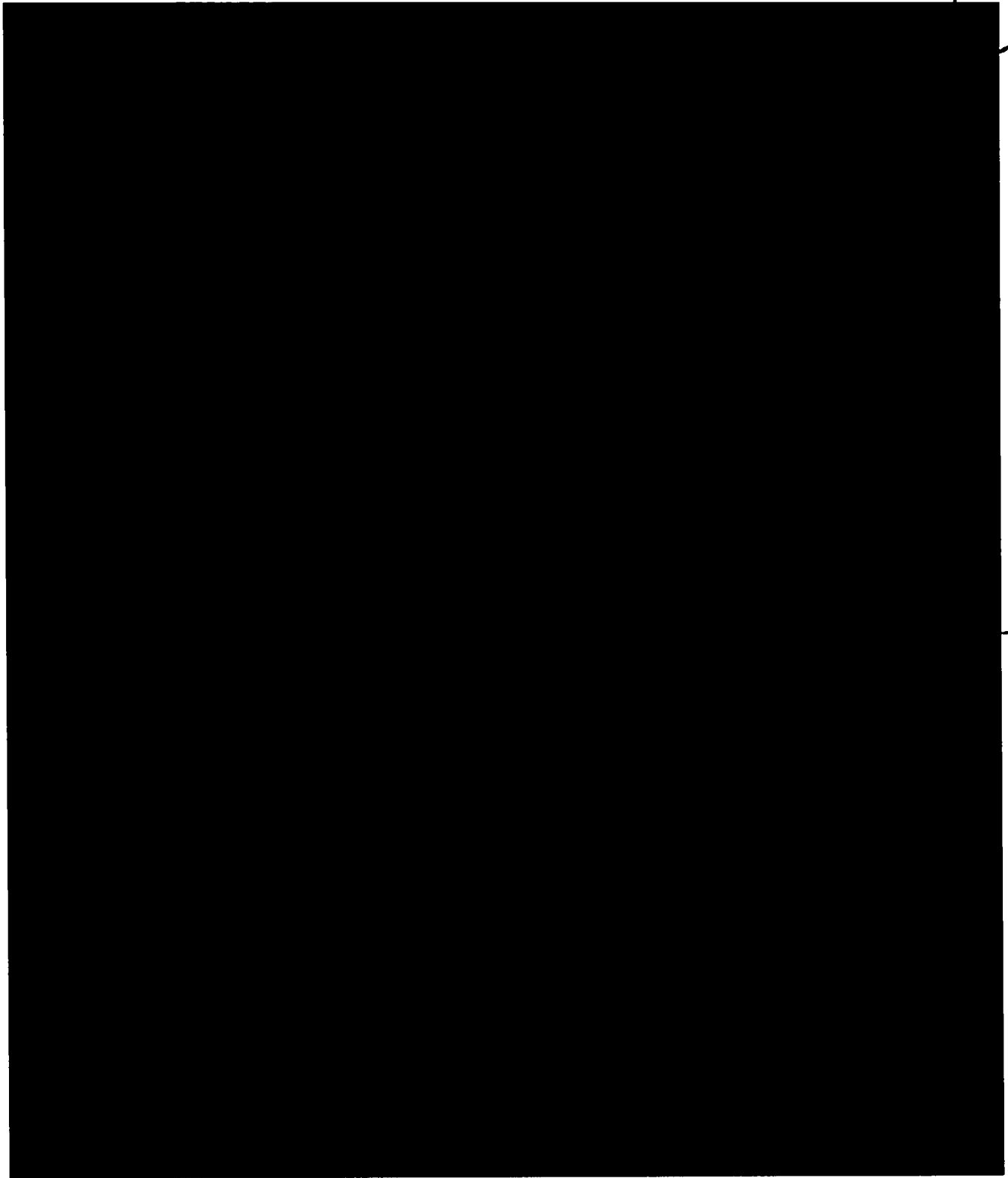


Table 3.7-21 Cylinder Preparation System

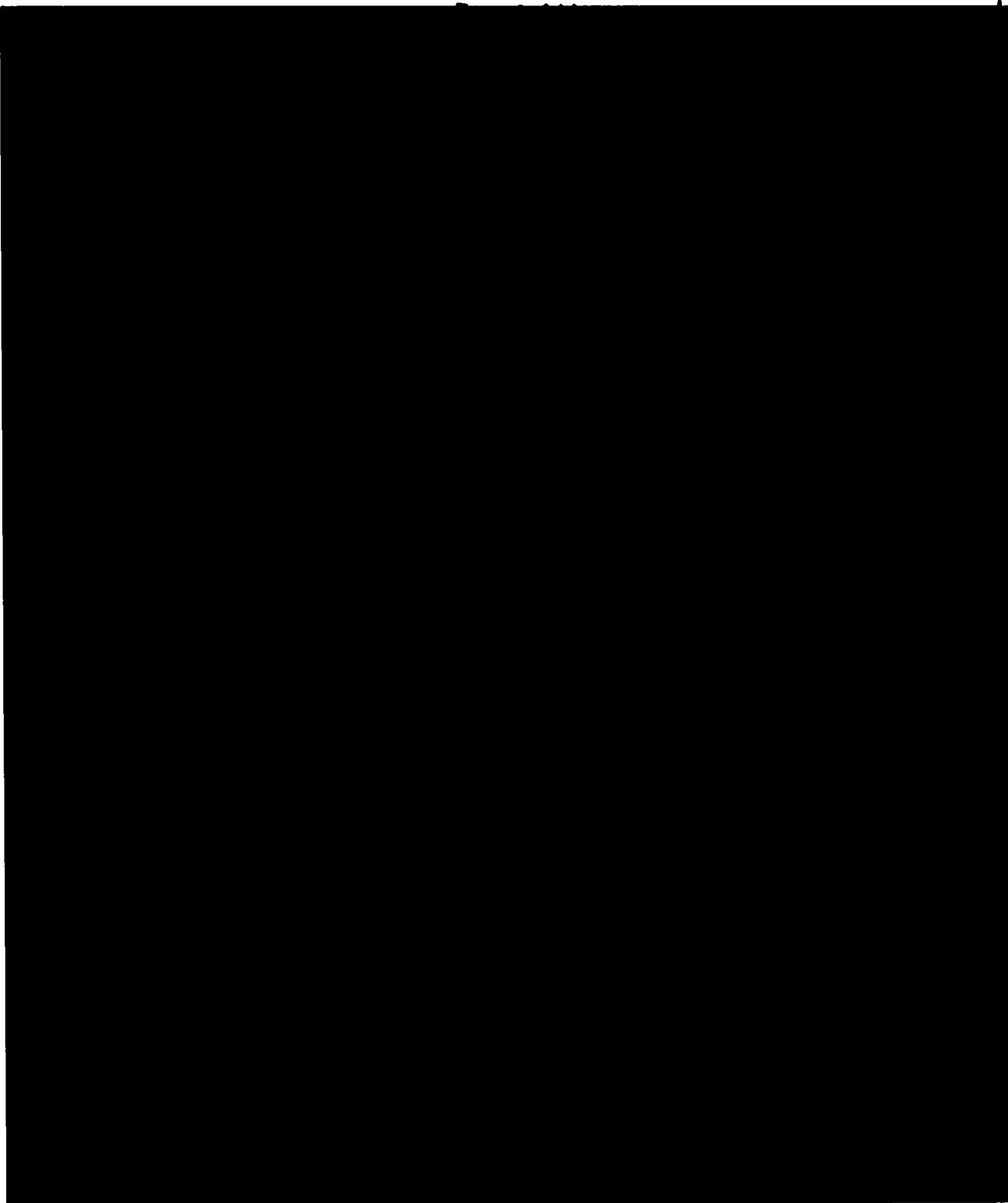


Table 3.7-21 Cylinder Preparation System

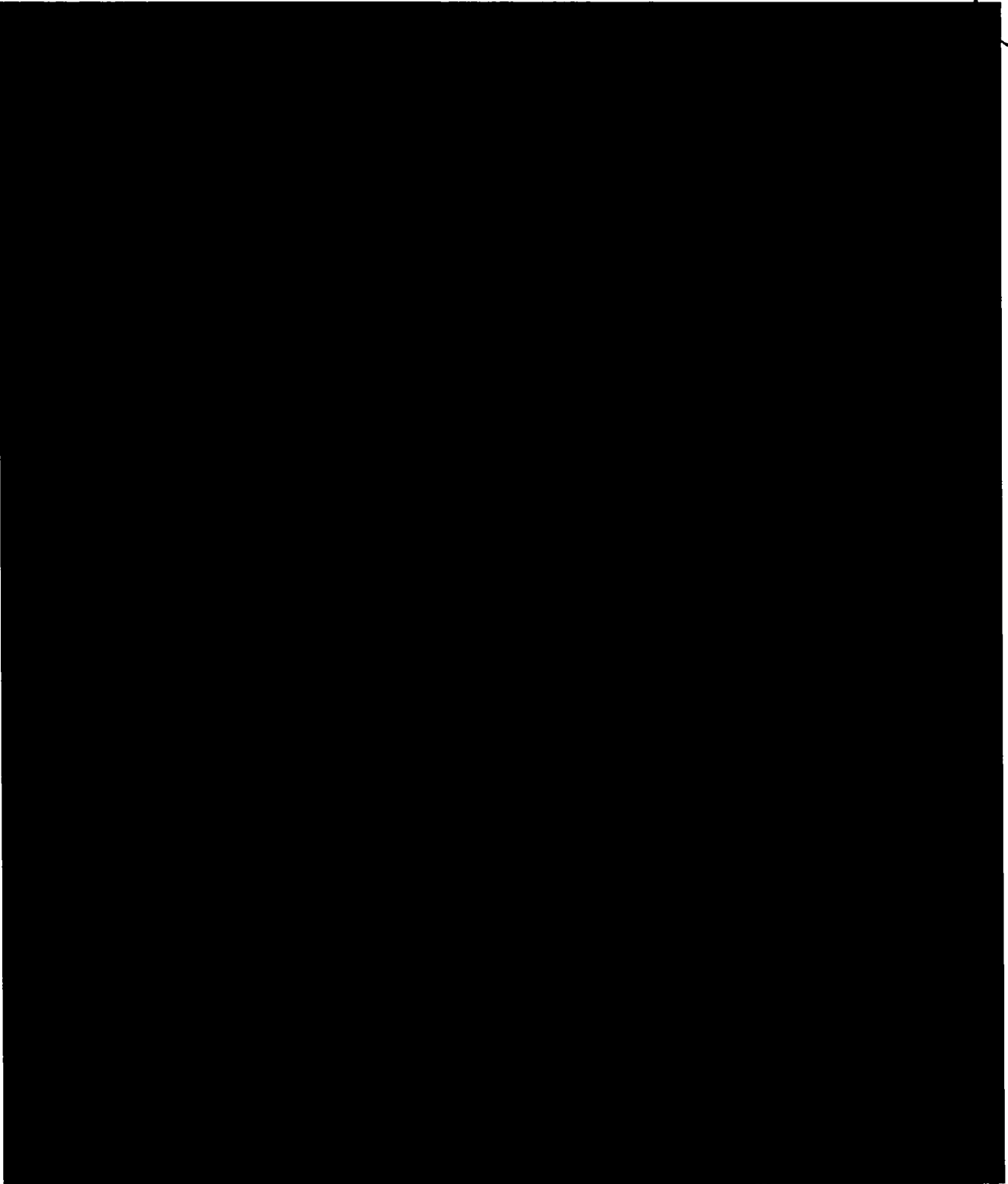


Table 3.7-21 Cylinder Preparation System

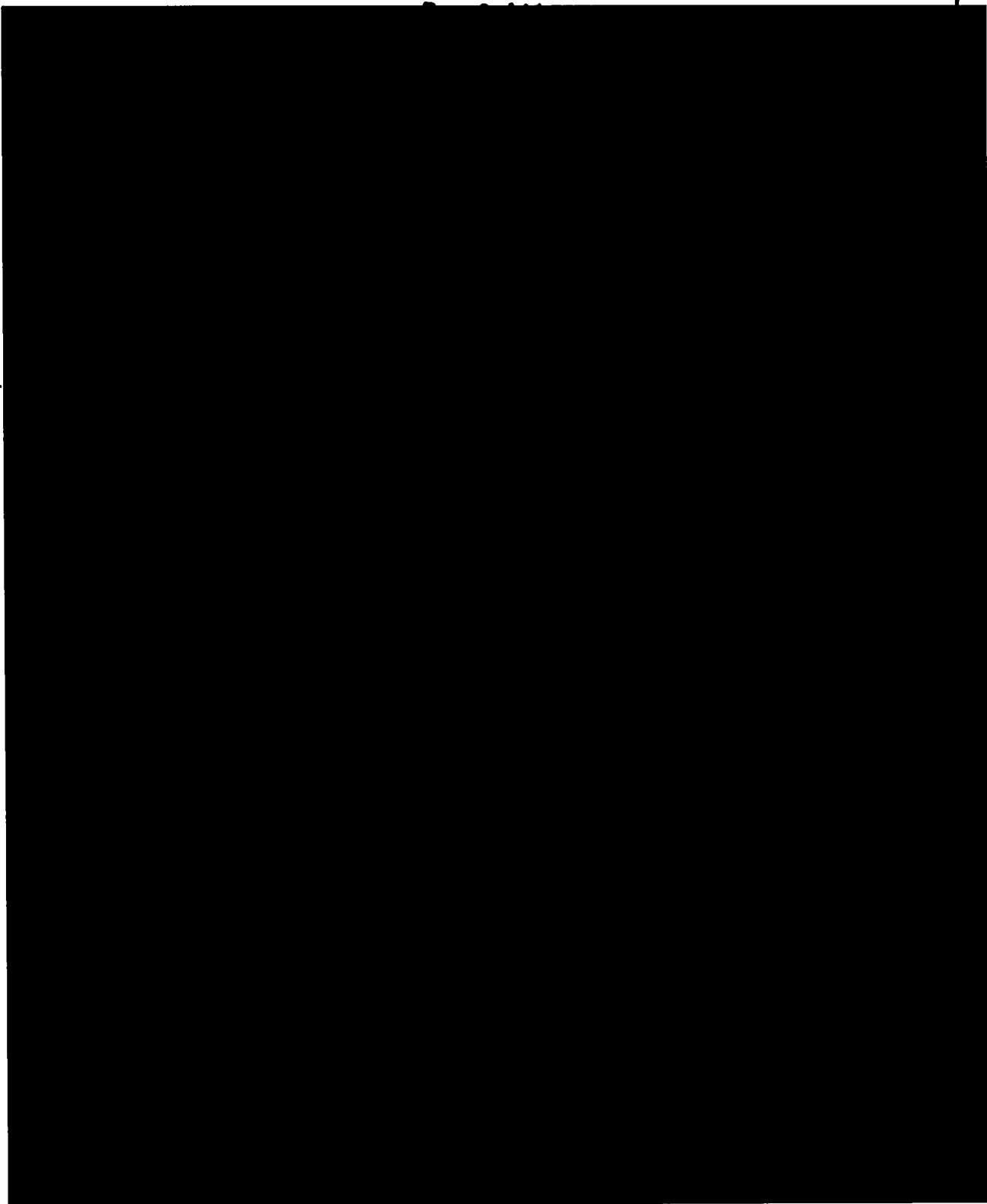


Table 3.7-21 Cylinder Preparation System

Page 7 of 11

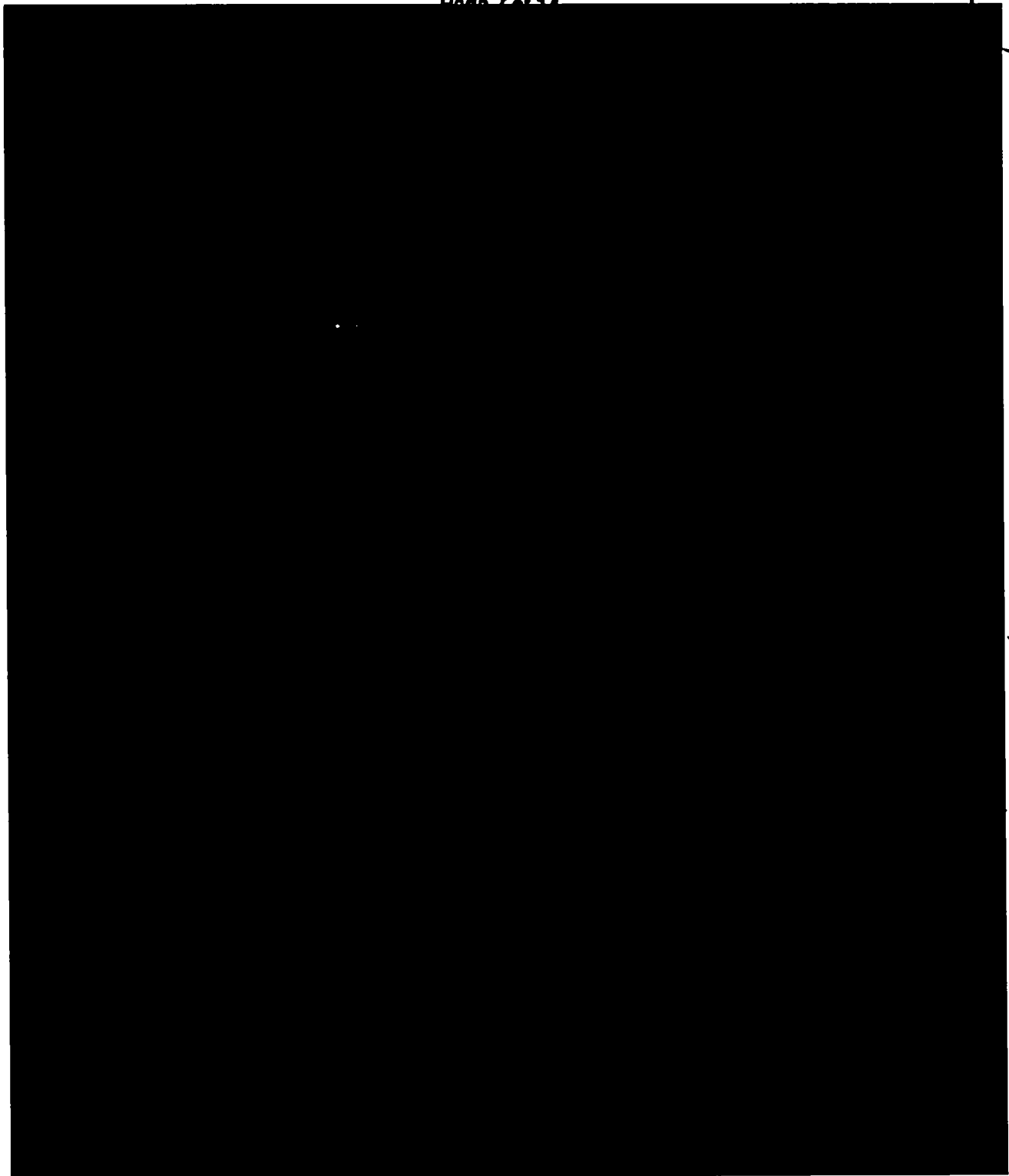


Table 3.7-21 Cylinder Preparation System

Page 8 of 14

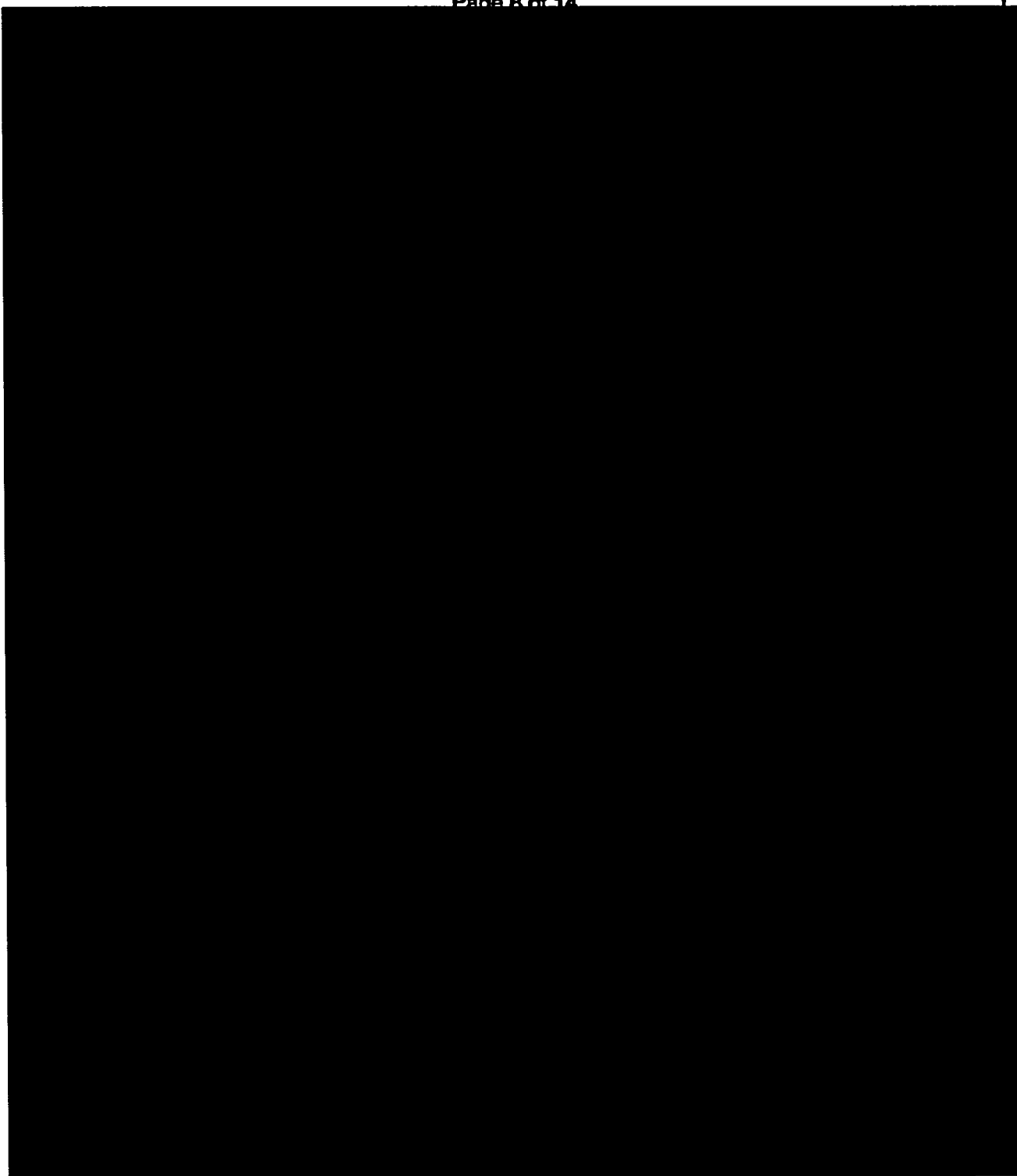


Table 3.7-21 Cylinder Preparation System

Page 9 of 14

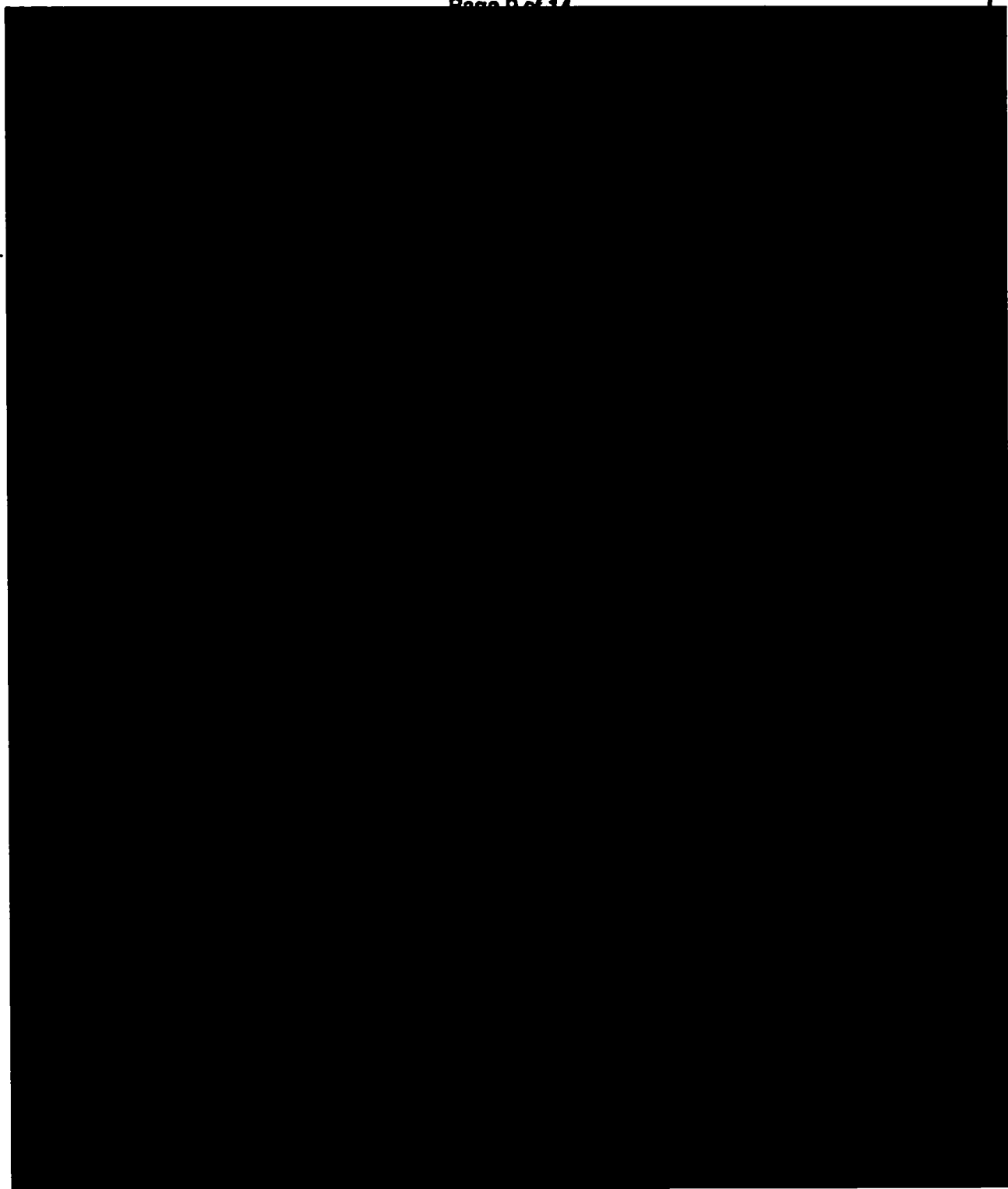


Table 3.7-21 Cylinder Preparation System

Page 10 of 14

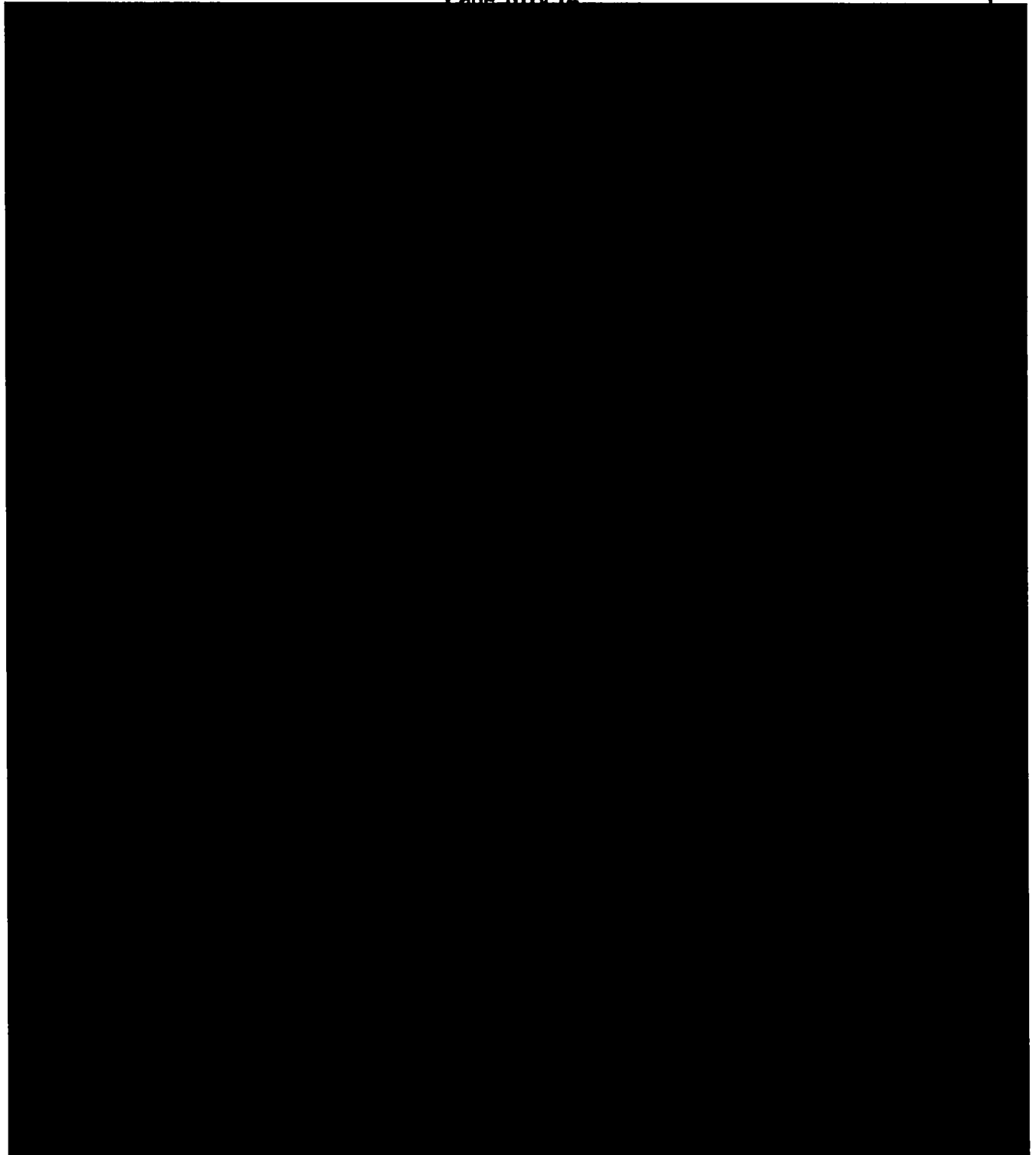


Table 3.7-21 Cylinder Preparation System

Page 11 of 14

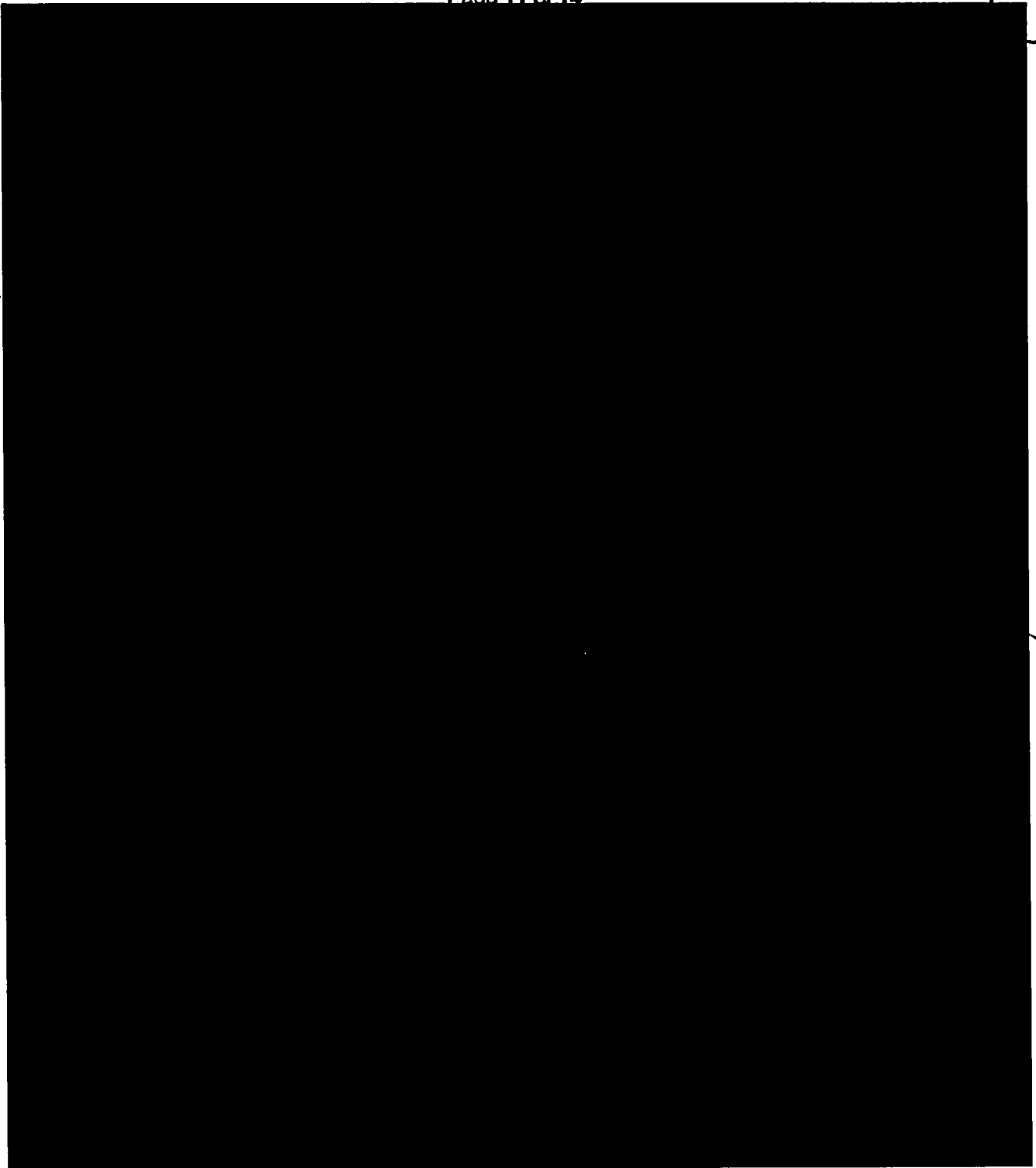


Table 3.7-21 Cylinder Preparation System

Page 18 of 44

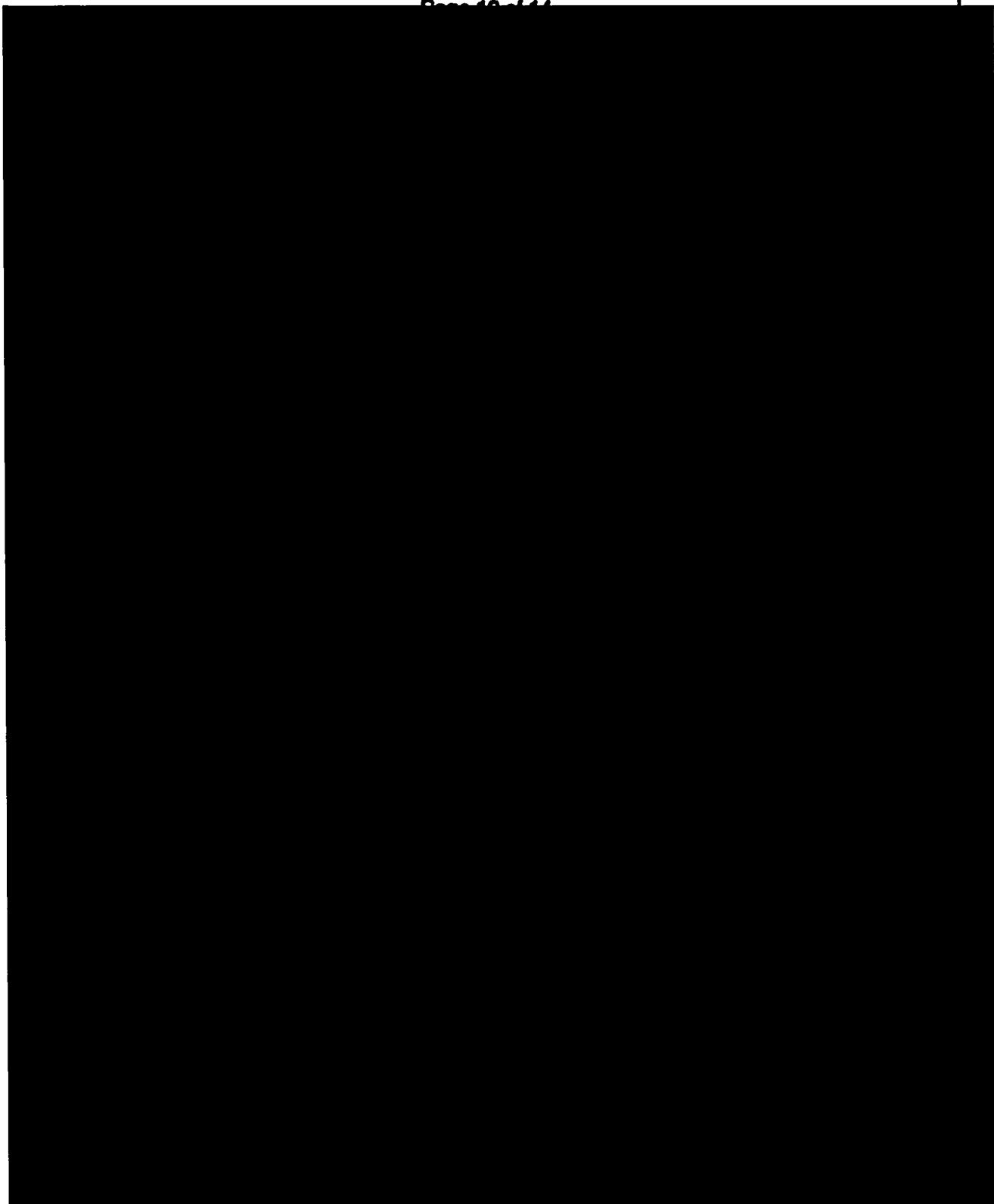


Table 3.7-21 Cylinder Preparation System

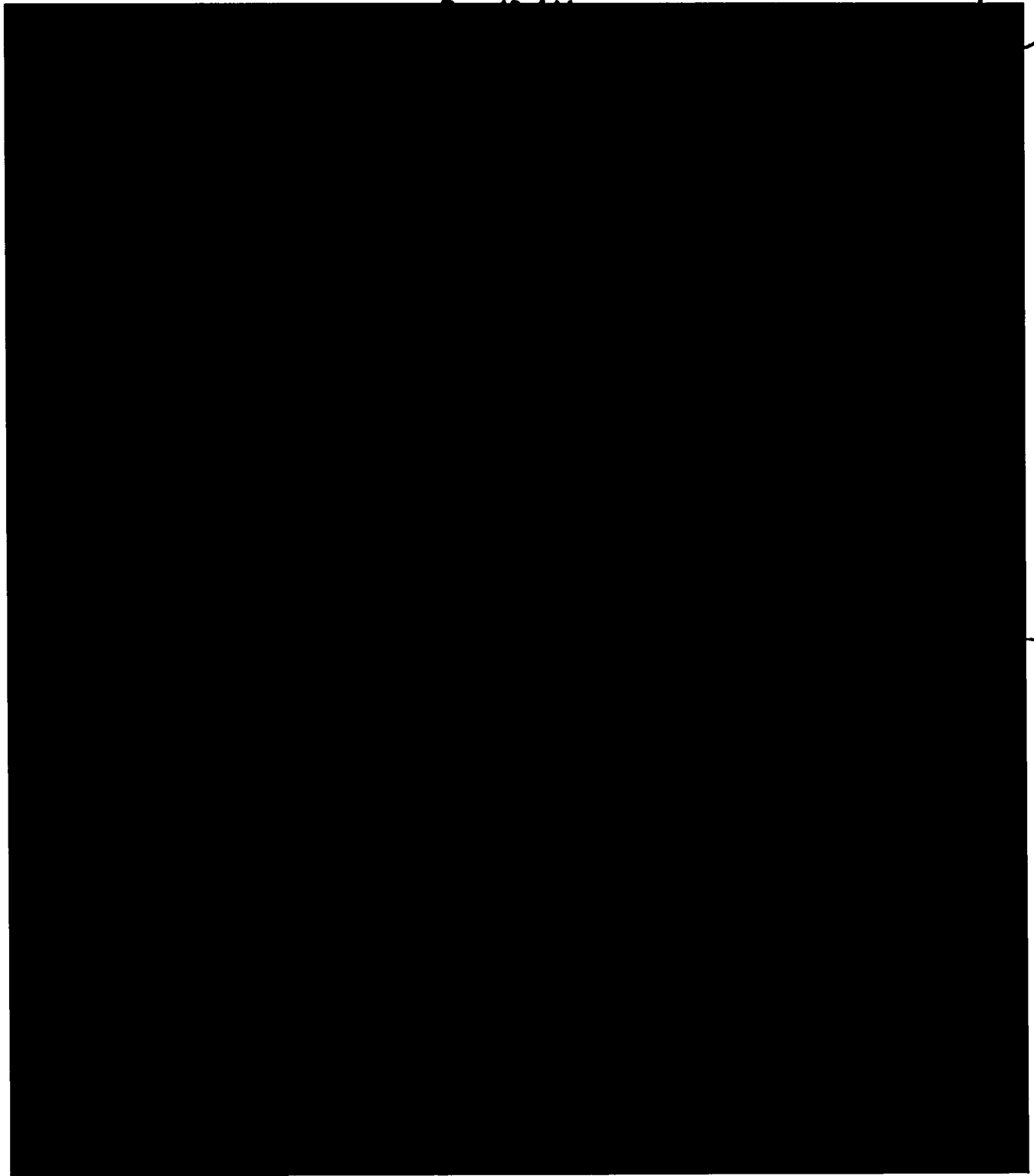
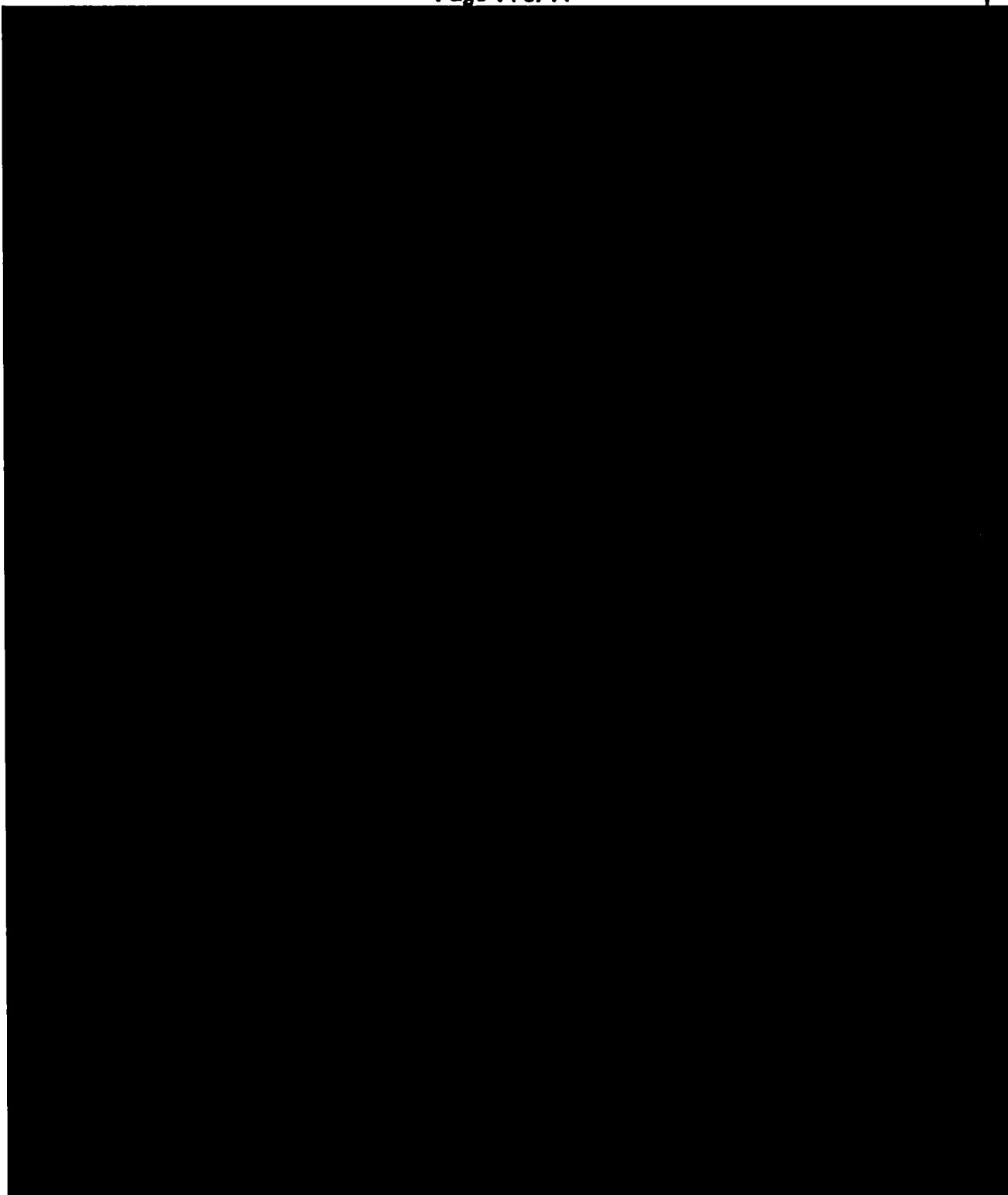


Table 3.7-21 Cylinder Preparation System

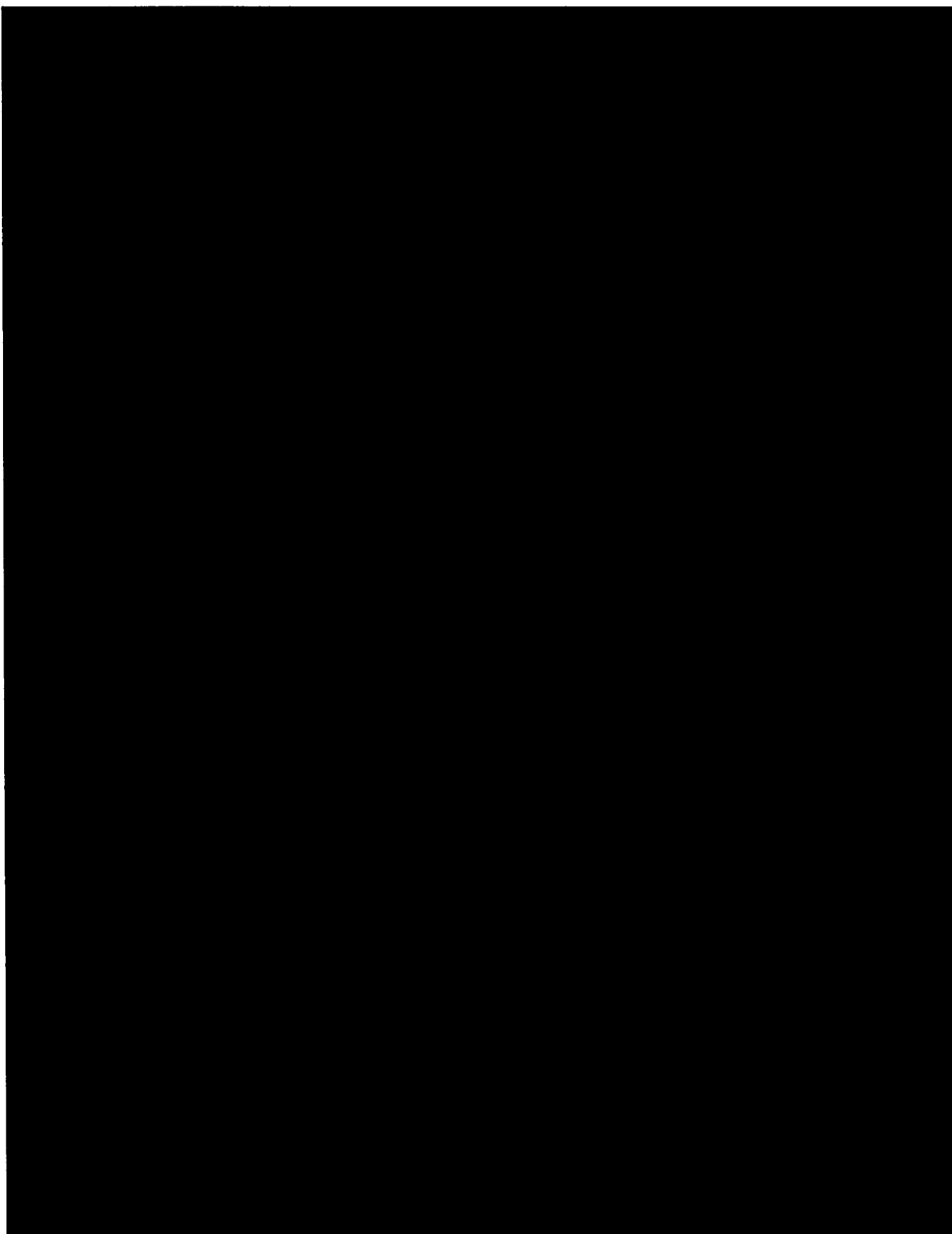
Page 14 of 14



(This page intentionally left blank)

FIGURES

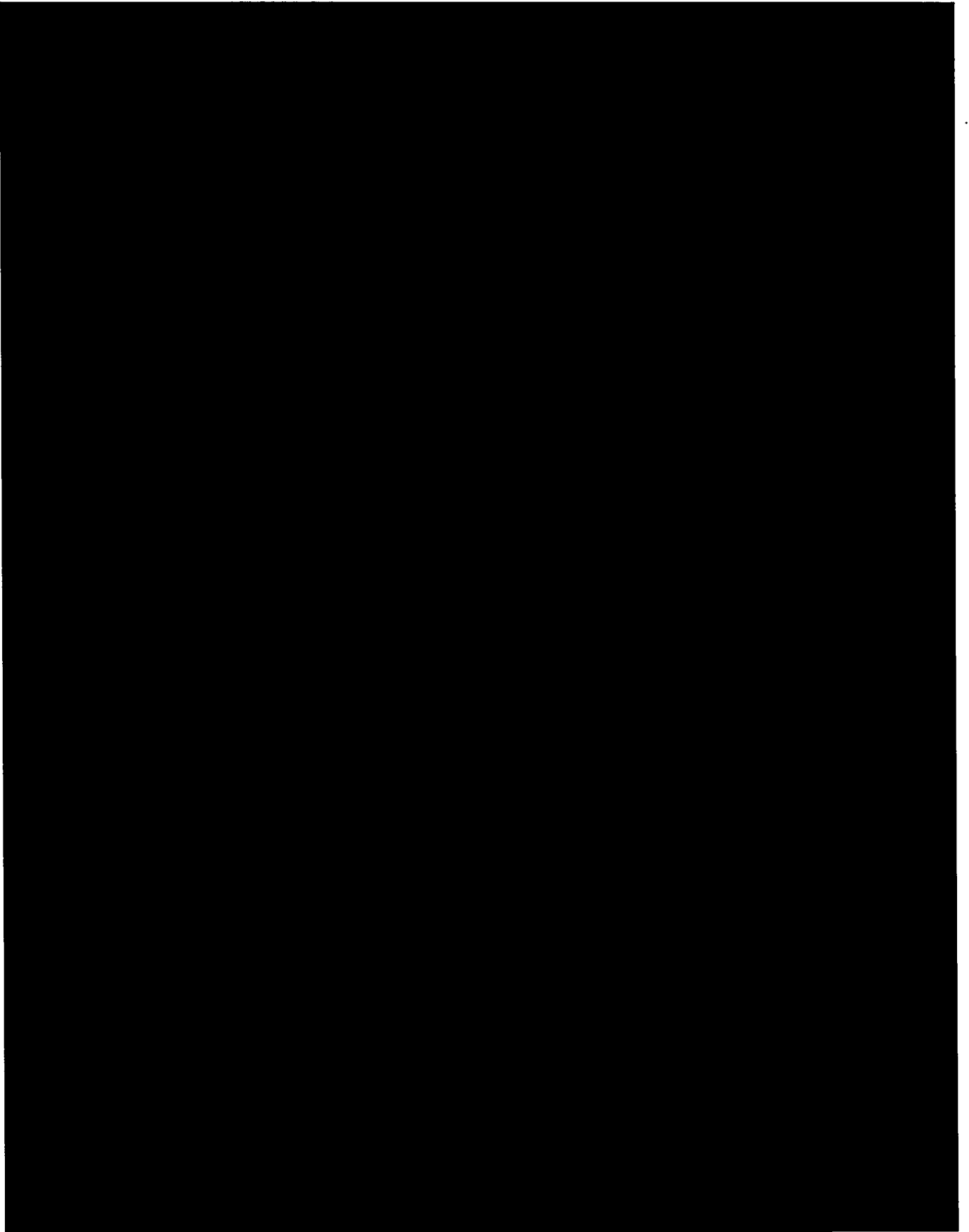
(This page intentionally left blank)



)

)

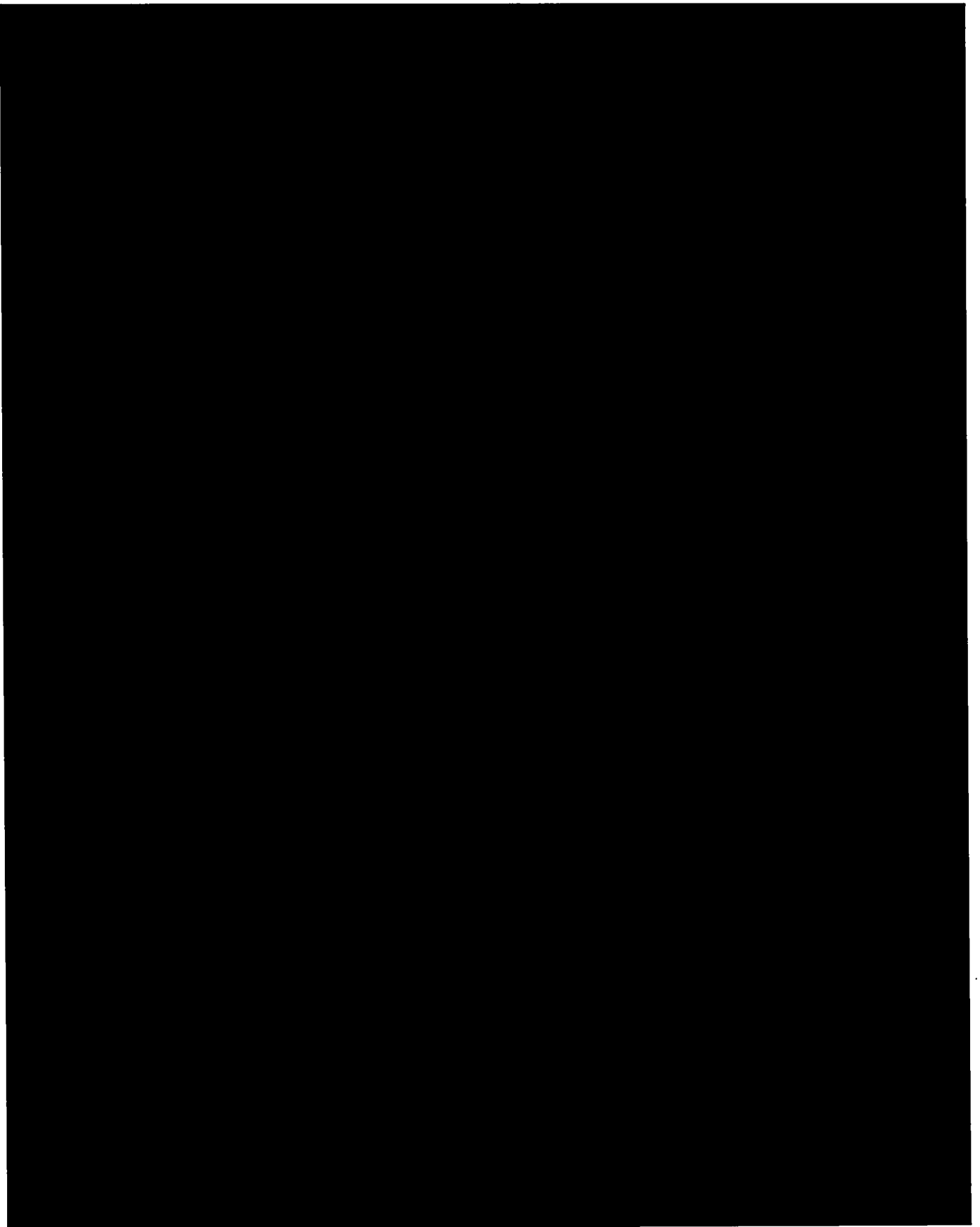
)



C

C

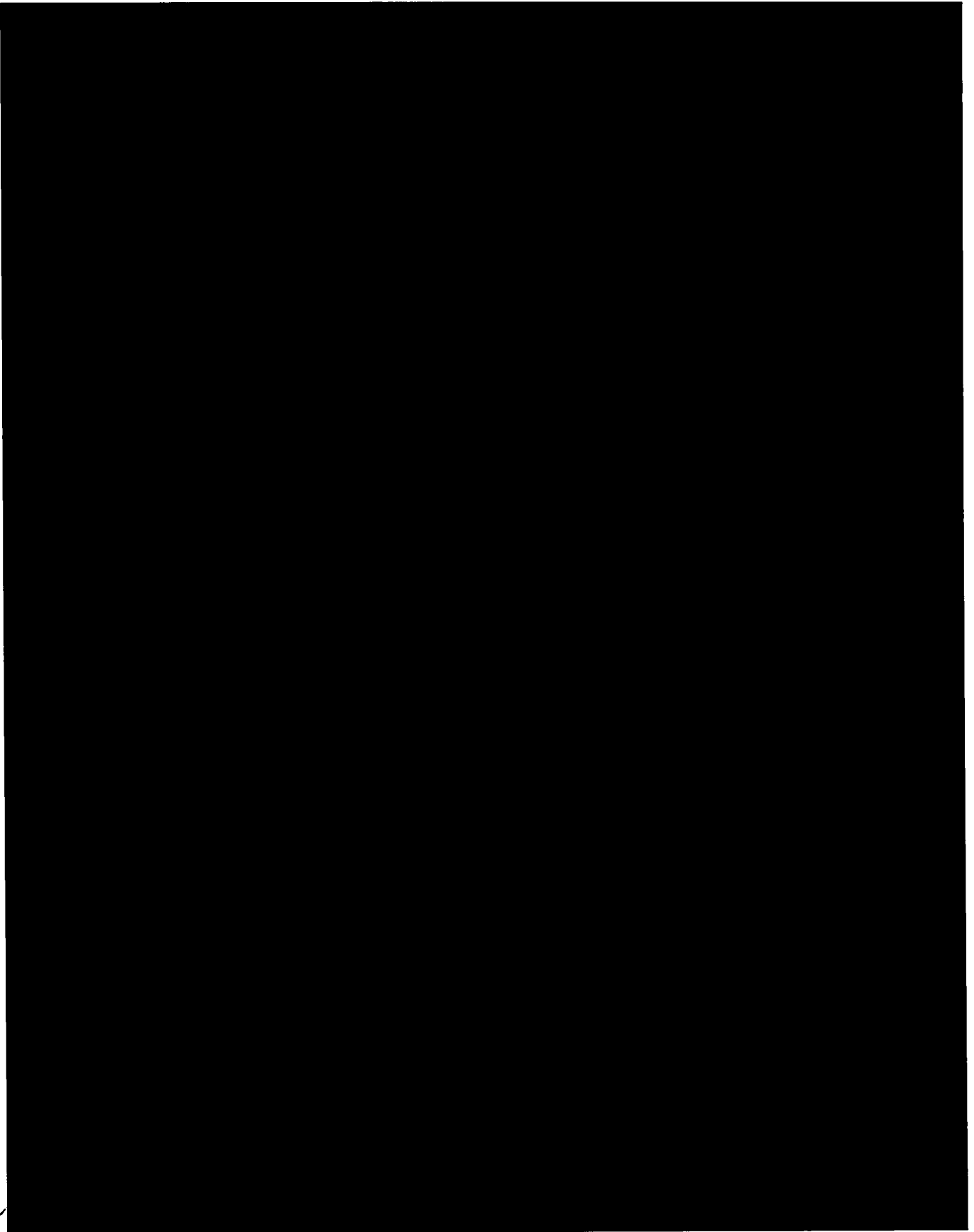
C



)

)

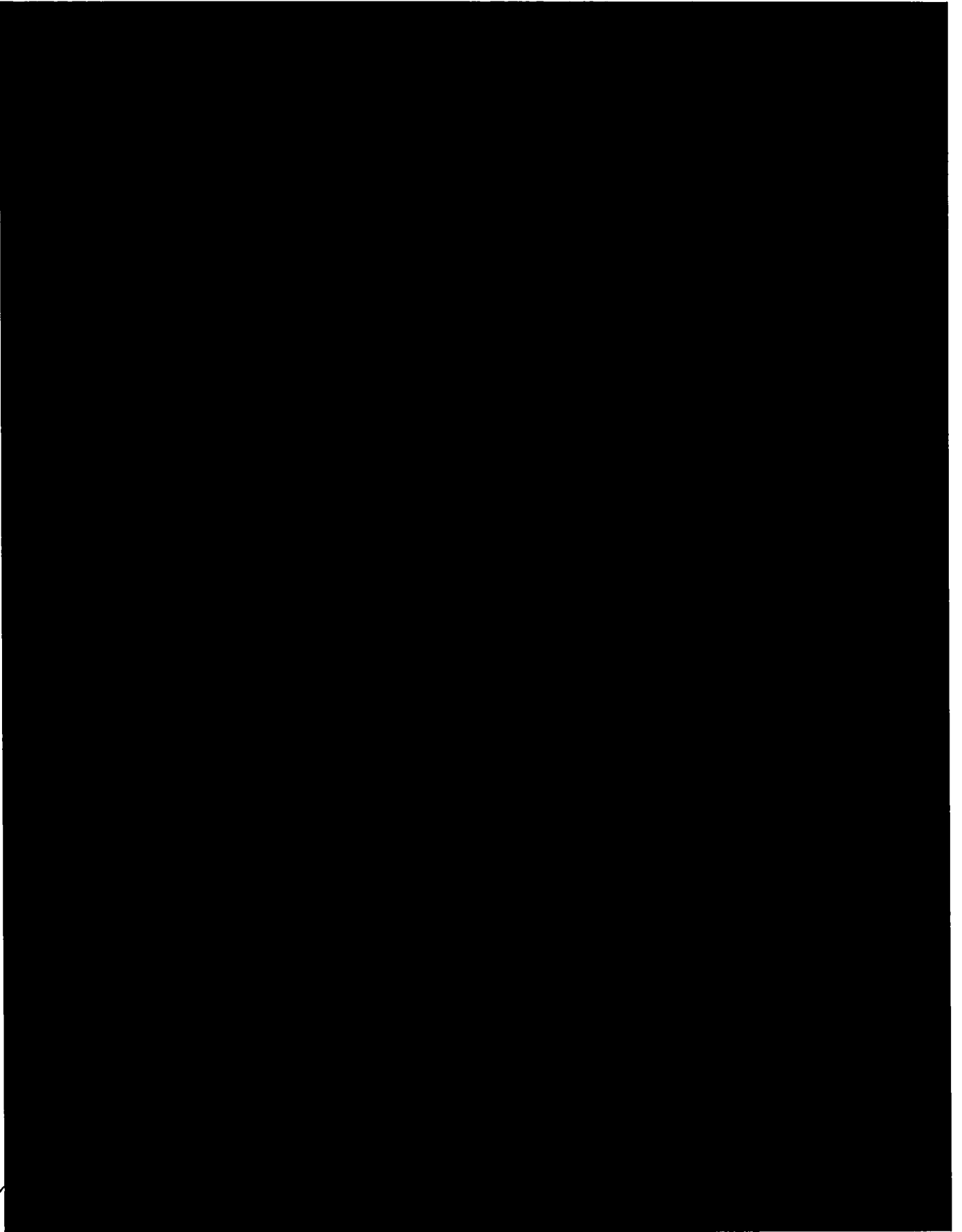
)



(

(

(



)

)

)

TABLE OF CONTENTS

	Page
3.8 ITEMS RELIED ON FOR SAFETY (IROFS)	3.8-1
3.8.1 IROFS	3.8-1
3.8.2 Sole IROFS List	3.8-2
3.8.3 Basis for Enhanced or High Availability Failure Probability Index Number	3.8-3
3.8.4 References.....	3.8-6

LIST OF TABLES

Table 3.8-1	Items Relied On For Safety (IROFS)
Table 3.8-2	Sole Items Relied On For Safety (IROFS)

3.8 ITEMS RELIED ON FOR SAFETY (IROFS)

This section of the Integrated Safety Analysis (ISA) Summary lists all of the Items Relied On For Safety (IROFS) designated for high-and intermediate-consequence accident sequences.

3.8.1 IROFS

Table 3.8-1, Items Relied On For Safety (IROFS), provides the IROFS designated for the National Enrichment Facility (NEF).

These IROFS either reduce the likelihood of occurrence, or the consequences, of the accident scenarios such that the associated risks are acceptable. The IROFS, which reduce the likelihood of occurrence, are termed "preventive" whereas the IROFS, which reduce the consequences, are termed "mitigative."

The IROFS designated for the NEF ensure that the hazards identified for this facility result in potential accident sequences that are of acceptable risk, as defined in Table 3.1-6, Risk Matrix with Risk Index Values. There are no IROFS that are frequently or continuously challenged.

Table 3.8-1, describes each IROFS, identifies its expected safety function, and references the accident sequence (as found in Table 3.7-2, Accident Sequence Descriptions and Table 3.7-4, External Events and Fire Accident Descriptions) that describes the conditions needed for the IROFS to reliably perform its function and the effects of its failure. The Table 3.8-1 description of each IROFS also identifies the Failure Probability Index Numbers. For indices that are more negative than the lower absolute value nominally assigned to the type of IROFS indicated from Table 3.1-10, a reference is made to Section 3.8.3, Basis for Enhanced or High Availability Failure Probability Index Number, to justify the index value used. The reliability for an IROFS is proportionate to the amount of risk reduction relied on in the ISA. Thus, the level of the reliability management measures applied to an IROFS is commensurate with the required reliability. Management measures will ensure that IROFS are designed, implemented, and maintained, as necessary, to be available and reliable to perform their safety function when needed. The degree of reliability and availability of IROFS ensured by these measures are consistent with the evaluations of accident likelihood in the ISA. As described in Section 3.8.1.3, general high-quality Management Measures are applied to all IROFS. However, certain IROFS evaluated in the ISA may require "enhanced" administrative controls or may require automatic engineered controls to have "high availability." The basis for these evaluations is presented in Section 3.8.3, as referenced from Table 3.8-1.

For accident sequences postulated to result in nuclear criticality, IROFS are specified to ensure subcriticality under all normal and credible abnormal conditions. In order to identify IROFS, it was conservatively assumed that initiating events would result in criticality. The IROFS associated with criticality accident sequences have been specified consistent with the definition of "Items relied on for safety" in 10 CFR 70.4, "Definitions" (CFR, 2003a).

IROFS will be designed, constructed, tested and maintained to QA Level 1. IROFS will comply with design requirements established by the ISA and the applicable codes and standards (current approved version at the time of design). IROFS components and their designs will be of proven technology for their intended application. These IROFS components and systems will

be qualified to perform their required safety functions under normal and accident conditions, e.g., pressure, temperature, humidity, seismic motion, electromagnetic interference, and radio-frequency interference, as required by the ISA. IROFS components and systems will be qualified using the applicable guidance in Institute of Electrical and Electronics Engineers (IEEE) standard IEEE-323, 1983, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations" (IEEE, 1983). Furthermore, IROFS components and systems will be designed, procured, installed, tested, and maintained using the applicable guidance in Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Revision 1, dated October 2003 (NRC, 2003). IROFS systems will be designed and maintained consistent with the reliability assumptions in the ISA. Redundant IROFS systems will be separate and independent from each other. IROFS systems will be designed to be fail-safe. In addition, IROFS systems will be designed such that process control system failures will not affect the ability of the IROFS systems to perform their required safety functions. Plant control systems will not be used to perform IROFS functions. Installation of IROFS systems will be in accordance with engineering specifications and manufacturer's recommendations. Required testing and calibration of IROFS will be consistent with the assumptions of the ISA and setpoint calculations, as applicable. For hardware IROFS involving instrumentation which provides automatic prevention or mitigation of events, setpoint calculations are performed in accordance with a setpoint methodology, which is consistent with the applicable guidance provided in Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3, dated December 1999 (NRC, 1999).

In addition, for those IROFS requiring operator actions, a human factors engineering review of the human-system interfaces shall be conducted using the applicable guidance in NUREG-0700, "Human-System Interface Design Review Guidelines," Revision 2, dated May 2002 (NRC, 2002), and NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, dated February 2004 (NRC, 2004).

For IROFS and IROFS with Enhanced Failure Probability Index Numbers (i.e., enhanced IROFS) that require "independent verification" of a safety function, the independent verification shall be independent with respect to personnel and personnel interface. Specifically, a second qualified individual, operating independently (e.g., not at the same time or not at the same location) of the individual assigned the responsibility to perform the required task, shall, as applicable, verify that the required task (i.e., safety function) has been performed correctly (e.g., verify a condition), or re-perform the task (i.e., safety function), and confirm acceptable results before additional action(s) can be taken which potentially negatively impact the safety function of the IROFS. The required task and independent verification shall be implemented by procedure and documented by initials or signatures of the individuals responsible for each task. In addition, the individuals performing the tasks shall be qualified to perform, for the particular system or process (as applicable) involved, the tasks required and shall possess operating knowledge of the particular system or process (as applicable) involved and its relationship to facility safety. The requirements for independent verification are consistent with the applicable guidance provided in ANSI/ANS-3.2-1994 (ANSI, 1994).

The following information related to IROFS will be available onsite in the ISA documentation once final design is completed.

- Hardware IROFS design details, such as system schematics and/or descriptive lists, sufficient to determine the structures, system, equipment or component included within the hardware IROFS' boundary
- Identification of essential utilities and support systems on which the IROFS depends to perform the intended safety functions
- Operating ranges and limits for measured process variables, e.g., temperature, pressure, associated with IROFS
- Basis for establishing the average vulnerable outage time to maintain acceptable IROFS availability
- Safety limits and safety margins, as applicable.

3.8.2 Sole IROFS List

The sole IROFS for the NEF are provided in Table 3.8-2, Sole Items Relied On For Safety (IROFS). Table 3.8-2 identifies the sole IROFS titles, IROFS identifier, and references the accident sequence (in Table 3.7-2, Accident Sequence Descriptions, and Table 3.7-4, External Events and Fire Accident Descriptions) that describes the conditions needed for the IROFS to reliably perform its function and effects of its failure. The description of the sole IROFS associated safety functions is provided in Table 3.8-1. Sole IROFS are those designated as Class A on Table 3.8-1.

A sole IROFS is a single item or feature that is relied upon to prevent or mitigate an accident for which the consequences could exceed the performance requirements in 10 CFR 70.61 (CFR, 2003b). It is acceptable to rely on these sole IROFS for non-criticality accident sequences because these IROFS will reliably provide sufficient preventive and mitigative features to ensure that the associated accident sequence results in an acceptable risk.

3.8.3 Basis for Enhanced or High Availability Failure Probability Index Number

For Failure Probability Index Number (FPIN) indices that are more negative than the lower absolute value nominally assigned to the type of IROFS indicated from Table 3.1-10, the following bases are provided. These IROFS reflect "enhanced" administrative controls and/or active engineered controls with "high availability." The following Sections are referenced from Table 3.8-1 for these IROFS. The nominal Management Measures outlined in Section 3.1.8.3 that apply to all IROFS, continue to also provide high quality assurance that these IROFS will be maintained, however, the following additional Management measures provided the basis for assigning the more negative value.

(Note subsection numbering is not contiguous. Subsections numbered to correspond to applicable IROFS number.)

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

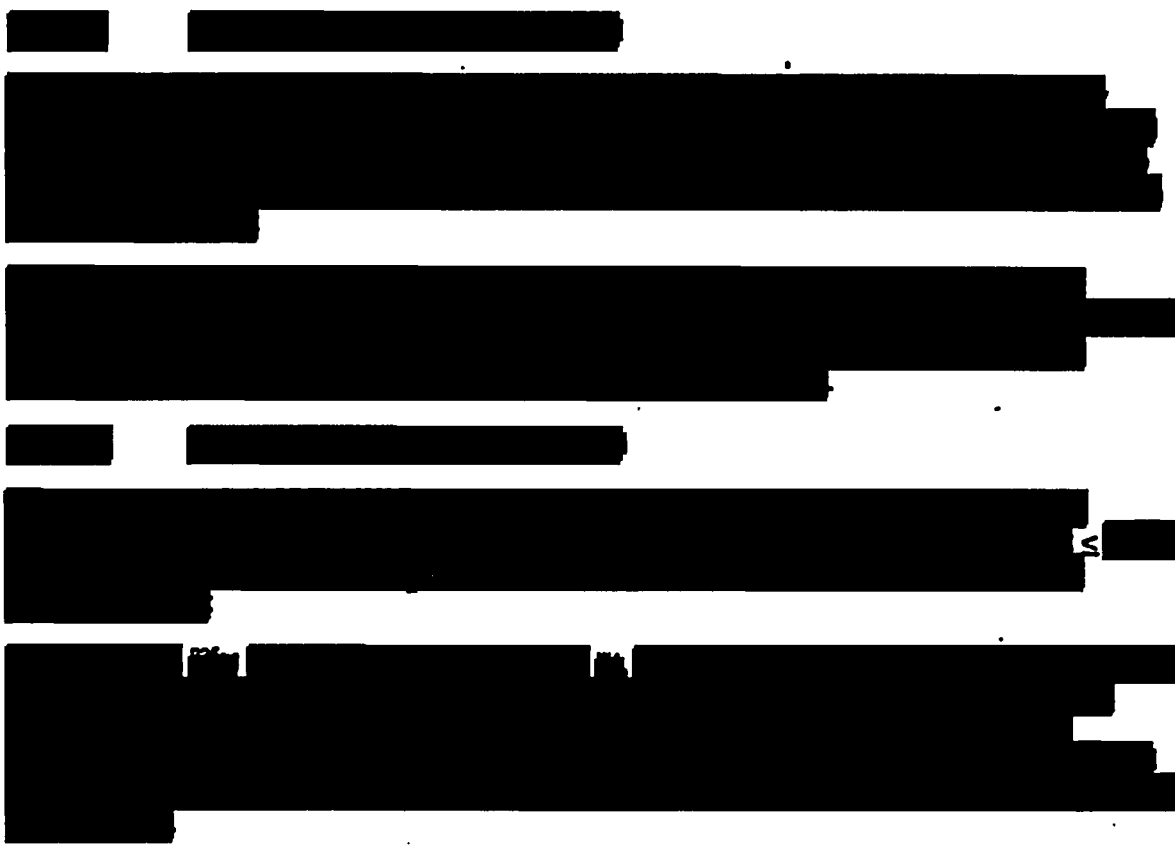
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



3.8.4 References

ANSI, 1994. Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants, ANSI/ANS-3.2-1994, American National Standards Institute/American Nuclear Society, 1994.

CFR, 2003a. Title 10, Code of Federal Regulations, Section 70.4, Definitions, 2003.

CFR, 2003b. Title 10, Code of Federal Regulations, Section 70.61, Performance Requirements, 2003.

IEEE, 1983. Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations, IEEE-323, Institute of Electrical and Electronics Engineers, 1983.

- NRC, 1999. Setpoints for Safety-Related Instrumentation, Regulatory Guide 1.105, U.S. Nuclear Regulatory Commission, Revision 3, December 1999.

NRC, 2002. Human-System Interface Design Review Guidelines, NUREG-0700, U.S. Nuclear Regulatory Commission, Revision 2, May 2002.

- NRC, 2003. Regulatory Guide 1.180, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems, Revision 1, October 2003.

NRC, 2004. Human Factors Engineering Program Review Model, NUREG-0711, U.S. Nuclear Regulatory Commission, Revision 2, February 2004.

TABLES

(This page Intentionally left blank)

Table 3.8-1 Items Relied On For Safety (IROFS)
Page 1 of 31

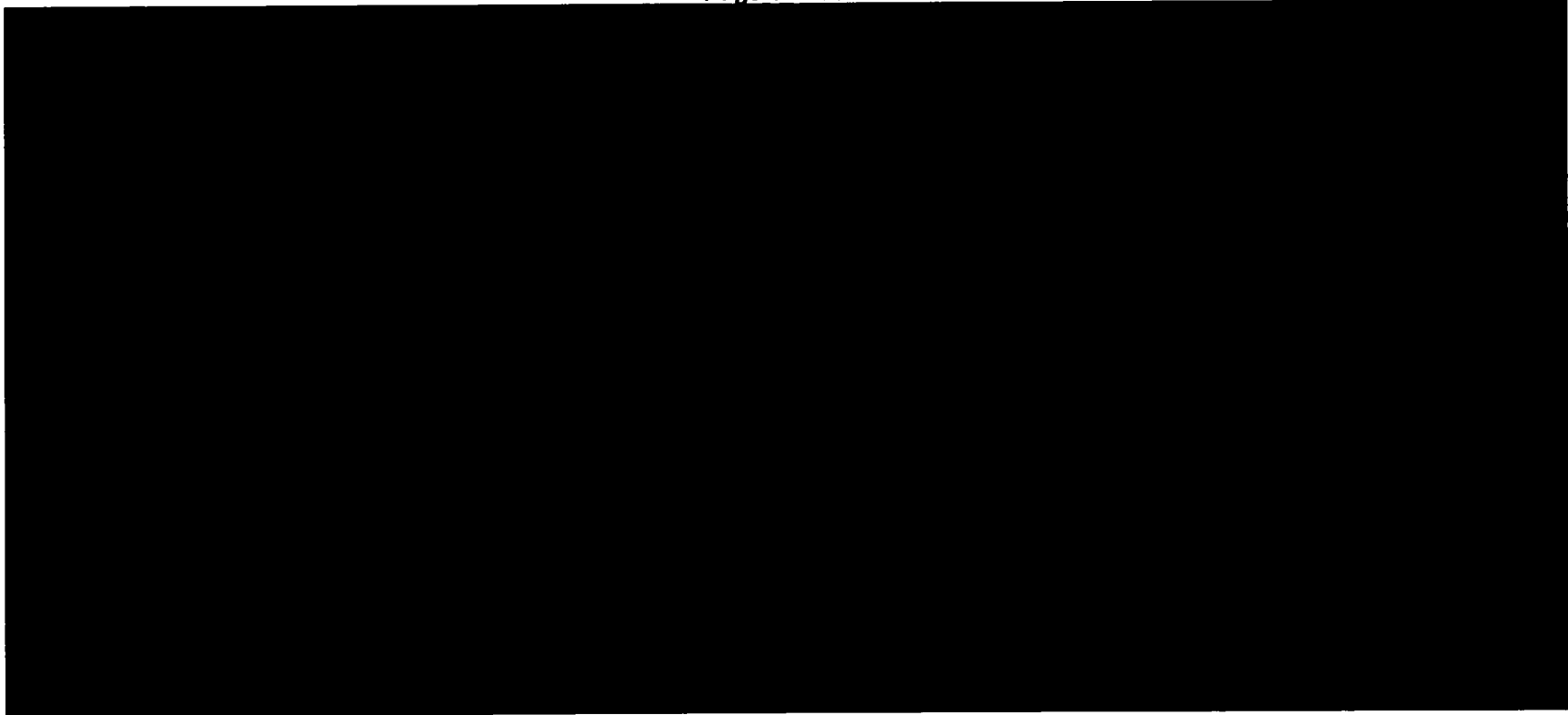


Table 3.8-1 Items Relied On For Safety (IROFS)

Page 2 of 31

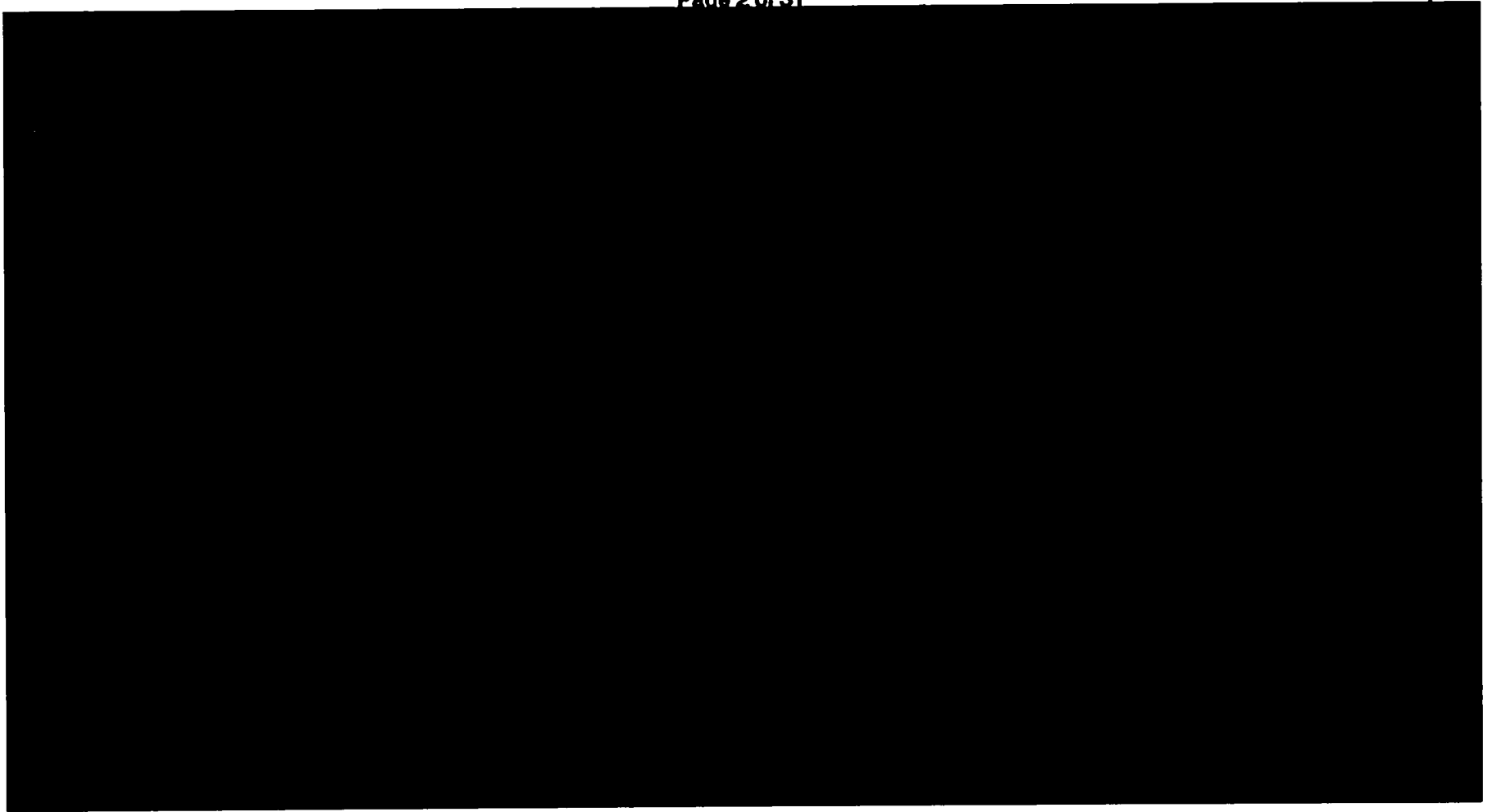


Table 3.8-1 Items Relied On For Safety (IROFS)

Page 2 of 21

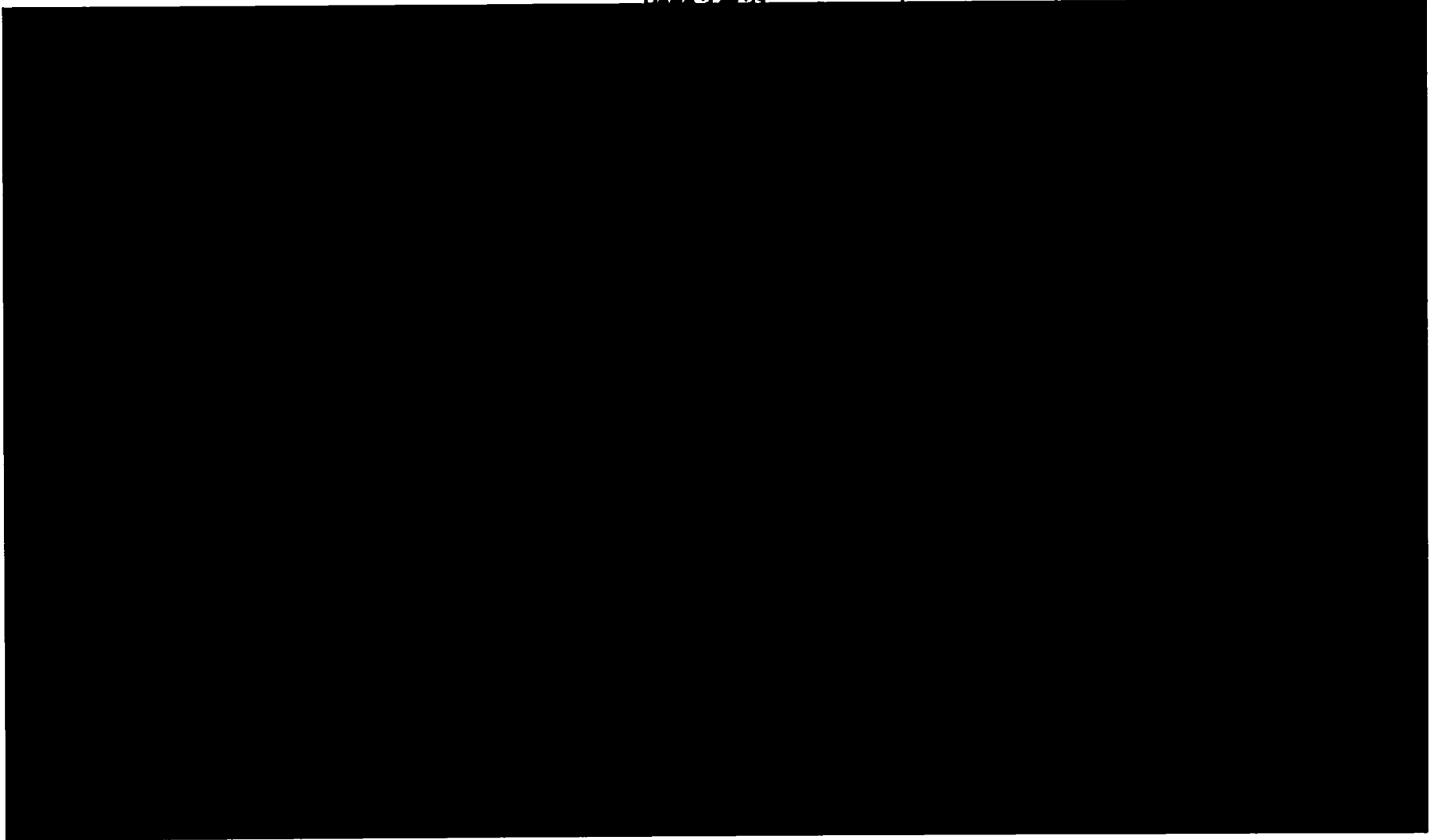


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 4 of 31

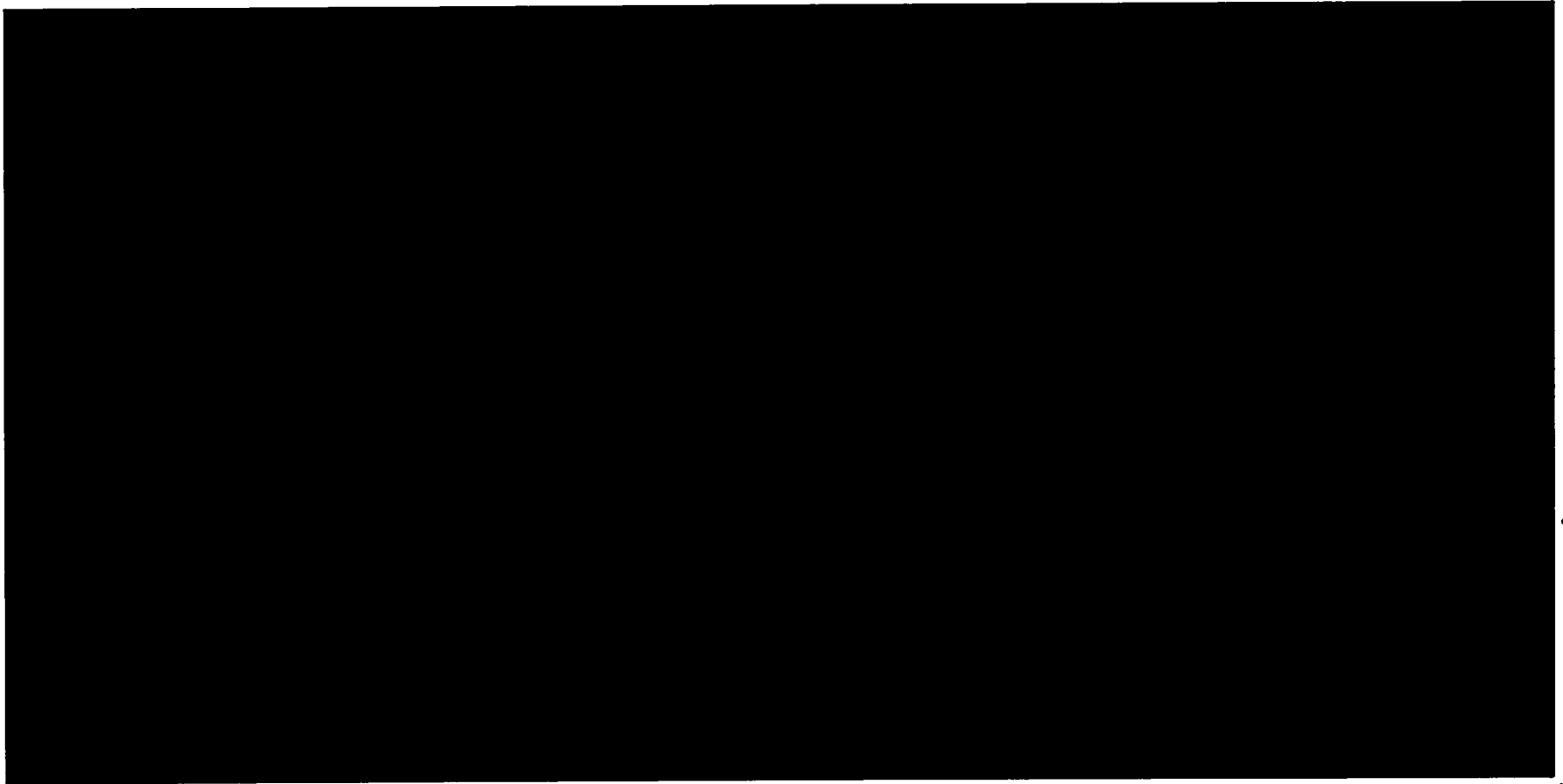


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 5 of 31

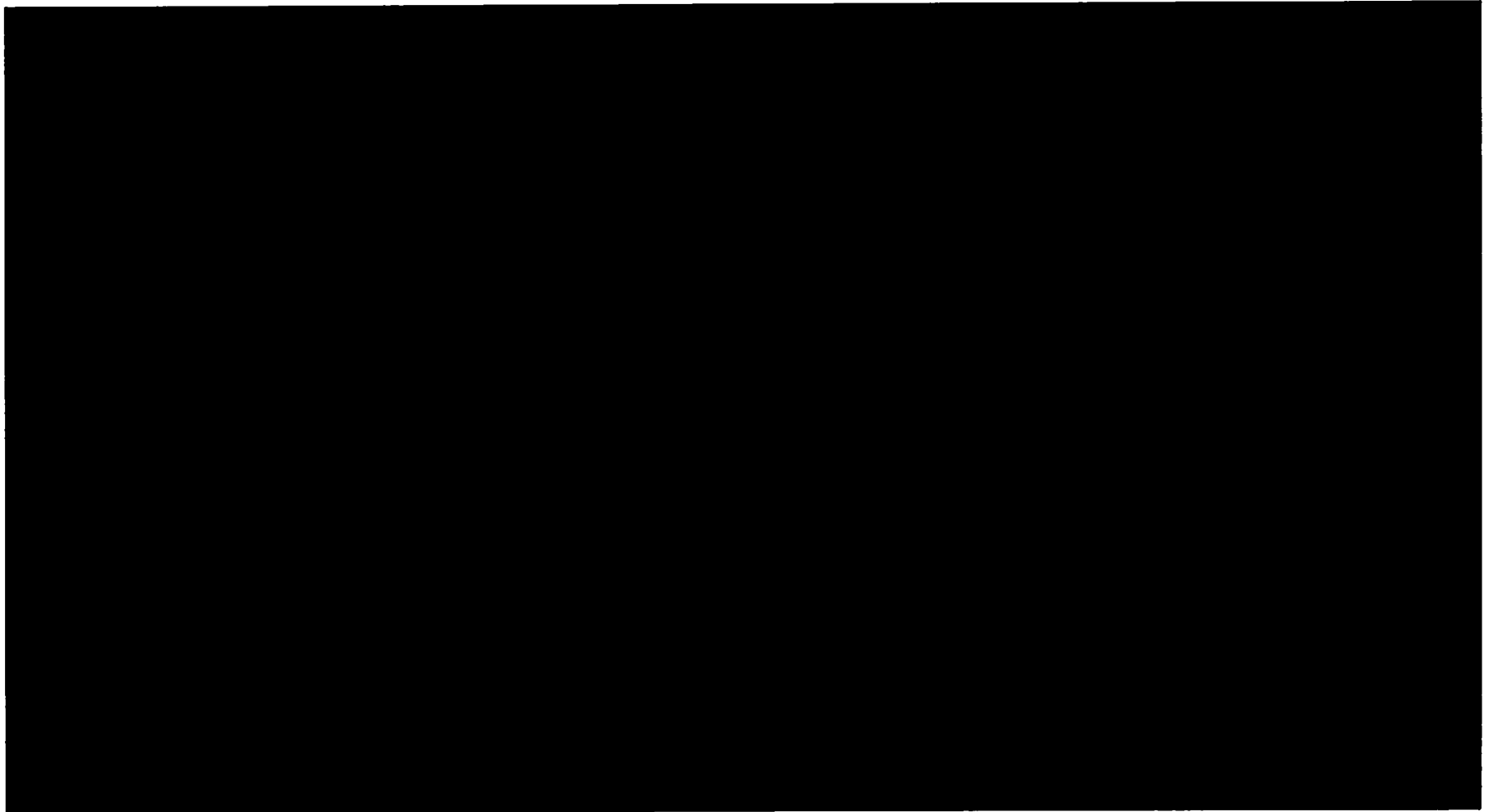


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 6 of 31

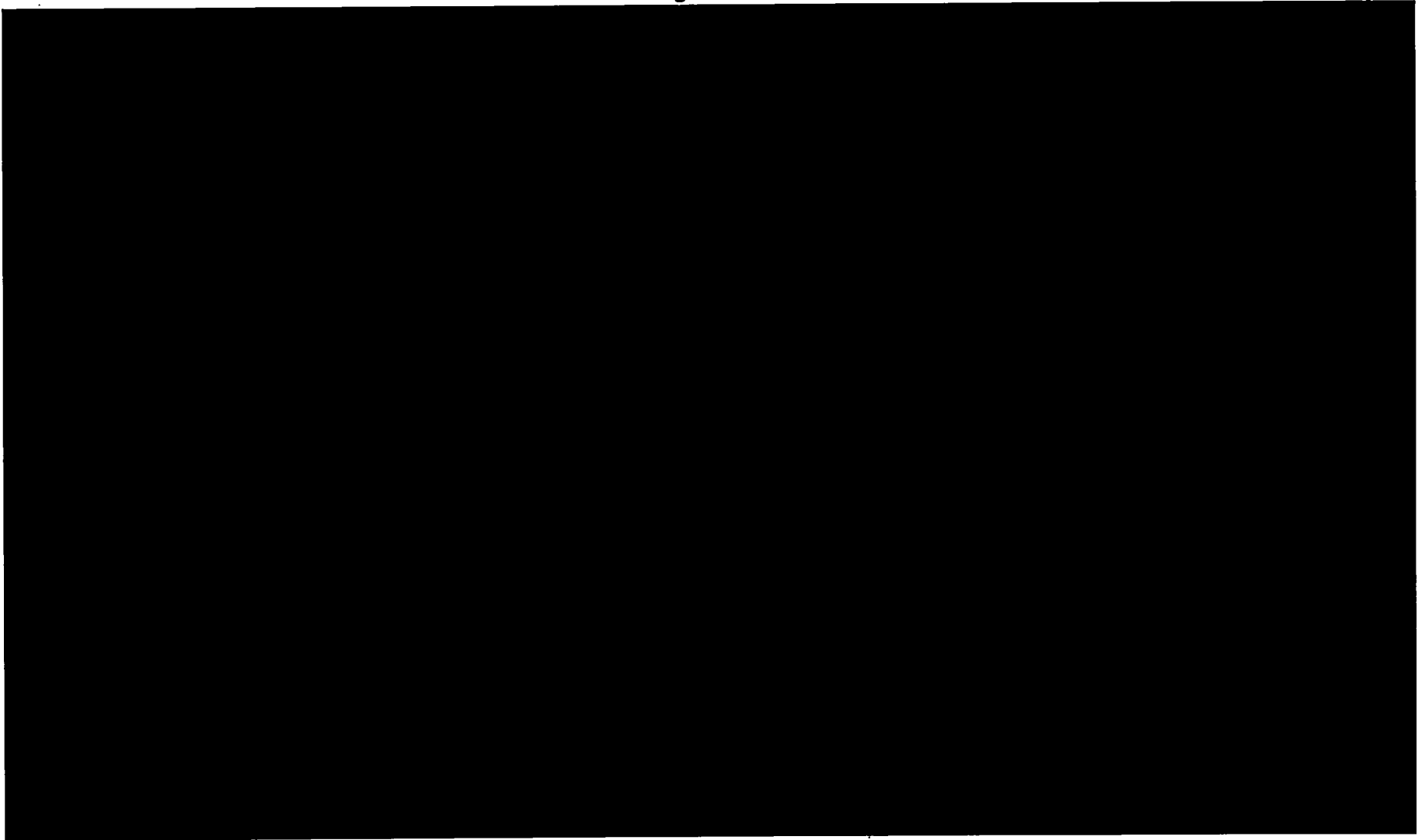


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 7 of 31

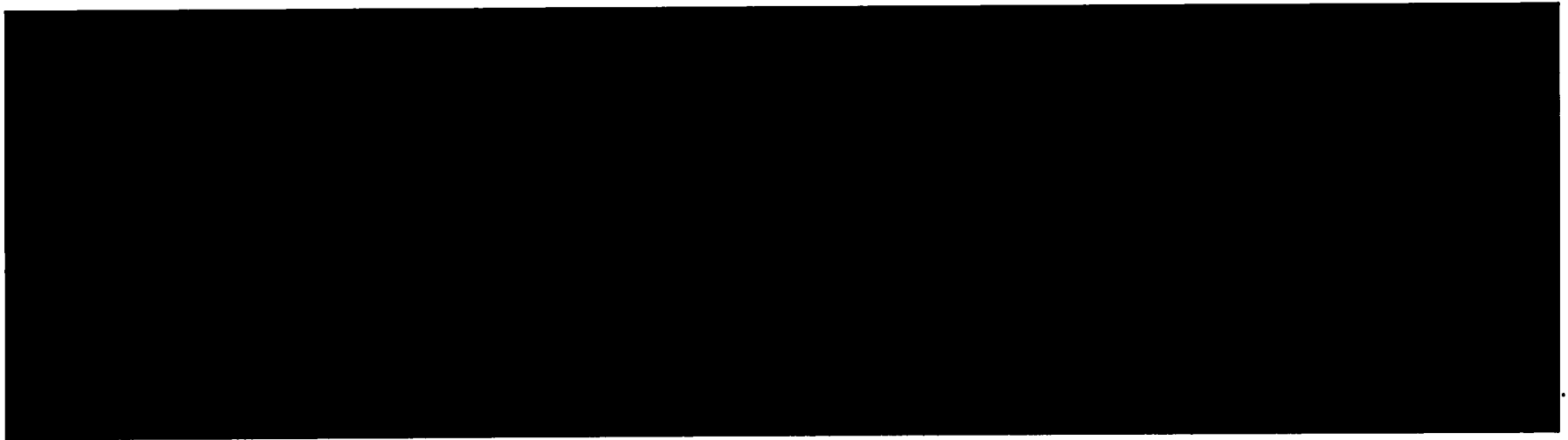


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 8 of 31

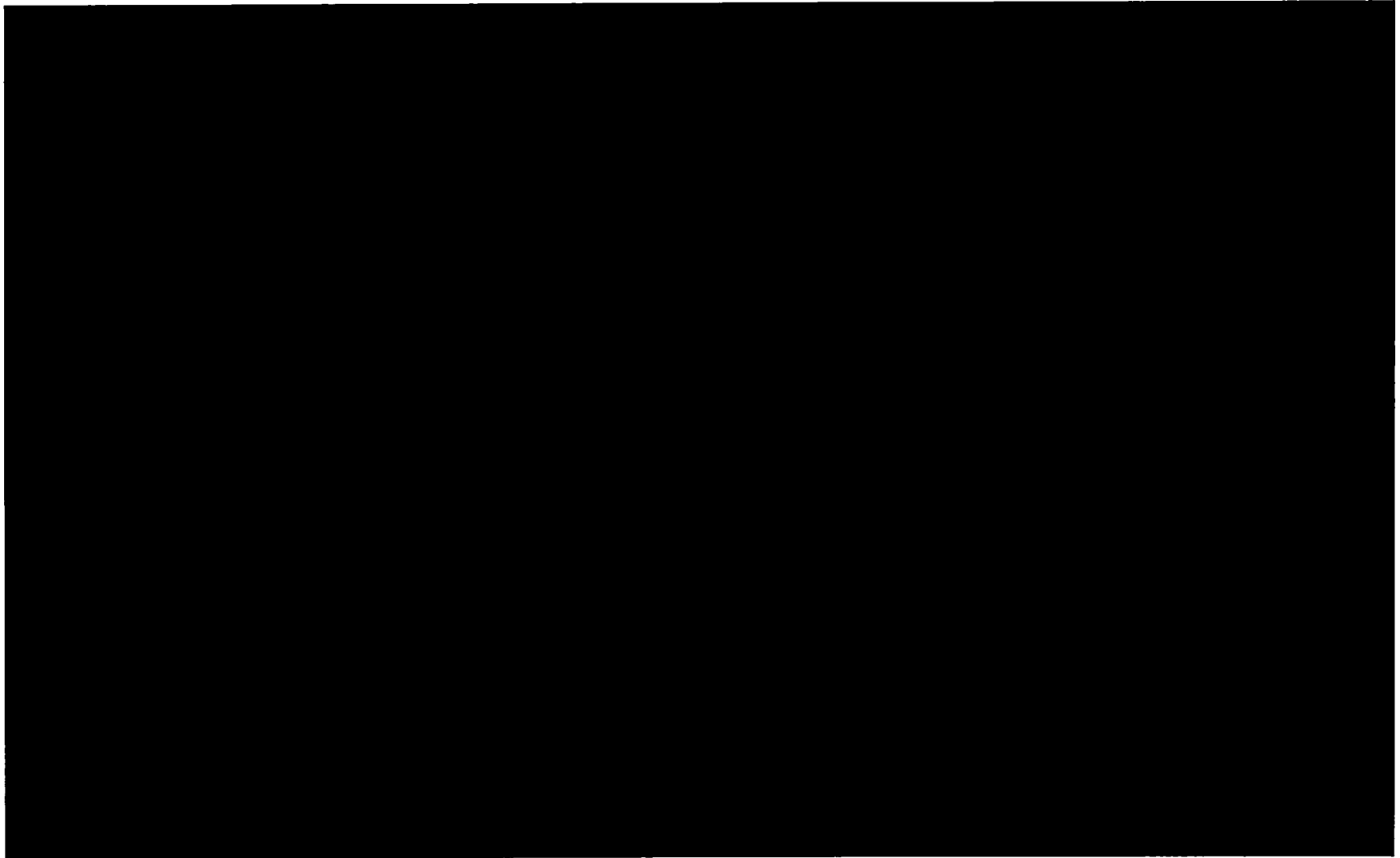


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 9 of 31

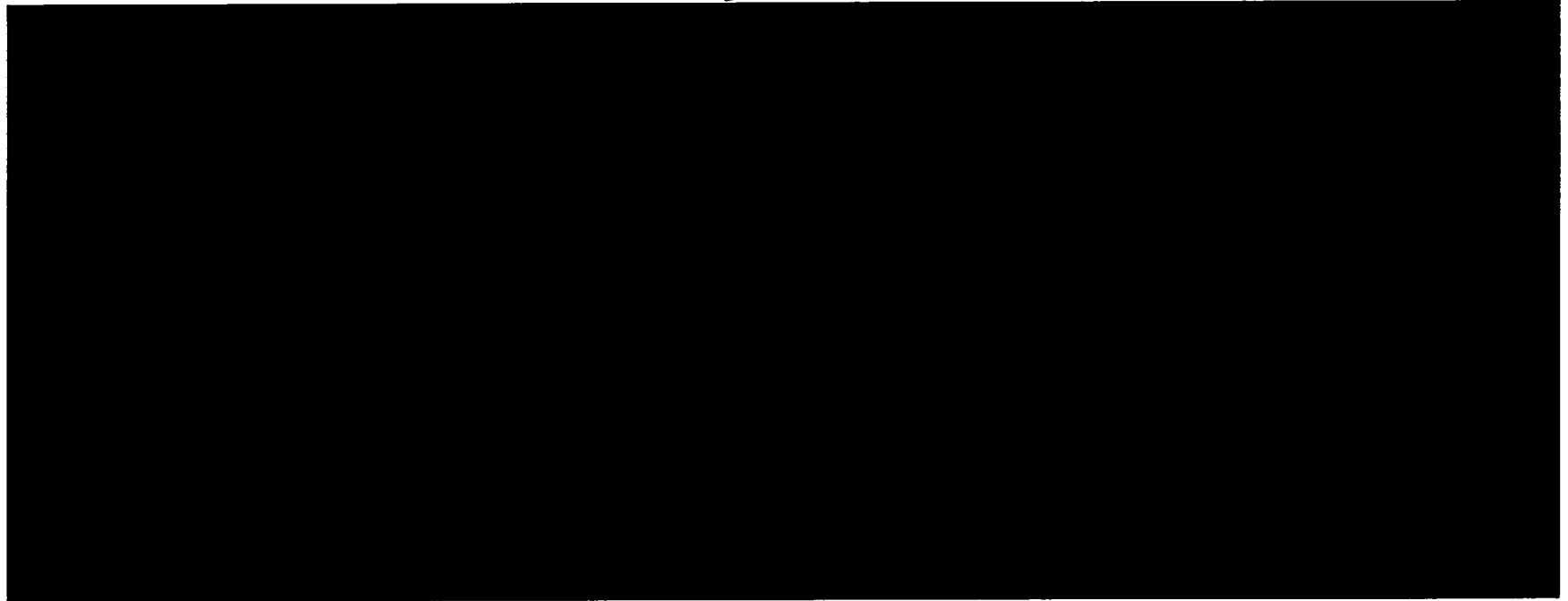


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 10 of 31

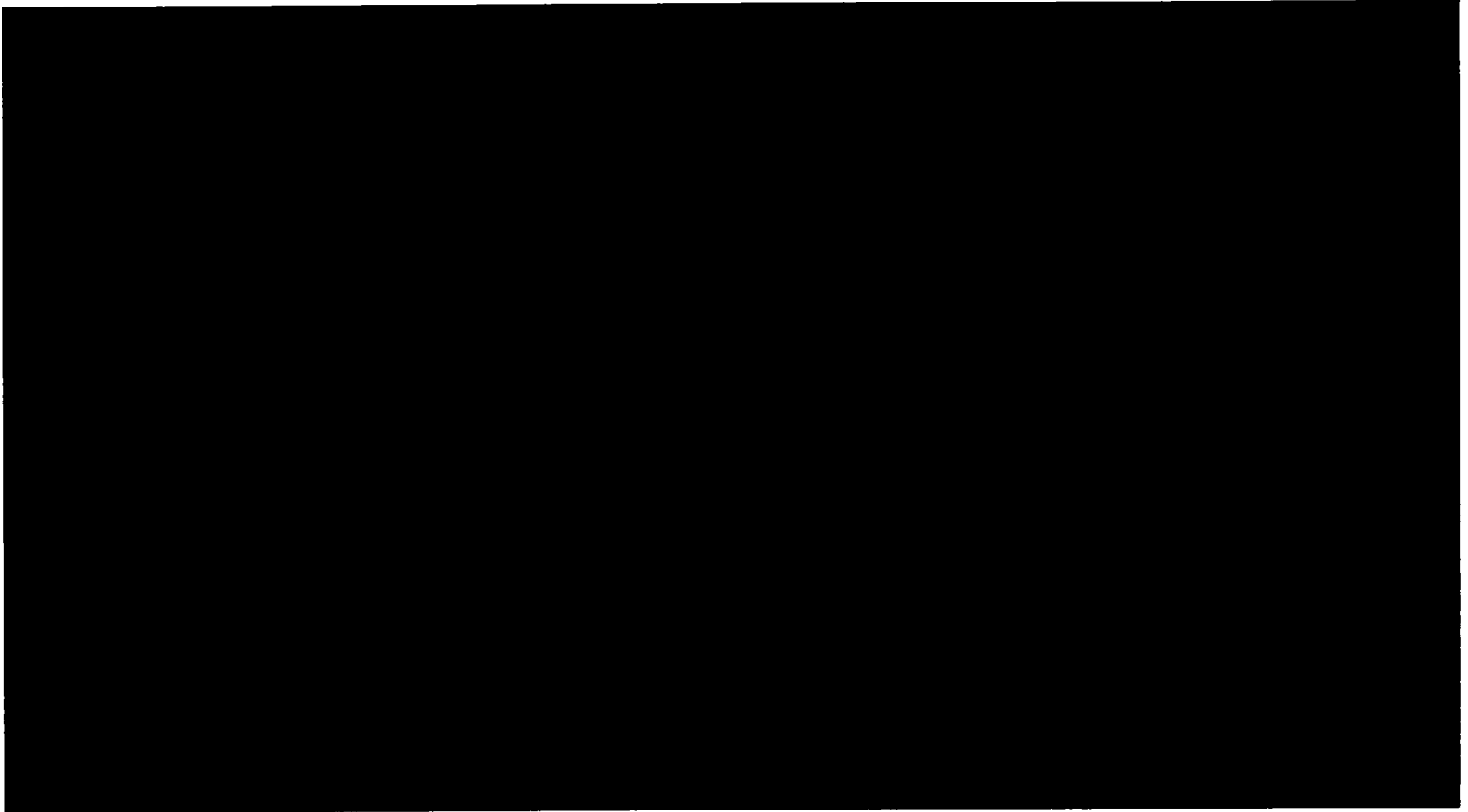


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 11 of 31

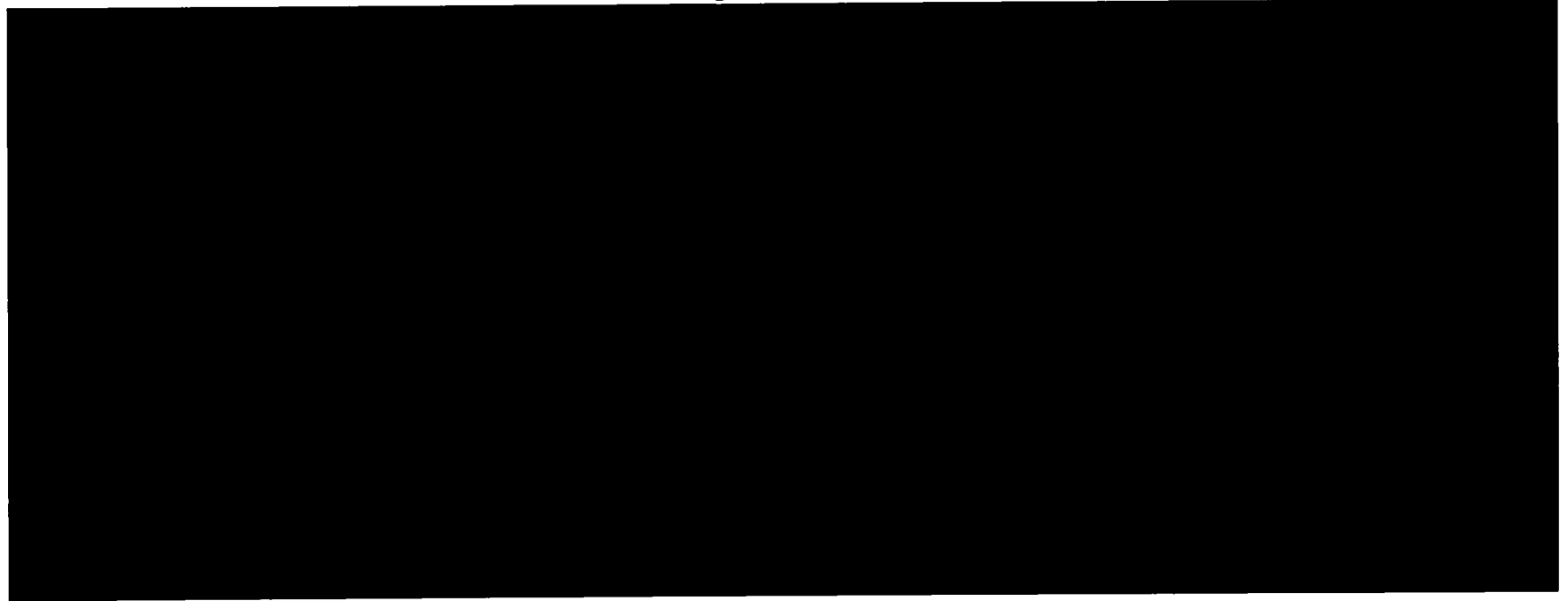


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 12 of 31

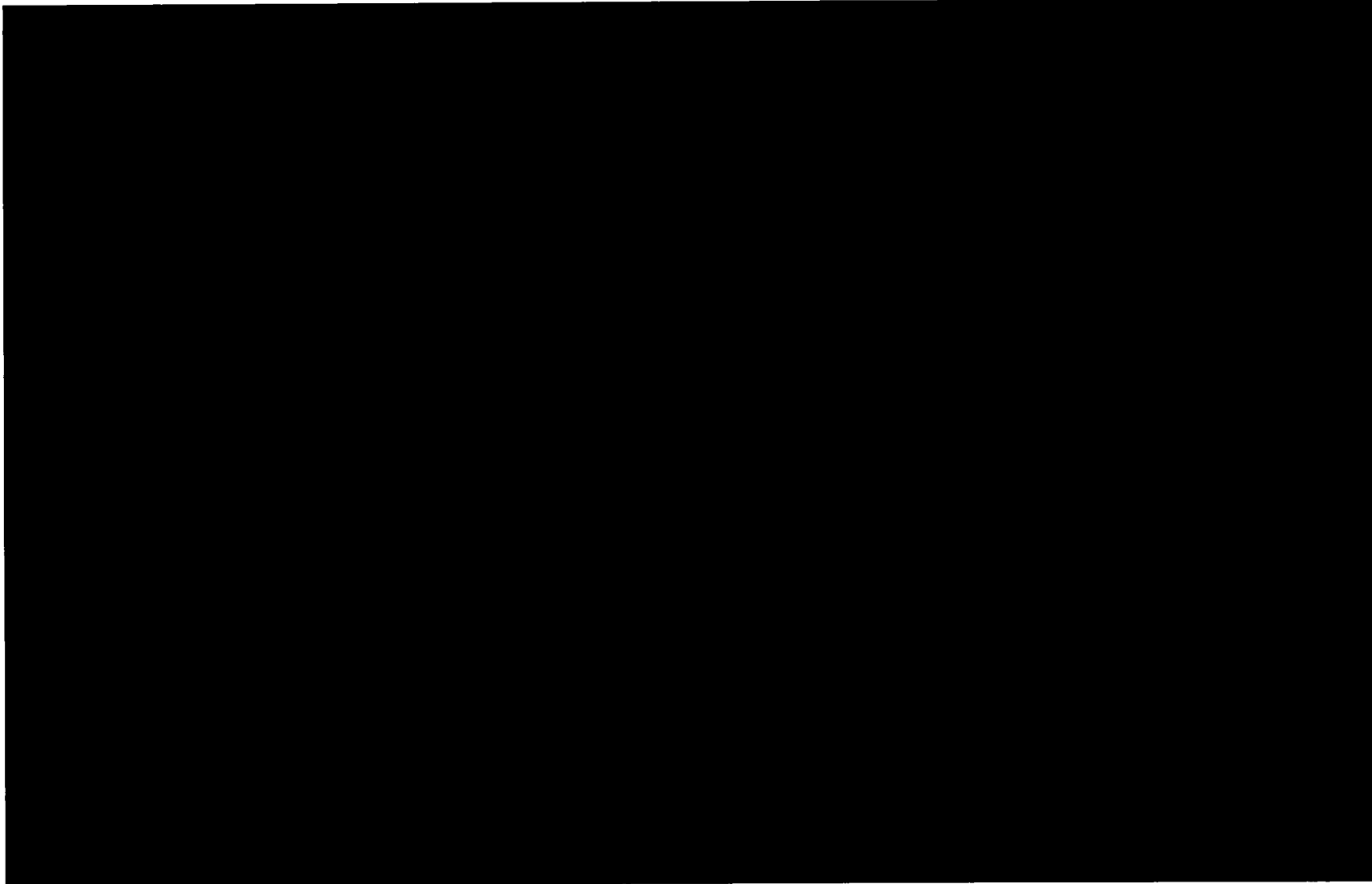


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 13 of 31

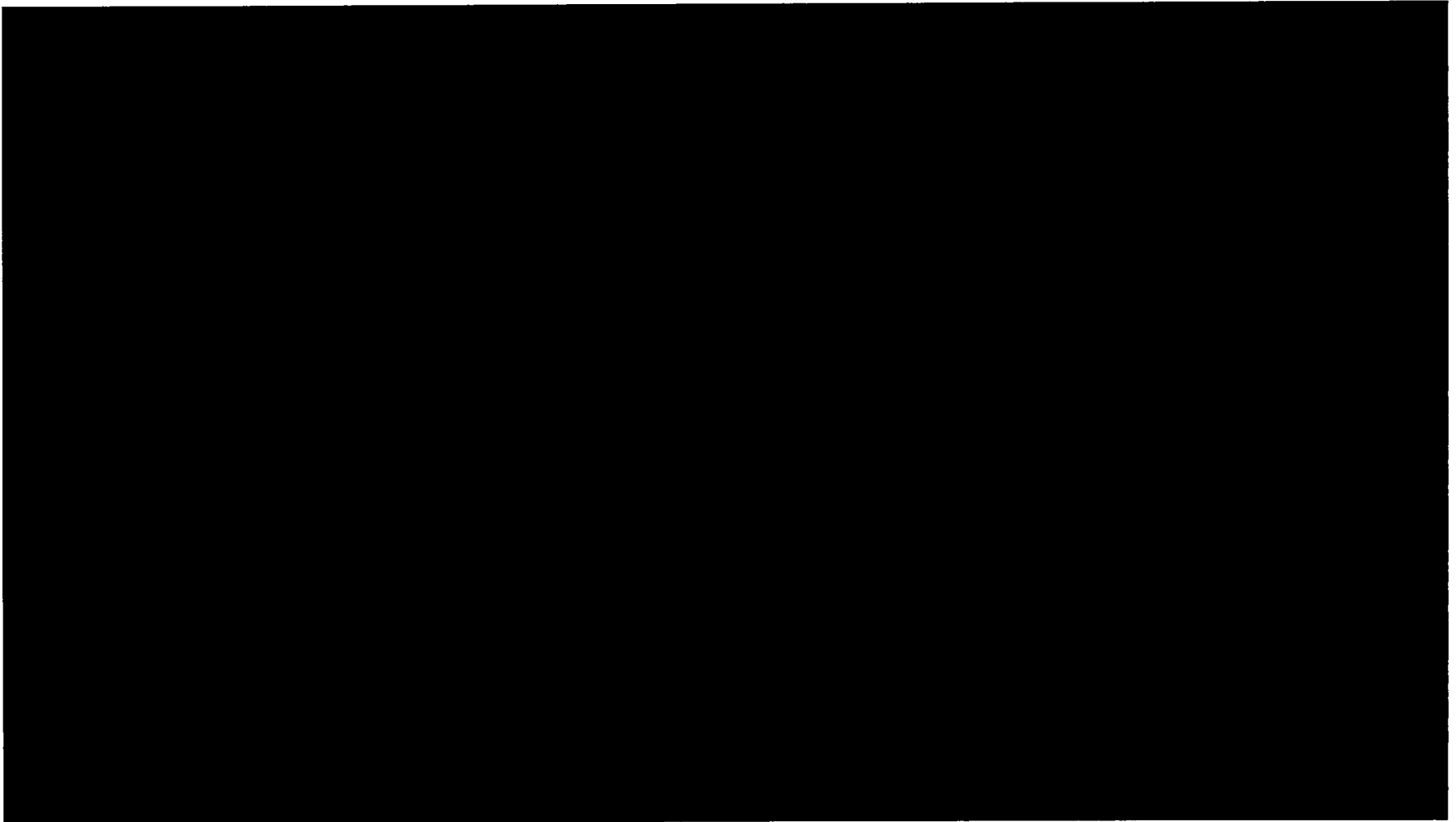


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 14 of 31



Table 3.8-1 Items Relied On For Safety (IROFS)
Page 15 of 31

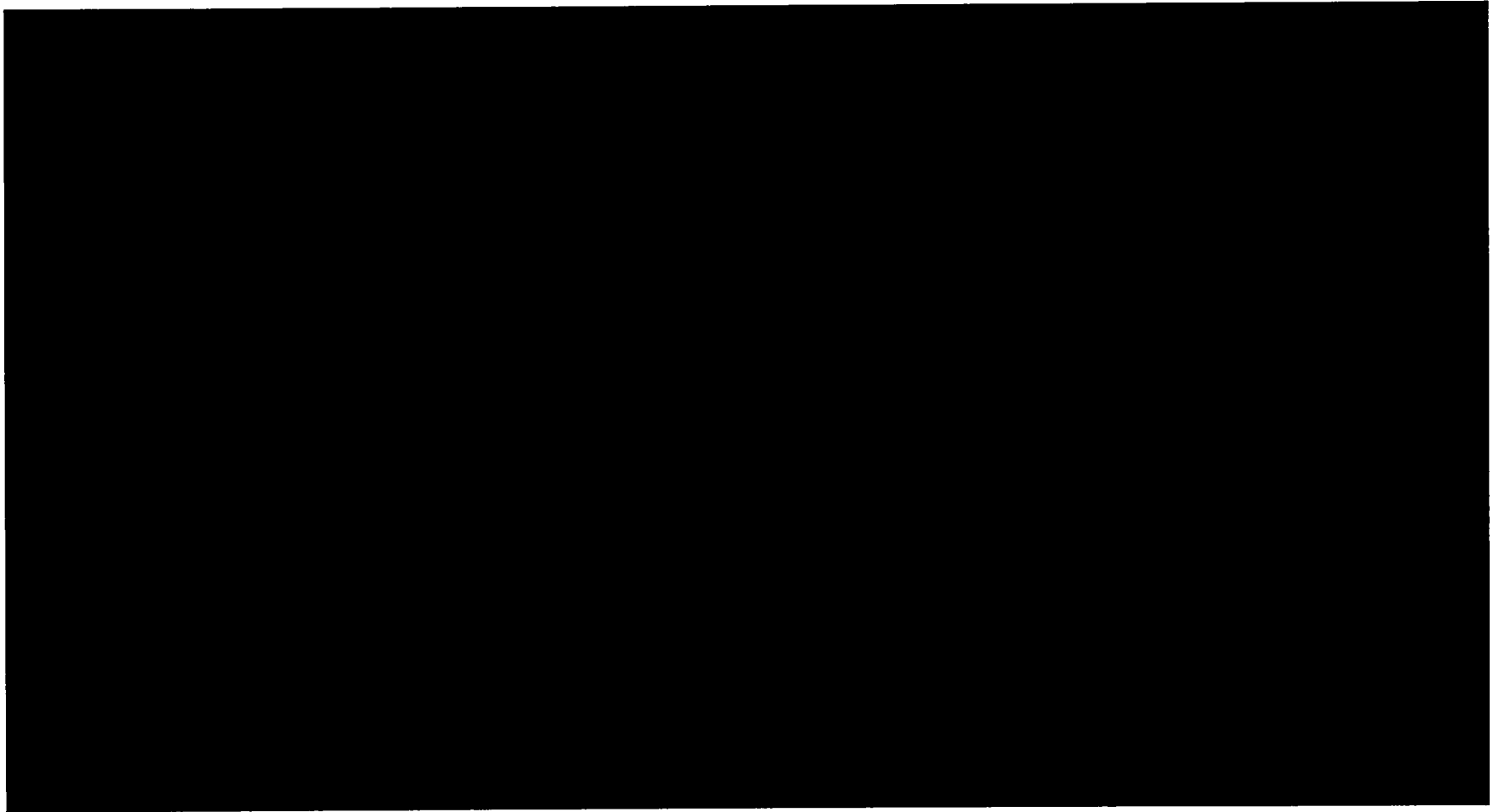


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 16 of 31

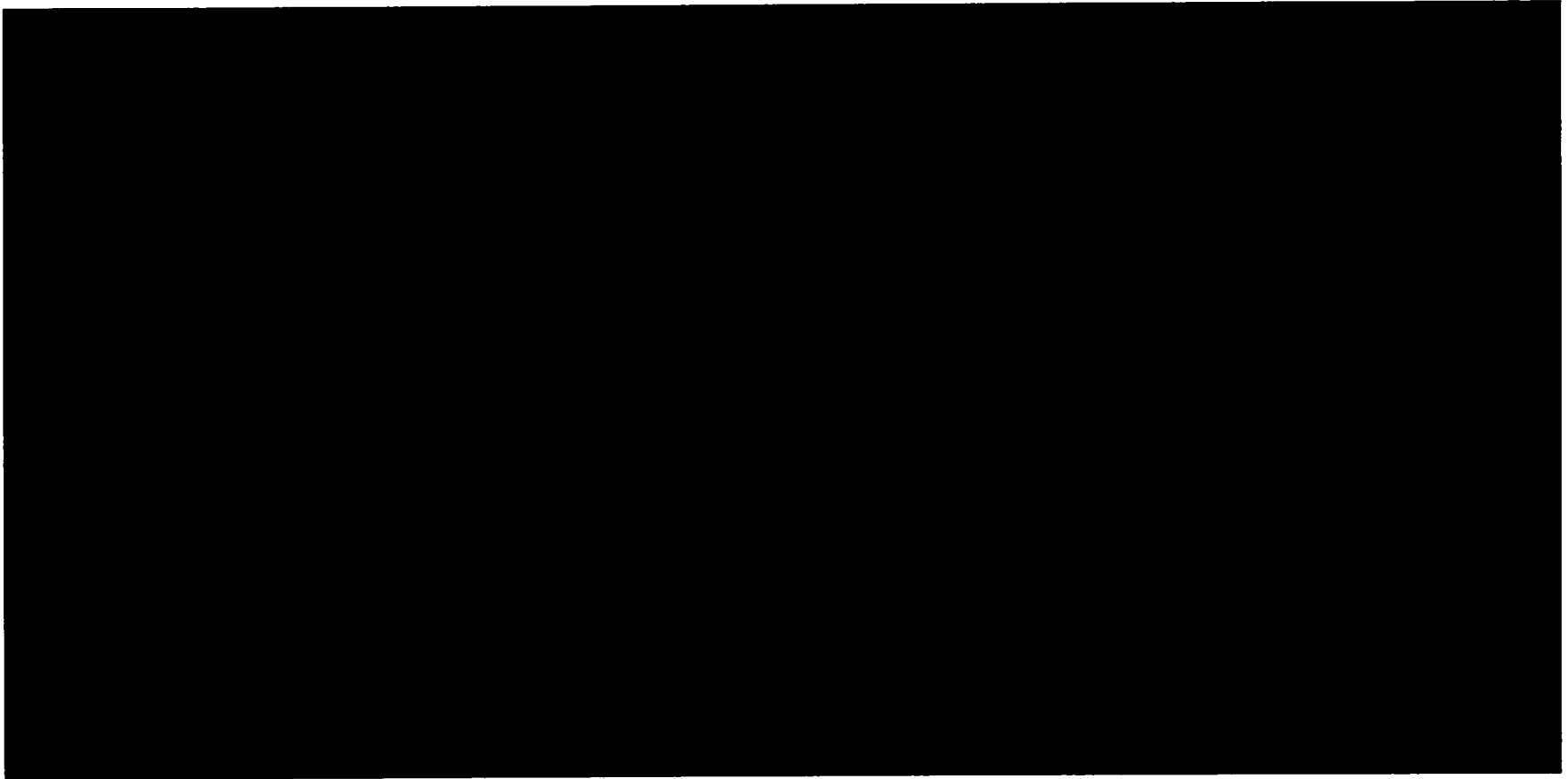


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 17 of 31

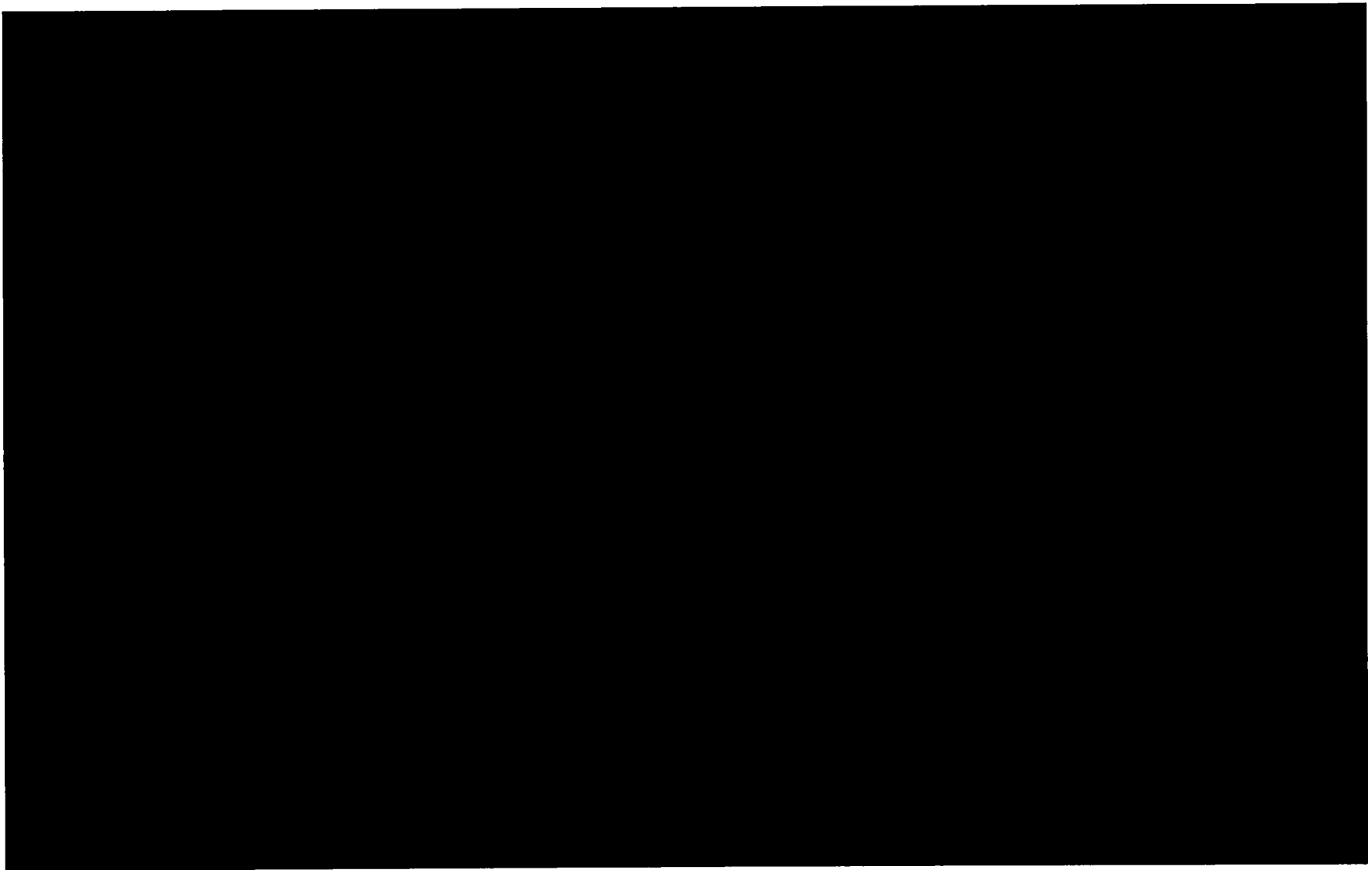


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 18 of 31

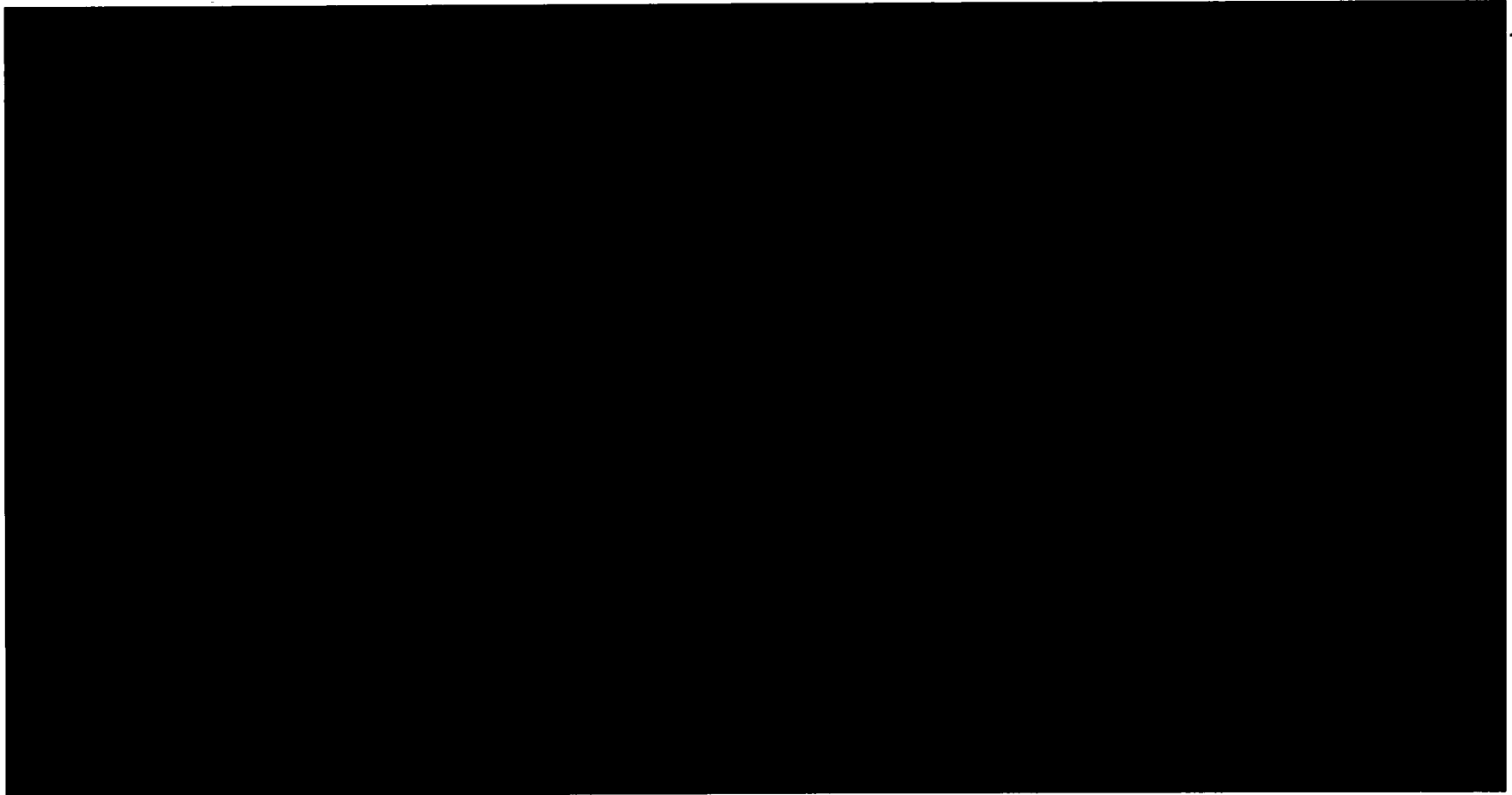


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 19 of 31

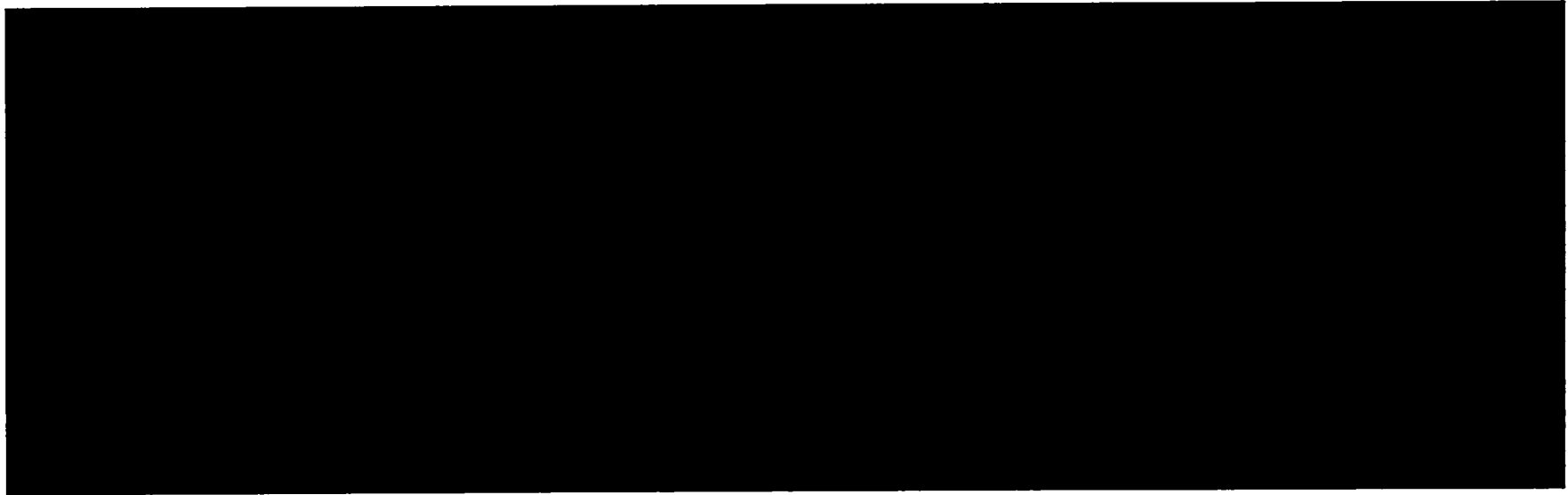


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 20 of 31

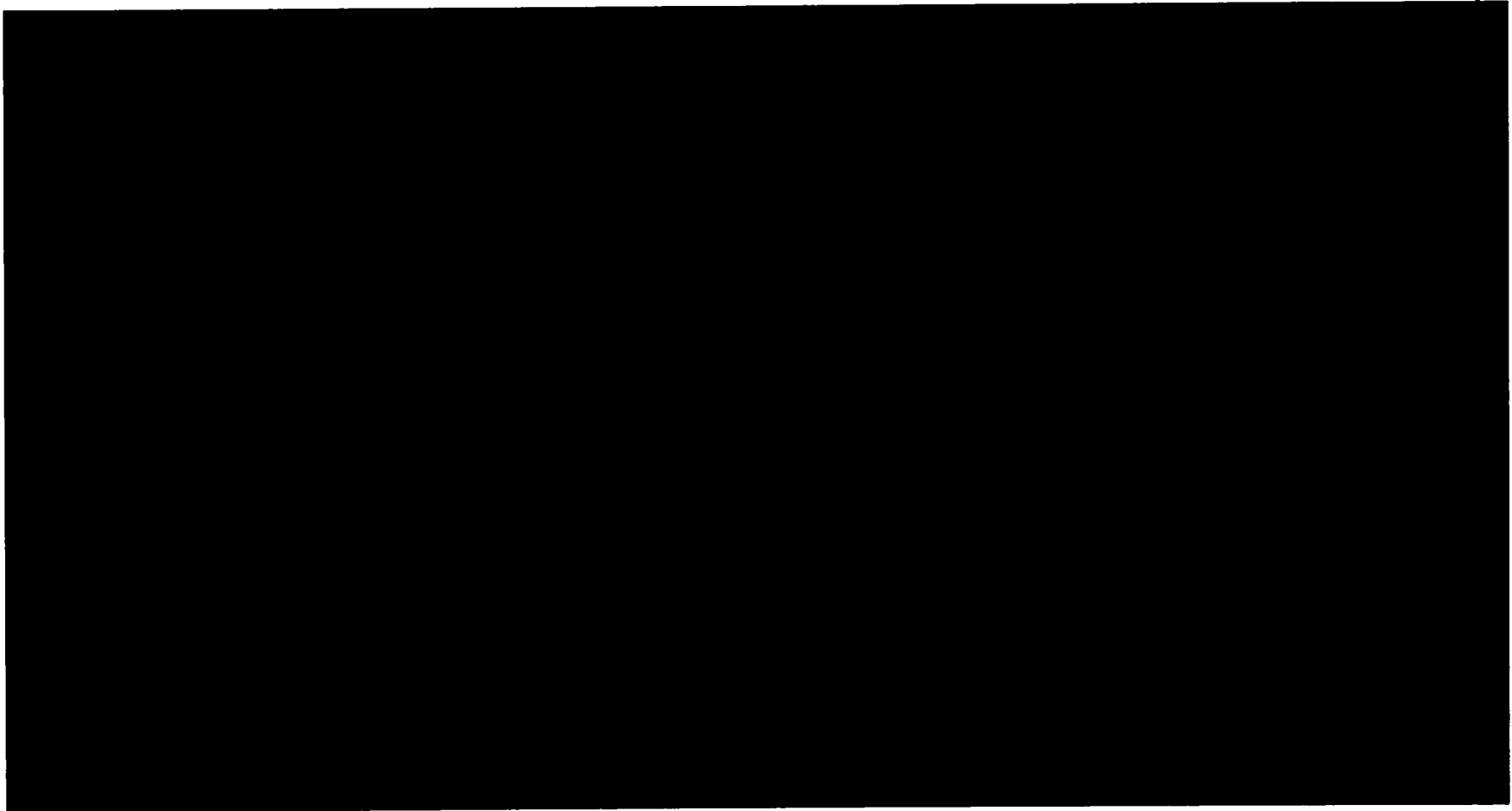


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 21 of 31

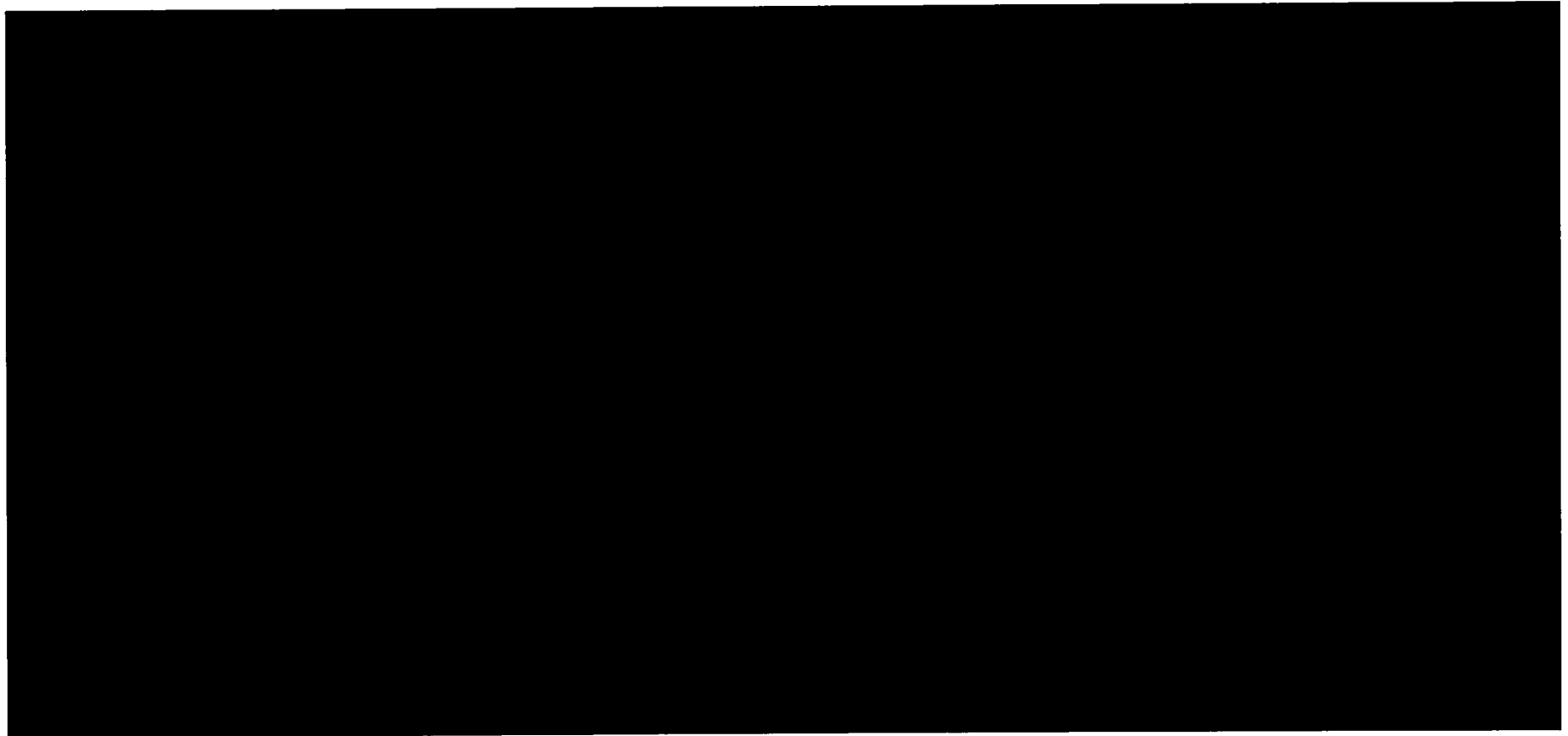


Table 3.8-1 Items Relied On For Safety (IROFS)

Page 22 of 31

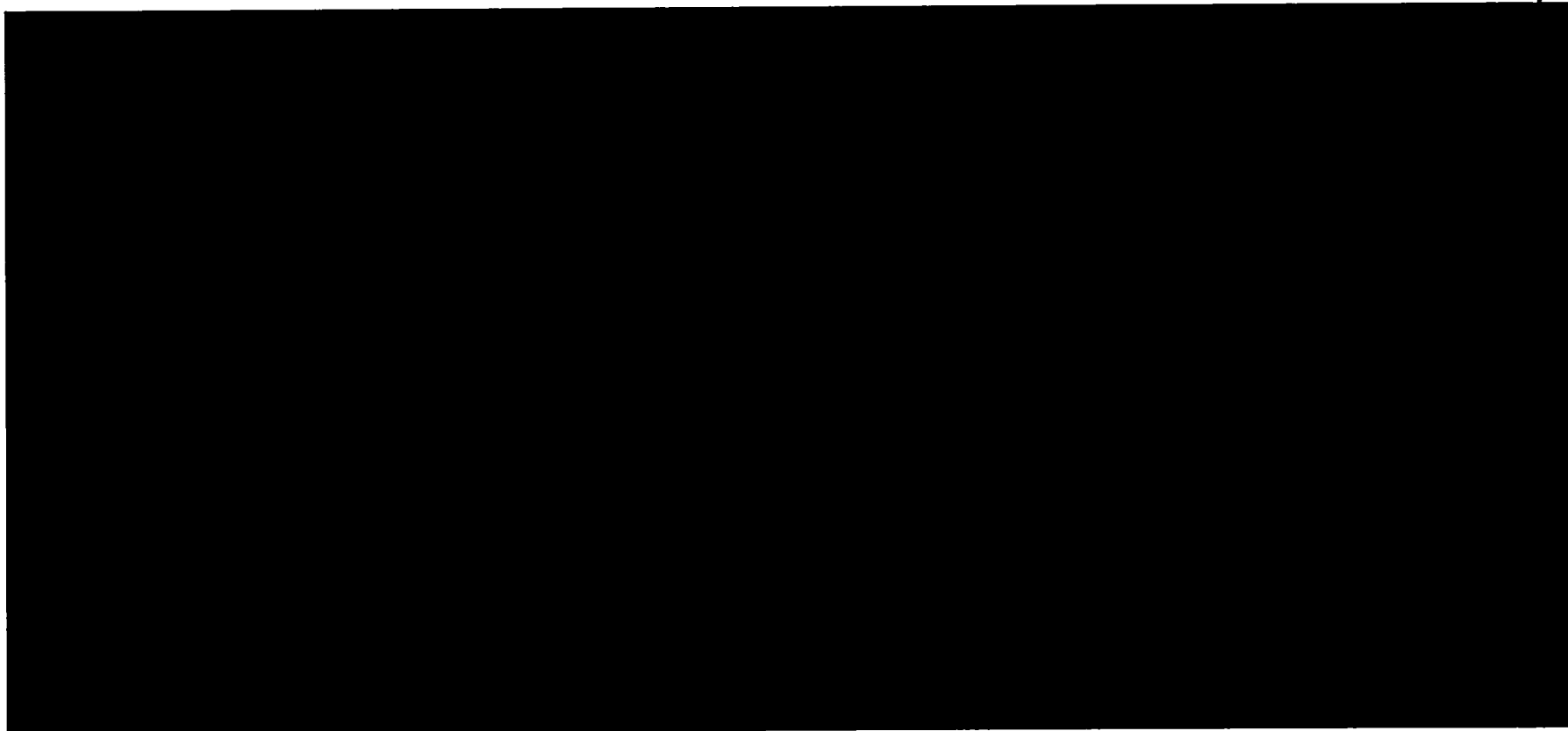


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 23 of 31

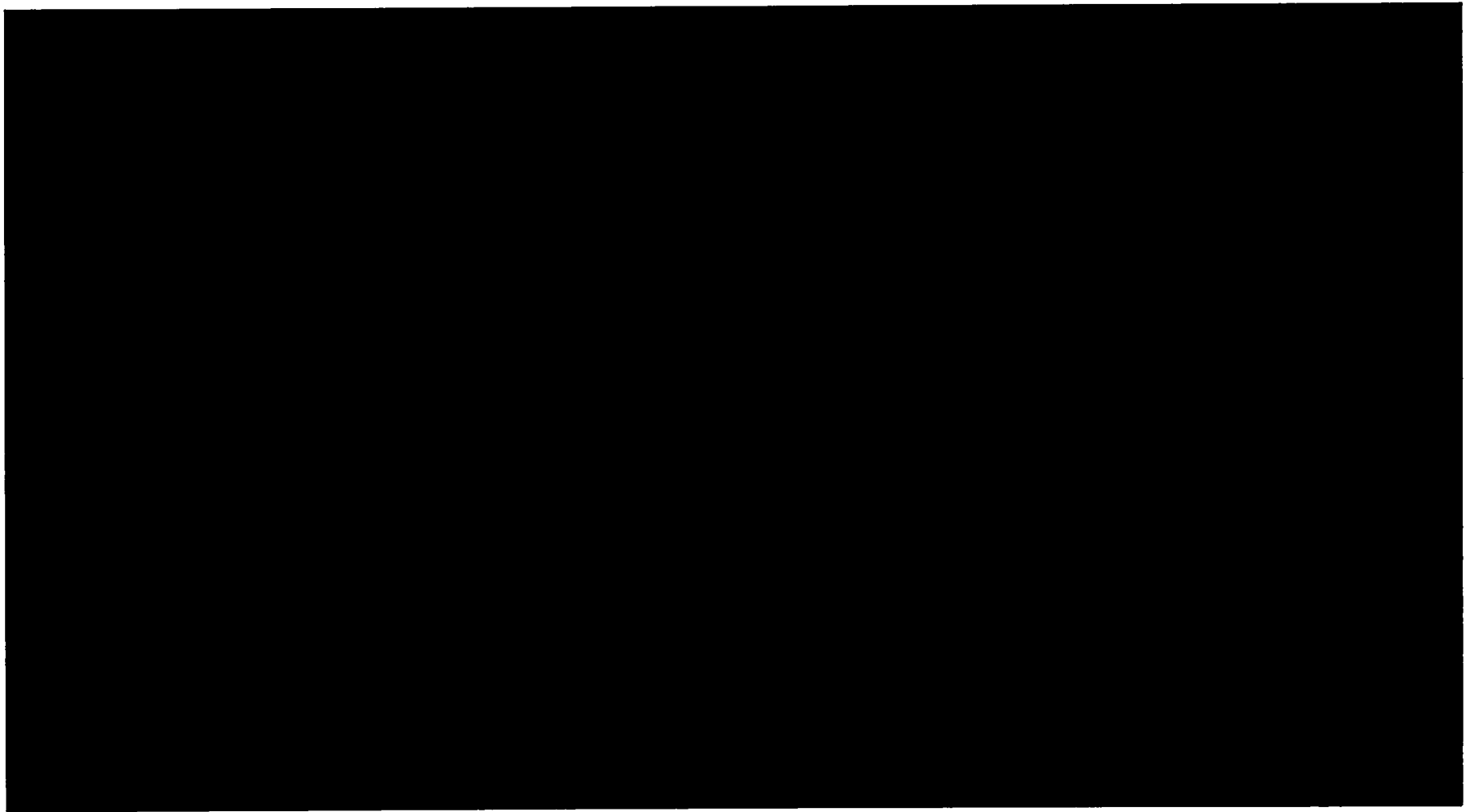


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 24 of 31

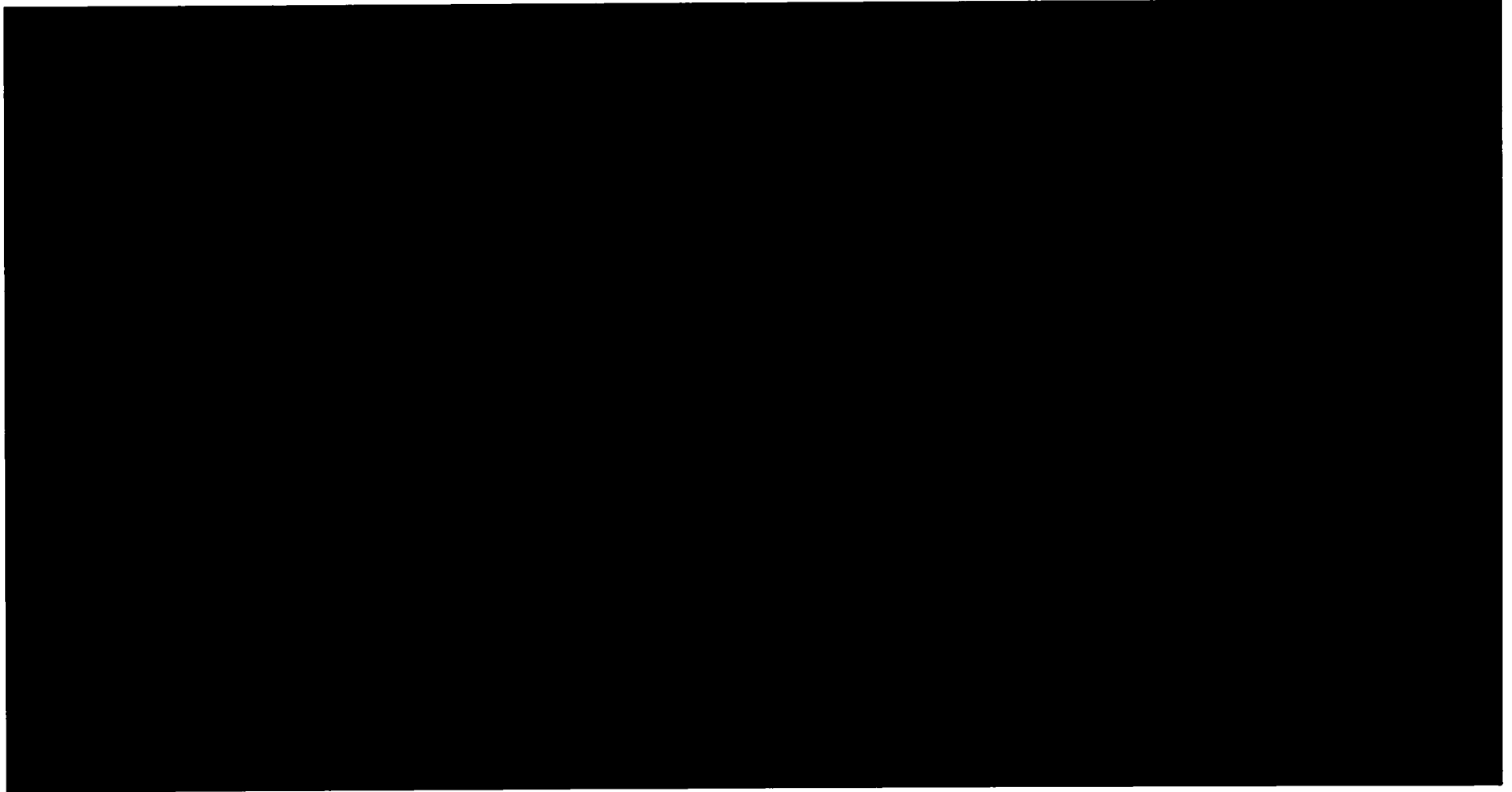


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 25 of 31

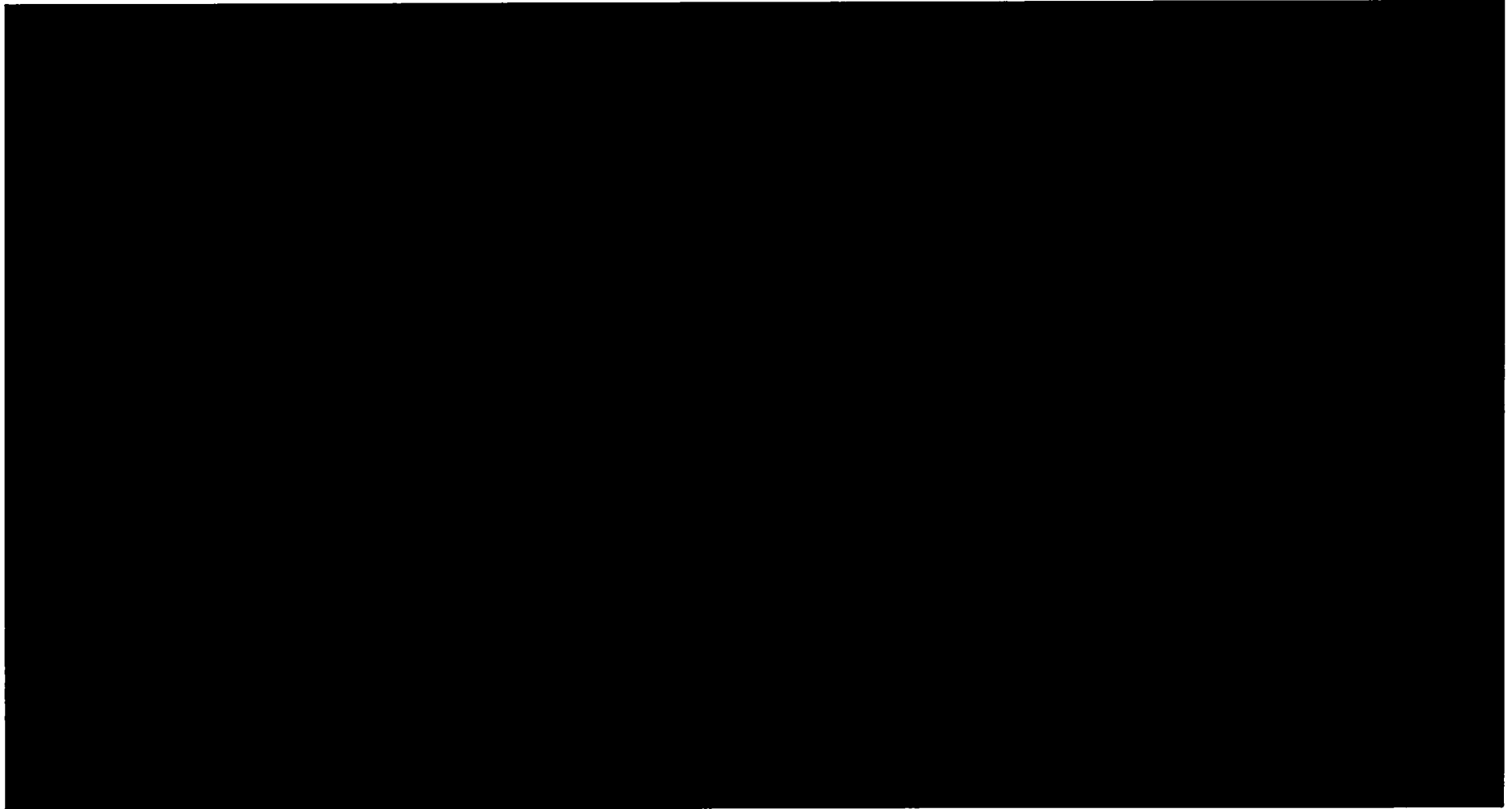


Table 3.8-1 Items Relied On For Safety (IROFS)

Page 26 of 31

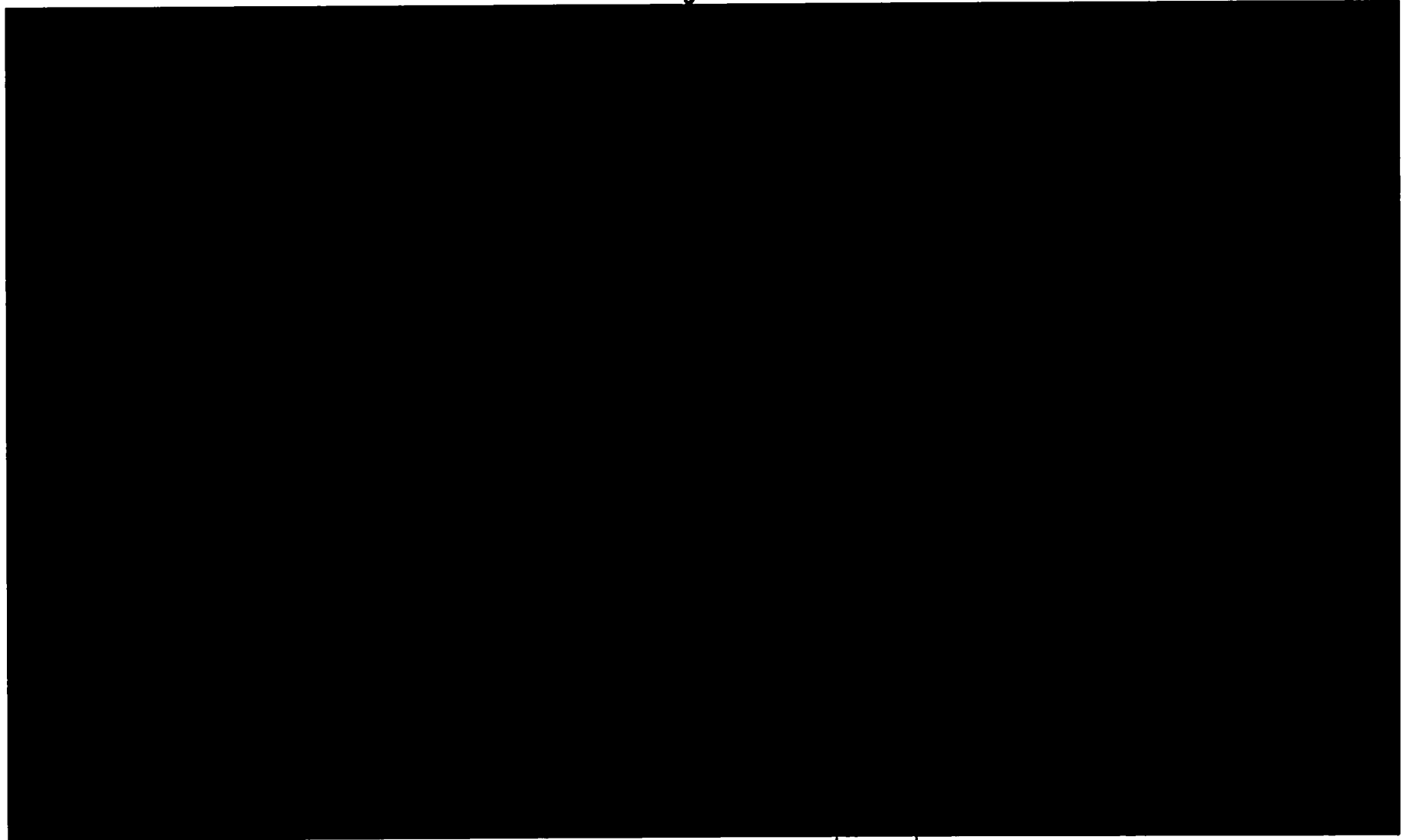


Table 3.8-1 Items Relied On For Safety (IROFS)

Page 27 of 31

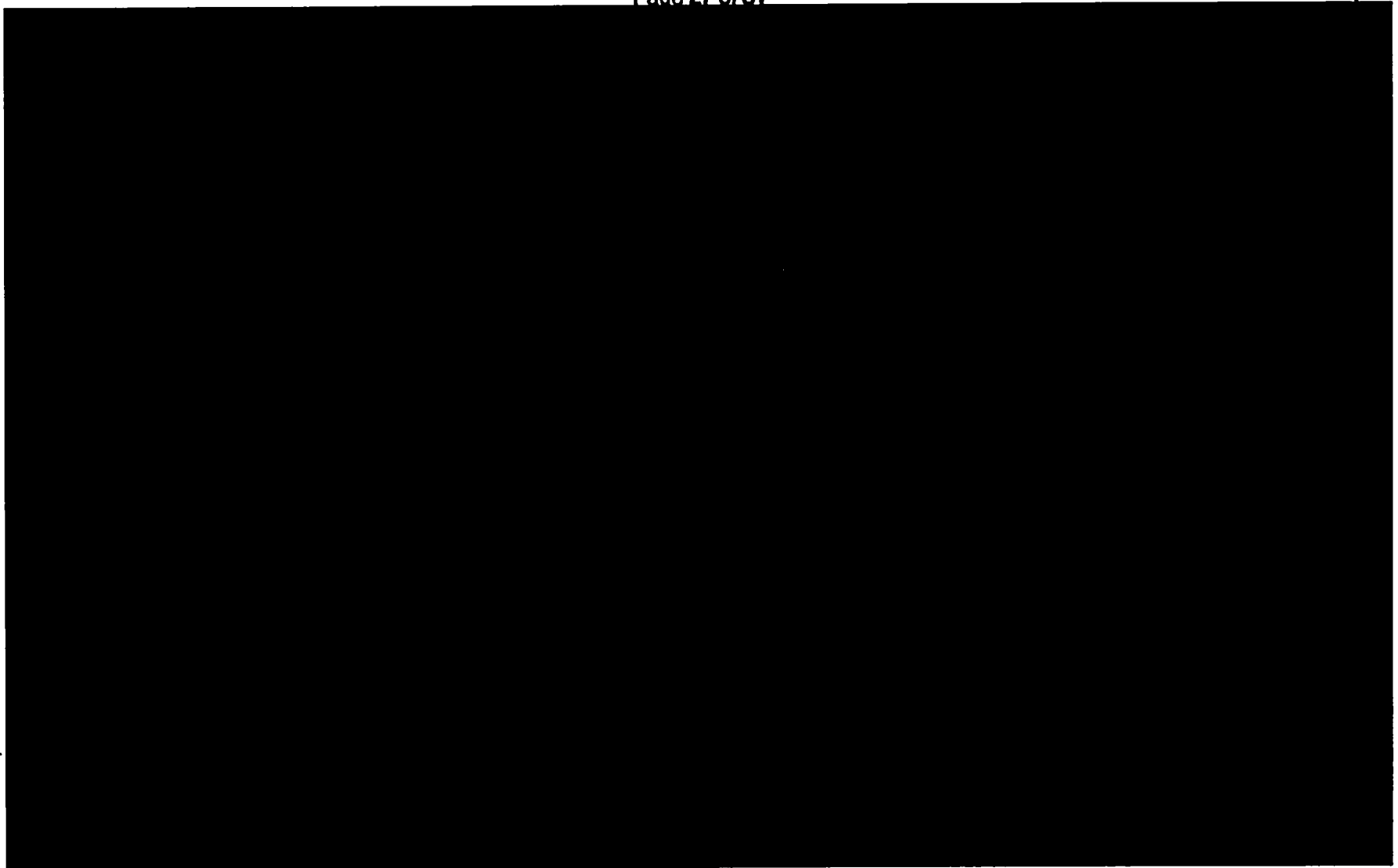


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 28 of 31

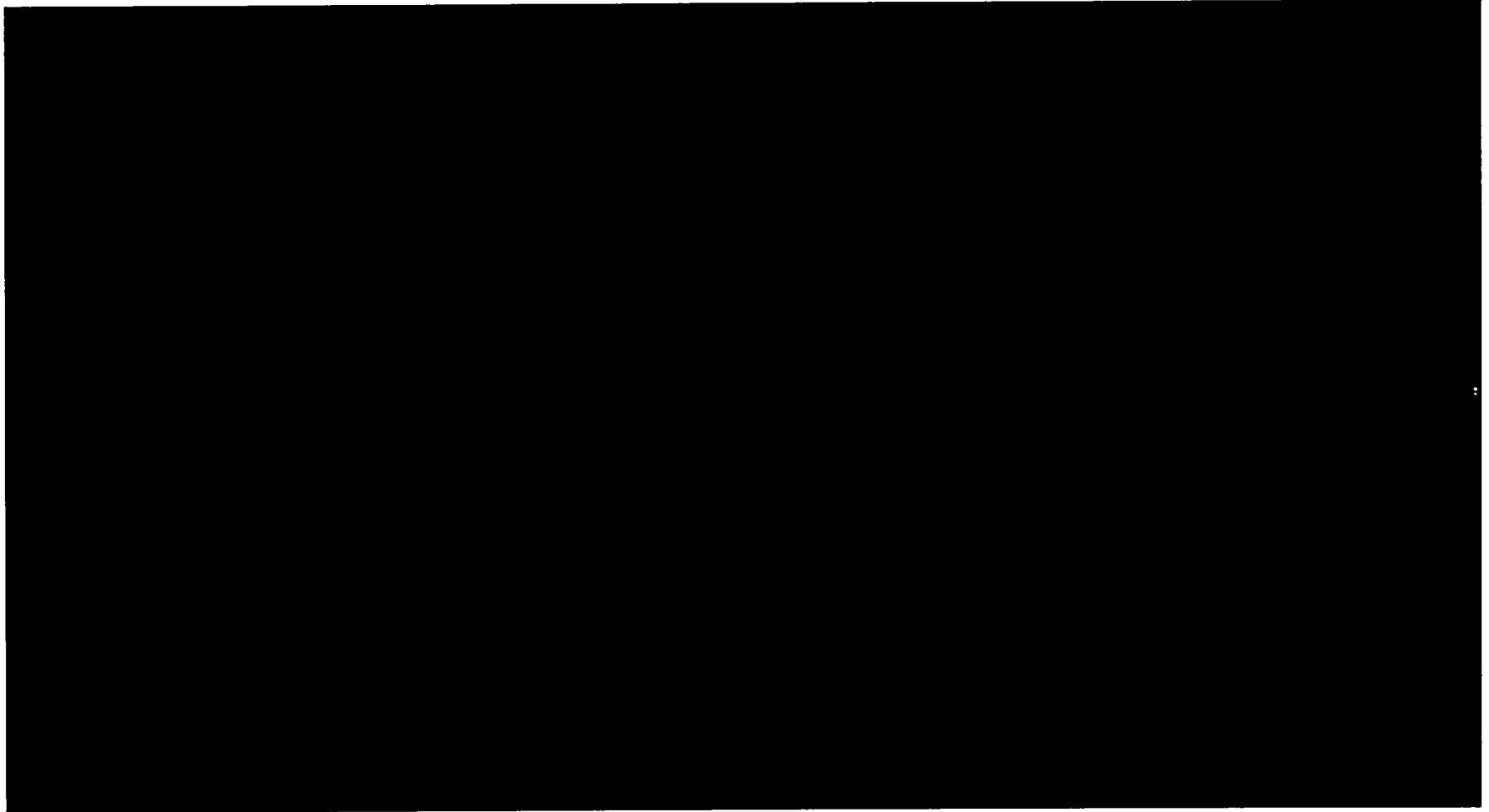


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 29 of 31

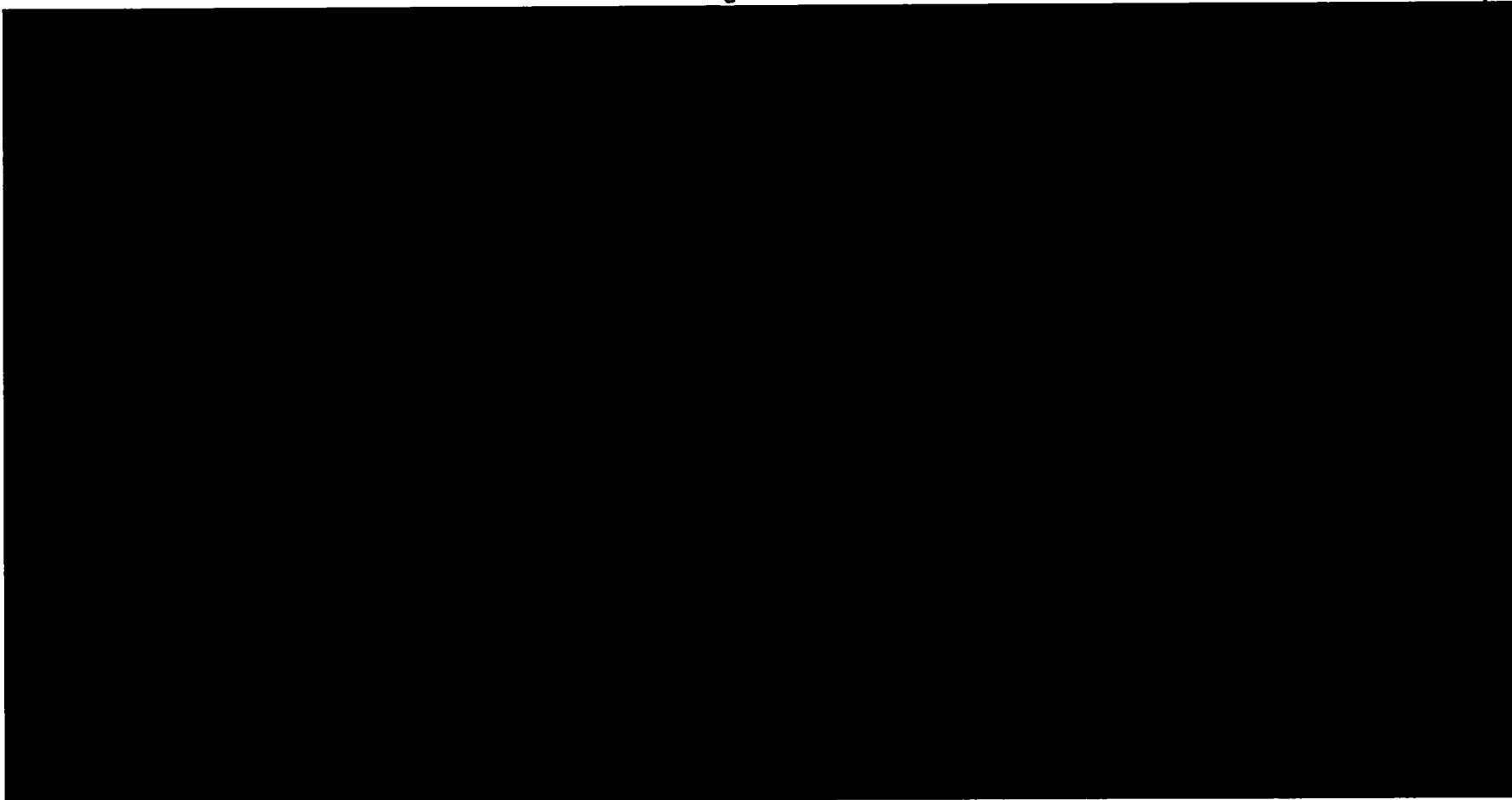
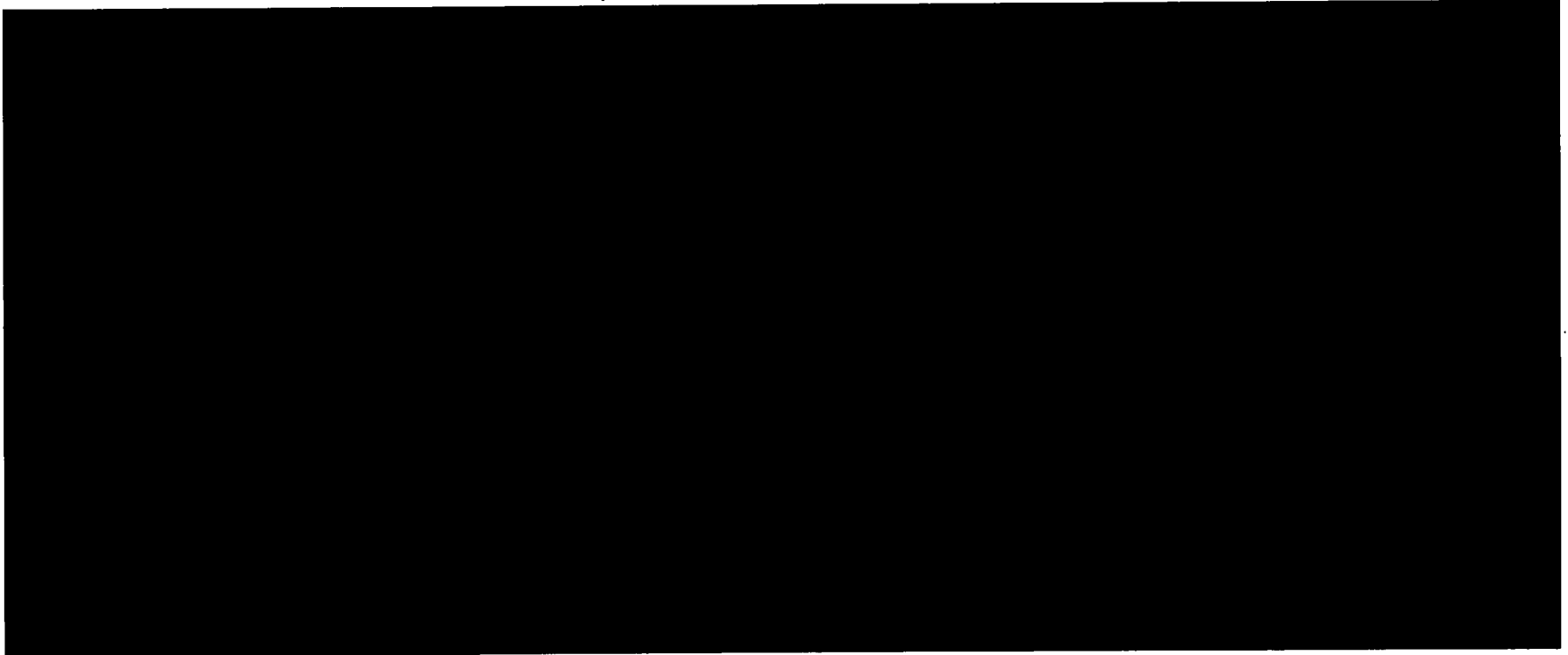
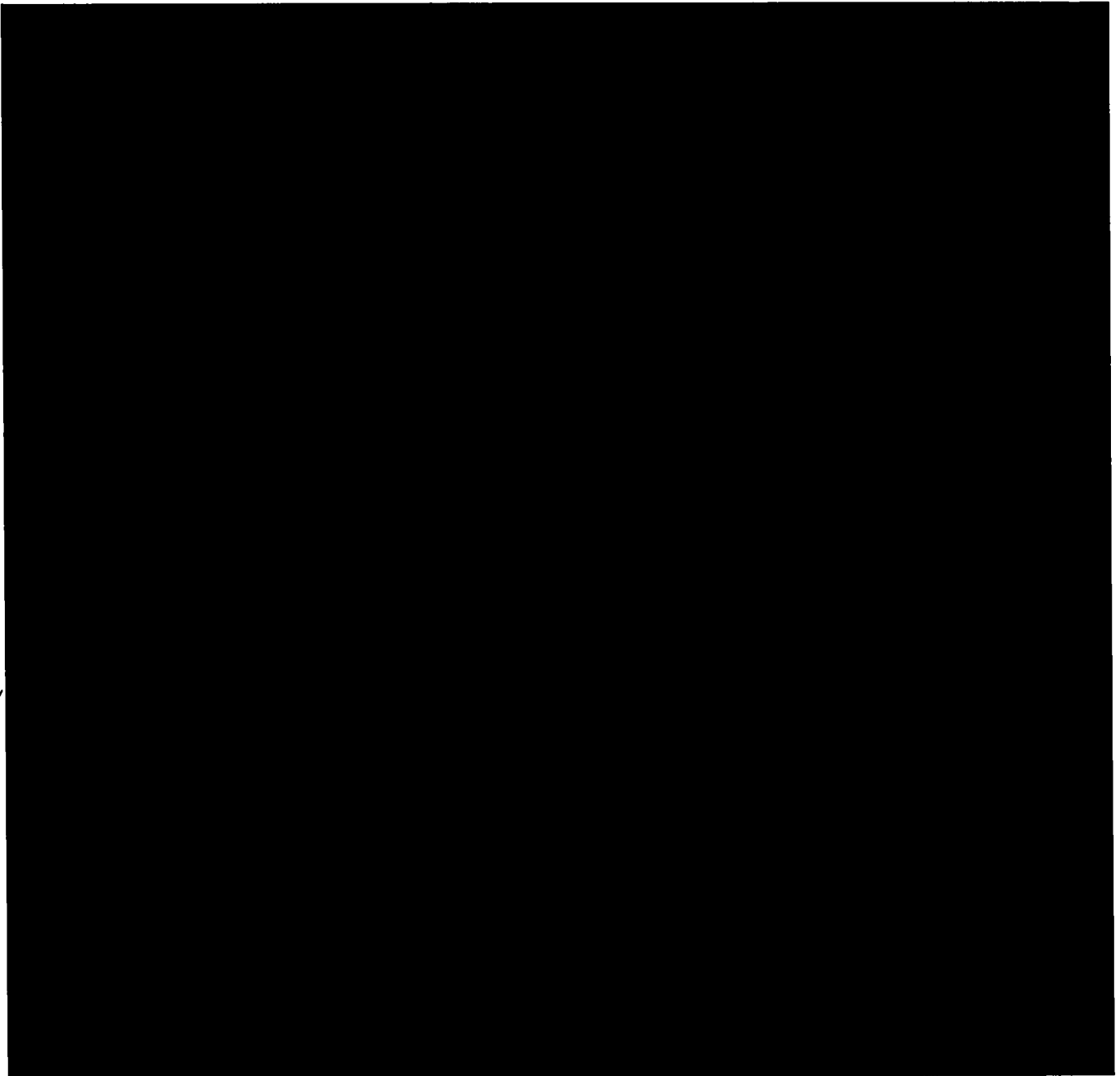


Table 3.8-1 Items Relied On For Safety (IROFS)
Page 30 of 31





(This page Intentionally left blank)

Table 3.8-2 Sole Items Relied On For Safety (IROFS)
Page 1 of 4

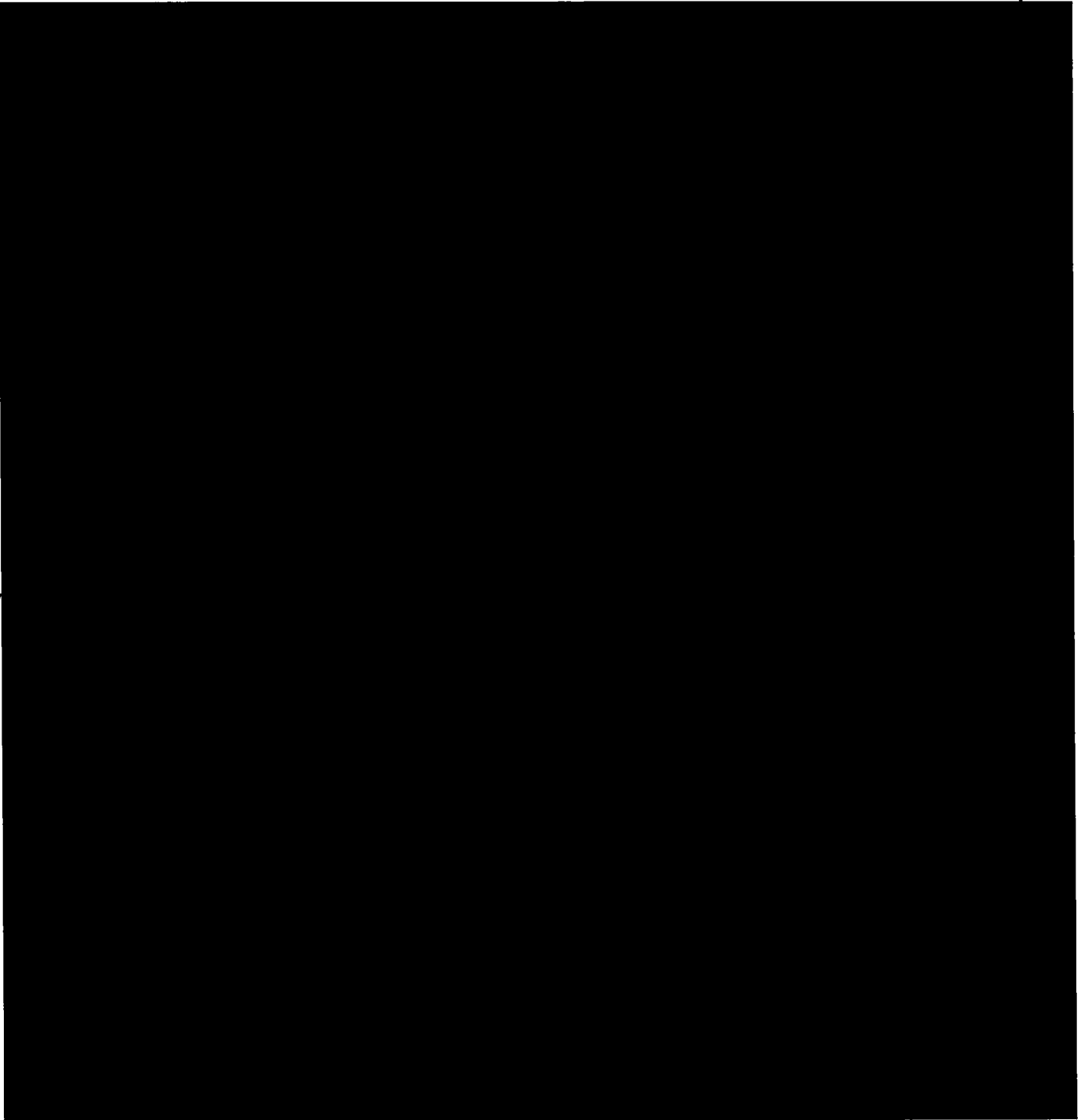


Table 3.8-2 Sole Items Relied On For Safety (IROFS)
Page 2 of 4

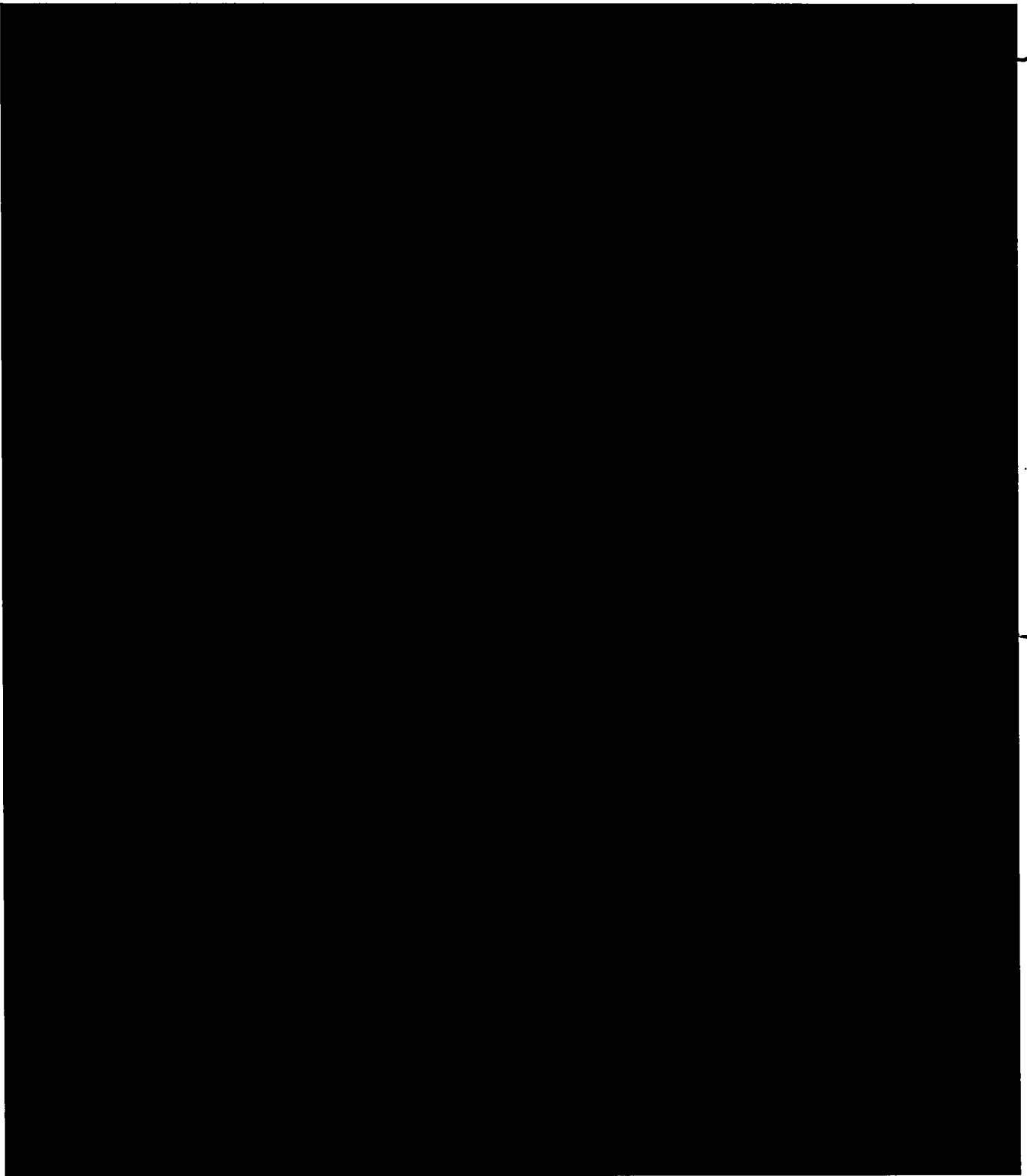


Table 3.8-2 Sole Items Relied On For Safety (IROFS)
Page 3 of 4

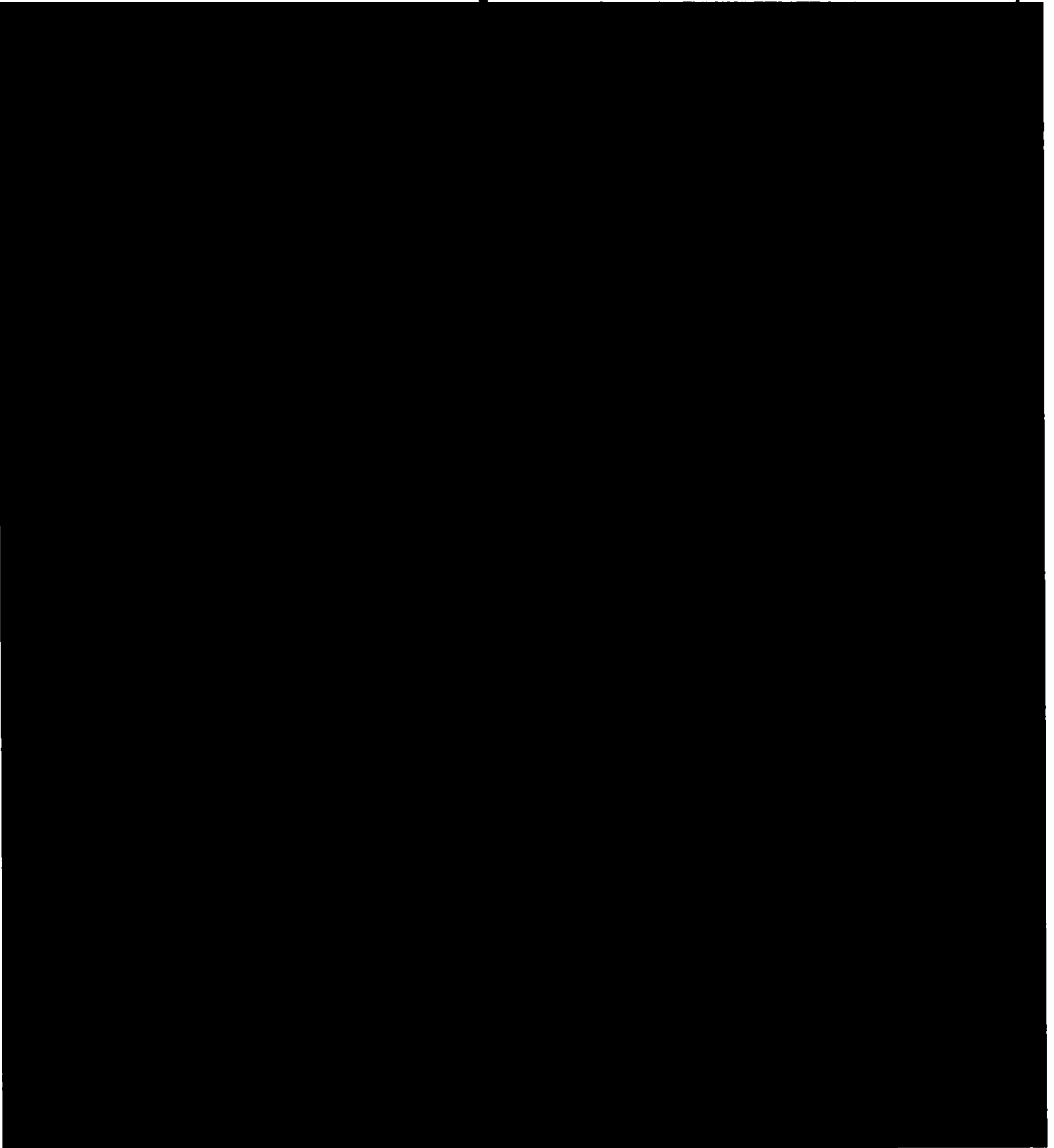


Table 3.8-2 : Sole Items Relied On For Safety (IROFS)

Page 4 of 4

