ThinkPad

Hardware Maintenance Manual

ThinkPad E450, E455, and E450c

Note: Before using this information and the product it supports, be sure to read the general information under Appendix A “Notices” on page 93.

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About this manual

This manual contains service and reference information for the following ThinkPad® products.

ThinkPad E450	Machine type (MT) 20DC and 20DD
ThinkPad E455	Machine type (MT) 20DE
ThinkPad E450c	Machine type (MT) 20EH

Use this manual along with the advanced diagnostic tests to troubleshoot problems.

Important: This manual is intended only for trained service technicians who are familiar with ThinkPad products. Use this manual along with the advanced diagnostic tests to troubleshoot problems effectively. Before servicing a ThinkPad product, be sure to read all the information under Chapter 1 “Safety information” on page 1 and Chapter 2 “Important service information” on page 19.

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Chapter 1. Safety information

This chapter presents following safety information that you need to be familiar with before you service a ThinkPad notebook computer.

- “General safety” on page 1
- “Electrical safety” on page 1
- “Safety inspection guide” on page 2
- “Handling devices that are sensitive to electrostatic discharge” on page 3
- “Grounding requirements” on page 4
- “Safety notices (multilingual translations)” on page 4

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
  1. Make sure that you can stand safely without slipping.
  2. Distribute the weight of the object equally between your feet.
  3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
  4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any object that weighs more than 16 kg (35 lb) or that you think is too heavy for you.*
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, make sure that other service technicians and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your toolcase away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Make sure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, about 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

  Attention: Metal objects are good electrical conductors.
- Wear safety glasses when you are hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.
- Fan louvers on the machine help to prevent overheating of internal components. Do not obstruct fan louvers or cover them with labels or stickers.

Electrical safety

Observe the following rules when working on electrical equipment.

Important: Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

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- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
  - Performing a mechanical inspection
  - Working near power supplies
  - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine, and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
  - Ensure that another person, familiar with the power-off controls, is near you.

    Attention: Another person must be there to switch off the power, if necessary.
  - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

    Attention: An electrical shock can occur only when there is a complete circuit. By observing the above rule, you may prevent a current from passing through your body.
  - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
  - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

  Observe the special safety precautions when you work with very high voltages; Instructions for these precautions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.
- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, ungrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts *with the power on* when they are removed from their normal operating places in a machine:
  - Power supply units
  - Pumps
  - Blowers and fans
  - Motor generators
  - Parts similar to those listed above

  This practice ensures correct grounding of the units.
- If an electrical accident occurs:
  - Use caution; do not become a victim yourself.
  - Switch off power.
  - Send another person to get medical aid.

Safety inspection guide

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-ThinkPad features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:
- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock)
- Explosive hazards, such as a damaged CRT face or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

To determine whether there are any potentially unsafe conditions, use the following checklist at the beginning of every service task. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power off the computer. Disconnect the power cord.
3. Check the power cord for:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and the frame ground.
   b. The power cord should be the authorized type specified for your computer. Go to: http://www.lenovo.com/serviceparts-lookup
   c. Insulation must not be frayed or worn.
4. Check for cracked or bulging batteries.
5. Remove the cover.
6. Check for any obvious non-ThinkPad alterations. Use good judgment as to the safety of any non-ThinkPad alterations.
7. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
8. Check for worn, frayed, or pinched cables.
9. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Handling devices that are sensitive to electrostatic discharge

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD.) ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:
- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

  Note: The use of a grounding system to guard against ESD damage is desirable but not necessary.
  – Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.

– When working on a double-insulated or battery-operated system, use an ESD common ground or reference point. You can use coax or connector-outside shells on these systems.
– Use the round ground prong of the ac plug on ac-operated computers.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Safety notices (multilingual translations)

The safety notices in this section are provided in the following languages:
- English
- Arabic
- Brazilian Portuguese
- French
- German
- Hebrew
- Japanese
- Korean
- Spanish
- Traditional Chinese

DANGER

Before the computer is powered on after FRU replacement, make sure that all screws, springs, and other small parts are in place and are not left loose inside the computer. Verify this by shaking the computer and listening for rattling sounds. Metallic parts or metal flakes can cause electrical short circuits.

DANGER

Some standby batteries contain a small amount of nickel and cadmium. Do not disassemble a standby battery, recharge it, throw it into fire or water, or short-circuit it. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

DANGER

The battery pack contains small amounts of nickel. Do not disassemble it, throw it into fire or water, or short-circuit it. Dispose of the battery pack as required by local ordinances or regulations. Use only the battery in the appropriate parts listing when replacing the battery pack. Use of an incorrect battery can result in ignition or explosion of the battery.

DANGER

The lithium battery can cause a fire, an explosion, or a severe burn. Do not recharge it, remove its polarized connector, disassemble it, heat it above 100°C (212°F), incinerate it, or expose its cell contents to water. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

DANGER

If the LCD breaks and the fluid from inside the LCD gets into your eyes or on your hands, immediately wash the affected areas with water for at least 15 minutes. Seek medical care if any symptoms from the fluid are present after washing.

DANGER

To avoid shock, do not remove the plastic cover that protects the lower part of the inverter card.

DANGER

Though the main batteries have low voltage, a short-circuited or grounded battery can produce enough current to burn personnel or combustible materials.

DANGER

Unless hot swap is allowed for the FRU being replaced, do as follows before removing it: power off the computer, unplug all power cords from electrical outlets, remove the battery pack, and disconnect any interconnecting cables.

خطر

قبل اعادة تشغيل الحاسب بعد الانتهاء من استبدال FRU، تأكد من أنه قد تم اعادة كل من
المسامير و السوست وكل الأجزاء الصغيرة الأخرى في أماكنهم ولم يتم فقدهم داخل الحاسب.
ويمكن التحقق من ذلك عن طريق هز الحاسب والاستماع لأي صوت صاخب يصدر منه.
قد تؤدي الأجزاء أو الرقائق المعدنية الى حدوث دائرة قصر.

خطر

تحتوي بعض البطاريات الاحتياطية على كمية صغيرة من مادتي النيكل والكادميوم. لا تقم بفك أو اعادة شحن البطارية الاحتياطية ولا تقم أيضا بالقاءها في النار أو الماء ولا تتسبب في احداث دائرة قصر بها. قم بالتخلص من البطارية كما هو موضح في القوانين المحلية. استخدم نوع البطارية المحدد والذي يوصى باستخدامه. حيث أنه قد يؤدي استخدام نوع بطارية غير صحيح الى اشتعالها أو انفجارها.

خطر

تحتوي حزمة البطارية على كمية صغيرة من مادة النيكل. لا تقم بفكها أو القاءها في النار أو الماء ولا تتسبب في احداث دائرة قصر بها. تخلص من حزمة البطارية وفقا لما هو موضح في القوانين المحلية. قم، عند استبدال حزمة البطارية، باستخدام الأنواع المحددة فقط والتي يوصى باستخدامها. حيث أنه قد يؤدي استخدام نوع بطارية غير صحيح الى اشتعالها أو انفجارها.

خطر

قد تتسبب بطارية الليثيوم في حدوث حريق أو انفجار أو حدوث حروق شديدة. لا تقم باعادة شحن البطارية أو ازالة موصل الاستقطاب الخاص بها ولا تحاول أيضا فكها أو تسخينها لأكثر من ١٠٠ درجة منوية (٢١٢ فهرنهايت) أو حرقها أو تعريض محتويات الخانة الخاصة بها للماء. قم بالتخلص من البطارية وفقا لما هو موضح في القوانين المحلية. استخدم نوع البطارية المحدد والذي يوصى باستخدامه. حيث أنه قد يؤدي استخدام نوع بطارية غير صحيح الى اشتعالها أو انفجارها.

خطر

اذا ما انكسرت شاشة LCD ولامس السائل الداخلي عينيك أو يديك، قم في الحال بغسلهما بالماء لمدة لا تقل عن ١٥ دقيقة. اذا ما وجدت أي أعراض بعد الغسل اطلب عندئذ المساعدة الطبية.

خطر

لتجنب التعرض لأي صدمات، لا تقم بازالة الغطاء البلاستيكي الذي يحمي الجزء الأسفل من بطاقة العاكس.

خطر

على الرغم من أن البطاريات الرئيسية يكون لها جهد منخفض، الا أنه قد تقوم البطاريات
التي حدث قصور بها أو التي تم توصيلها أرضيا باصدار تيار يكفي لحدوث حروق للأفراد
أو تعرض المواد القابلة للاشتعال للحريق.

خطر

ما لم يتم السماح بالتبديل الفوري لأي FRU الجاري استبداله بدون ضرورة اغلاق النظام، قم
بتنفيذ ما يلي قبل ازالته: قم بايقاف تشغيل الحاسب ونزع كل أسلاك الطاقة من المخارج الكهربائية
وقم أيضا بازالة حزمة البطارية ثم قم بفصل أي كابلات متصلة.

PERIGO

Antes de ligar o computador após a substituição da FRU, certifique-se de que todos os parafusos, molas e outras peças pequenas estejam no lugar e não estejam soltos dentro do computador. Verifique isso sacudindo o computador e procurando ouvir sons de peças soltas. Peças metálicas ou lascas de metal podem causar curto-circuito.

PERIGO

Algumas baterias reserva contêm uma pequena quantidade de níquel e cádmio. Não desmonte uma bateria reserva, recarregue-a, jogue-a no fogo ou na água, ou deixe-a entrar em curto-circuito. Descarte a bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

PERIGO

O pacote da bateria contém uma pequena quantidade de níquel. Não o desmonte, jogue-o no fogo ou na água, ou deixe-o entrar em curto-circuito. Descarte o pacote da bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas ao substituir o pacote da bateria. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

PERIGO

A bateria de lítio pode causar incêndio, explosão ou graves queimaduras. Não a recarregue, remova seu conector polarizado, desmonte-a, aqueça-a acima de 100°C (212°F), incinere-a, ou exponha o conteúdo de sua célula à água. Descarte a bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

PERIGO

Se o LCD quebrar e o fluido de dentro dele entrar em contato com seus olhos ou com suas mãos, lave as áreas afetadas imediatamente com água durante pelo menos 15 minutos. Procure cuidados médicos se algum sintoma causado pelo fluido surgir após a lavagem.

PERIGO

Para evitar choque elétrico, não remova a capa plástica que protege a parte inferior da placa inversora.

PERIGO

Embora as principais baterias possuam baixa voltagem, uma bateria em curto-circuito ou aterrada pode produzir corrente o bastante para queimar materiais de pessoal ou inflamáveis.

PERIGO

A menos que uma hot swap seja permitida para a FRU que está sendo substituída, faça o seguinte antes de removê-la: desligue o computador, desconecte todos os cabos de energia das tomadas, remova o pacote de baterias e desconecte quaisquer cabos de interconexão.

DANGER

Avant de remettre l'ordinateur sous tension après remplacement d'une unité en clientèle, vérifiez que tous les ressorts, vis et autres pièces sont bien en place et bien fixées. Pour ce faire, secouez l'unité et assurez-vous qu'aucun bruit suspect ne se produit. Des pièces métalliques ou des copeaux de métal pourraient causer un court-circuit.

DANGER

Certaines batteries de secours contiennent du nickel et du cadmium. Ne les démontez pas, ne les rechargez pas, ne les exposez ni au feu ni à l'eau. Ne les mettez pas en court-circuit. Pour les mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la pile de sauvegarde ou celle de l'horloge temps réel, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. Une batterie ou une pile inappropriée risque de prendre feu ou d'exploser.

DANGER

La batterie contient du nickel. Ne la démontez pas, ne l'exposez ni au feu ni à l'eau. Ne la mettez pas en court-circuit. Pour la mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la batterie, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. En effet, une batterie inappropriée risque de prendre feu ou d'exploser.

DANGER

La pile de sauvegarde contient du lithium. Elle présente des risques d'incendie, d'explosion ou de brûlures graves. Ne la rechargez pas, ne retirez pas son connecteur polarisé et ne la démontez pas. Ne l'exposez pas à une temperature supérieure à 100°C, ne la faites pas brûler et n'en exposez pas le contenu à l'eau. Mettez la pile au rebut conformément à la réglementation en vigueur. Une pile inappropriée risque de prendre feu ou d'exploser.

DANGER

Si le panneau d'affichage à cristaux liquides se brise et que vous recevez dans les yeux ou sur les mains une partie du fluide, rincez-les abondamment pendant au moins quinze minutes. Consultez un médecin si des symptômes persistent après le lavage.

DANGER

Afin d'éviter tout risque de choc électrique, ne retirez pas le cache en plastique protégeant la partie inférieure de la carte d'alimentation.

DANGER

Bien que le voltage des batteries principales soit peu élevé, le court-circuit ou la mise à la masse d'une batterie peut produire suffisamment de courant pour brûler des matériaux combustibles ou causer des brûlures corporelles graves.

DANGER

Si le remplacement à chaud n'est pas autorisé pour l'unité remplaçable sur site que vous remplacez, procédez comme suit avant de retirer l'unité : mettez l'ordinateur hors tension, débranchez tous les cordons d'alimentation des prises de courant, retirez le bloc de batterie et déconnectez tous les câbles d'interconnexion.

VORSICHT

Bevor nach einem FRU-Austausch der Computer wieder angeschlossen wird, muß sichergestellt werden, daß keine Schrauben, Federn oder andere Kleinteile fehlen oder im Gehäuse vergessen wurden. Der Computer muß geschüttelt und auf Klappergeräusche geprüft werden. Metallteile oder-splitter können Kurzschlüsse erzeugen.

VORSICHT

Die Bereitschaftsbatterie, die sich unter dem Diskettenlaufwerk befindet, kann geringe Mengen Nickel und Cadmium enthalten. Sie darf nur durch die Verkaufsstelle oder den IBM Kundendienst ausgetauscht werden. Sie darf nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Die Batterie kann schwere Verbrennungen oder Verätzungen verursachen. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Bereitschafts-oder Systembatterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

VORSICHT

Akkus enthalten geringe Mengen von Nickel. Sie dürfen nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

VORSICHT

Die Systembatterie ist eine Lithiumbatterie. Sie kann sich entzünden, explodieren oder schwere Verbrennungen hervorrufen. Batterien dieses Typs dürfen nicht aufgeladen, zerlegt, über 100°C erhitzt oder verbrannt werden. Auch darf ihr Inhalt nicht mit Wasser in Verbindung gebracht oder der zur richtigen Polung angebrachte Verbindungsstecker entfernt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

VORSICHT

Die Leuchtstoffröhre im LCD-Bildschirm enthält Quecksilber. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Der LCD-Bildschirm besteht aus Glas und kann zerbrechen, wenn er unsachgemäß behandelt wird oder der Computer auf den Boden fällt. Wenn der Bildschirm beschädigt ist und die darin befindliche Flüssigkeit in Kontakt mit Haut und Augen gerät, sollten die betroffenen Stellen mindestens 15 Minuten mit Wasser abgespült und bei Beschwerden anschließend ein Arzt aufgesucht werden.

VORSICHT

Aus Sicherheitsgründen die Kunststoffabdeckung, die den unteren Teil der Spannungswandlerplatine umgibt, nicht entfernen.

VORSICHT

Obwohl Hauptbatterien eine niedrige Spannung haben, können sie doch bei Kurzschluß oder Erdung genug Strom abgeben, um brennbare Materialien zu entzünden oder Verletzungen bei Personen hervorzurufen.

VORSICHT

Wenn ein Austausch der FRU bei laufendem Betrieb nicht erlaubt ist, gehen Sie beim Austausch der FRU wie folgt vor: Schalten Sie den Computer aus, ziehen Sie alle Netzkabel von den Netzsteckdosen ab, entfernen Sie den Akku und ziehen Sie alle miteinander verbundenen Kabel ab.

סכנה

לפני הפעלת המחשב לאחר החלפת FRU יש לוודא שכל הברגים, הקפיצים, והחלקים קטנים אחרים
נמצאים במקומם ואינם חופשיים לזוז בתוך המחשב. כדי לוודא זאת, יש לטלטל את המחשב
ולהקשיב לגילוי קולות שקשוק. חלקי או שבבי מתכת עלולים לגרום לקצרים חשמליים.

סכנה

סוללות המתנה מסוימות מכילות כמות קטנה של ניקל וקדמיום. אין לפרק סוללת המתנה, לטעון אותה מחדש, להשליך אותה לאש או למים או לקצר אותה. יש לסלק את הסוללה כנדרש על ידי התקנות והחוקים המקומיים. יש להשתמש רק בסוללה המופיעה ברשימת החלקים המתאימה. שימוש בסוללה לא מתאימה עלול לגרום להצתה או התפוצצות של הסוללה.

סכנה

מארז הסוללה מכיל כמות קטנה של ניקל וקדמיום. אין לפרק את מארז הסוללה, להשליך אותו לאש או למים או לקצר אותו. יש לסלק את מארז הסוללה הסוללה כנדרש על ידי התקנות וחוקים המקומיים. יש להשתמש רק בסוללה המופיעה ברשימת החלקים המתאימה בזמן החלפת מארז הסוללה. שימוש בסוללה לא מתאימה עלול לגרום להצתה או התפוצצות של הסוללה.

סכנה

סוללת הליתיום עלולה לגרום לשריפה, להתפוצצות או לכוויות קשות. אין לטעון אותה מחדש, לפרק את המחבר המקוטב שלה, לפרק אותה או לחמם אותה לטמפרטורה העולה על 100 מעלות צלזיוס. אין לשרוף את הסוללה ואין לחשוף את תוכן התא למים. יש לסלק את הסוללה כנדרש בתקנות ובחוקים המקומיים. יש להשתמש רק בסוללה המופיעה ברשימת החלקים המתאימים. שימוש בסוללה אחרת עלול לגרום לסכנת שריפה או התפוצצות.

סכנה

אם מסך הגביש הנוזלי (LCD) נשבר והנוזל מתוך חמסך בא במגע עם עיניכם או ידיכם, שטפו את האזורים הנגועים מיד במים במשך 15 דקות לפחות. פנו לקבלת עזרה רפואית אם תסמינים הנובעים מחמגע עם הנוזל נמשכים לאחר השטיפה.

סכנה

כדי למנוע התחשמלות, אין להסיר את מכסה הפלסטיק המגן על חלקו התחתון של הכרטיס החפוך.

סכנה

אף שהסוללות הראשיות הן בעלות מתח נמוך, סוללה מקוצרת או מוארקת עלולה להפיק זרם מספיק לגרימת כוויות או להצתת חומרים דליקים.

סכנה

אלא אם כן מותרת 'החלפה חמה' של ה-FRU המוחלף, פעלו כדלהלן לפני הסרתו:
כבו את המחשב, נתקו את כל כבלי החשמל מהשקעים, הוציאו את מארז הסוללות ונתקו את כל הכבלים המחוברים.

危険

FRU の交換後、 ThinkPad の電源を入れる前に、ねじ、バネ、その他の小さな部品がすべて正しい位置にあり、また ThinkPad の内部で緩んでいないことを確認してください。
これを確認するには、 ThinkPad を振って、カチャカチャと音がしないか確かめます。金属部品や金属破片はショートの原因になることがあります。

危険

予備バッテリーの中には少量のニッケルとカドミウムが含まれているものがあります。したがって、予備バッテリーの分解、再充電、火または水の中への投棄、またはショートさせることは決して行わないでください。バッテリーを廃棄する場合は地方自治体の条例に従ってください。適切なパーツ・リストにあるバッテリーだけを使用してください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

危険

バッテリー・パックには少量のニッケルが含まれています。バッテリー・パックを分解したり、火または水の中に投げ込んだり、ショートさせないでください。バッテリー・パックの廃棄にあたっては、地方自治体の条例または規則に従ってください。バッテリー・パックを交換するときは、適切なパーツ・リストにあるバッテリーだけを使用してください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

危険

リチウム・バッテリーは、火災、爆発、または重症のやけどを引き起こすことがあります。バックアップ・バッテリーの充電、その極性コネクターの取り外し、バッテリー本体の分解、
100 ℃ (212 ˚F) 以上への加熱、焼却、電池の中身を水に浸すことはしないでください。バッテリーを廃棄する場合は地方自治体の条例に従ってください。適切なパーツ・リストにあるバッテリーだけを使用してください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

危険

LCD が破損し、 LCD の中の液体が目に入ったり、手に触れたりした場合は、液体が触れた部分を少なくとも 15 分間洗い流してください。洗い流した後に、液体によって何らかの症状が現れた場合は、医師の治療を受けてください。

危険

感電を防ぐため、インバーター・カードの下部を保護しているプラスチック・カバーを外さないでください。

危険

メイン・バッテリーの電圧は低くても、ショートしたり、接地したバッテリーが、作業者にやけどを負わせたり、可燃物を燃やすだけの電流を発生させる場合があります。

危険

交換しようとしている FRU がホット・スワップに対応していない場合、それを取り外す前に、コンピューターの電源をオフにし、すべての電源コードをコンセントから抜き、バッテリー・パックを取り外して、相互接続しているケーブルをすべて切り離してください。

위험

FRU를 교체하고 나서 컴퓨터 전원을 켜기 전에 모든 나사, 스프링 및 기타 작은 부품들이 올바른 위치에 있는지, 컴퓨터 내부에 단단하게 연결되어 있는지 확인하십시오. 컴퓨터를 흔들어 달깍거리는 소리가 나지 않는지 확인하십시오. 금속 부품 또는 금속 조각은 누전을 일으킬 수 있습니다.

위험

일부 보조 배터리에는 소량의 니켈 및 카트뮴이 포함되어 있습니다. 보조 배터리를 분해하거나, 다시 충전하거나, 불 또는 물에 던지거나, 단락시키지 마십시오. 배터리 팩을 폐기할 때에는 해당 지역의 법률 규정을 따르십시오. 배터리 팩을 교체할 때에는 올바른 배터리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다.

위험

배터리 팩에는 소량의 니켈이 포함되어 있습니다. 배터리 팩을 분해하거나, 불 또는 물에 던지거나, 단락시키지 마십시오. 배터리 팩을 폐기할 때에는 해당 지역의 법률 규정을 따르십시오. 배터리 팩을 교체할 때에는 올바른 배터리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다.

위험

리튬 배터리는 화재, 폭발 또는 심각한 화상을 일으킬 수 있습니다. 리튬 배터리를 다시 충전하거나, 극성 커넥터를 제거하거나, 분해하거나, 100C(212F) 이상으로 가열하거나, 소각하거나, 전지 내용물을 물에 노출시키지 마십시오. 배터리를 폐기할 때에는 해당 지역을 법률 규정을 따르십시오. 올바른 배터리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다.

위험

LCD가 파손되어 LCD 내부의 액체가 눈에 들어가거나 손에 묻으면 즉시 깨끗한 물로 15분 이상 닦아 내십시오. 씻은 후에 조금이라도 이상을 느끼면 즉시 병원에 가서 의사의 진찰을 받아야 합니다.

위험

전기적 위험을 방지하려면 인버터 카드의 아래 부분을 보호하는 플라스틱 덮개를 제거하지 마십시오.

위험

기본 배터리의 전압은 낮지만, 단락되거나 접지된 배터리는 화상을 입히기에 충분한 전류와 가연성 물질을 발생시킬 수 있습니다.

위험

FRU 교체 시 Hot Swap이 지원되지 않는 경우, FRU를 제거하기 전에 컴퓨터의 전원을 끄고, 전기 콘센트에서 전원 코드를 분리하고, 배터리를 제거한 후, 연결된 모든 케이블을 분리하십시오.

PELIGRO

Antes de encender el sistema despues de sustituir una FRU, compruebe que todos los tornillos, muelles y demás piezas pequeñas se encuentran en su sitio y no se encuentran sueltas dentro del sistema. Compruébelo agitando el sistema y escuchando los posibles ruidos que provocarían. Las piezas metálicas pueden causar cortocircuitos eléctricos.

PELIGRO

Algunas baterías de reserva contienen una pequeña cantidad de níquel y cadmio. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

PELIGRO

Las baterías contienen pequeñas cantidades de níquel. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas al sustituir la batería. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

PELIGRO

La batería de repuesto es una batería de litio y puede provocar incendios, explosiones o quemaduras graves. No la recargue, ni quite el conector polarizado, ni la desmonte, ni caliente por encima de los 100°C (212°F), ni la incinere ni exponga el contenido de sus celdas al agua. Deséchela tal como dispone la normativa local.

PELIGRO

Si la LCD se rompe y el fluido de su interior entra en contacto con sus ojos o sus manos, lave inmediatamente las áreas afectadas con agua durante 15 minutos como mínimo. Obtenga atención medica si se presenta algún síntoma del fluido despues de lavarse.

PELIGRO

Para evitar descargas, no quite la cubierta de plástico que rodea la parte baja de la tarjeta invertida.

PELIGRO

Aunque las baterías principales tienen un voltaje bajo, una batería cortocircuitada o con contacto a tierra puede producir la corriente suficiente como para quemar material combustible o provocar quemaduras en el personal.

PELIGRO

Salvo que se permita el intercambio en caliente para la unidad sustituible localmente, realice lo siguiente antes de extraerla: apague el sistema, desconecte todos los cables de alimentación de las tomas de alimentación eléctrica, extraiga la batería y desconecte los cables de interconexión.

危險

完成 FRU 更換之後，在開啟電腦的電源之前，請確定所有螺絲、彈簧及其他小零件都已歸位，沒有遺留在電腦內部。若要確認這一點，請搖晃電腦，聽聽看是否有卡嗒的聲響。金屬零件或儀錶的火花會造成電線短路。

危險

部分備用電池含有微量的鋰和鎘。請勿拆開備用電池、再充電、丟入火或水中，或使其形成短路。請按照當地法令或規定來棄置電池。

僅限使用零件清單中的電池。使用不適當的電池會導致電池起火或爆炸。

危險

電池套件含有微量的鋰。請勿拆開電池套件、丟入火或水中，或使其形成短路。請按照當地法令或規定來棄置電池套件。

更換電池套件時，僅限使用零件清單中的電池。使用不適當的電池會導致電池起火或爆炸。

危險

鋰電池會導致起火、爆炸或嚴重燒傷。請勿再充電、拔除其電極接頭、拆開、加熱超過 100°C (212°F) 、焚燒，或讓電池組成物浸到水。請按照當地法令或規定來棄置電池。

僅限使用零件清單中的電池。使用不適當的電池會導致電池起火或爆炸。

危險

如果 LCD 破裂導致 LCD 流出的液體沾到您的眼睛或手，請立即以清水沖洗沾染部位至少 15 分鐘。如果在清洗後出現該液體所造成的任何症狀，請就醫治療。

危險

為避免電擊，請勿拆下轉換卡下面的塑膠護蓋。

危險

雖然主電池的電壓很低，但短路或接地電池所產生的電流，仍足以使人燒傷或使可燃物質起火。

危險

除非 FRU 允許以熱抽換來替換，否則請依下列方式將其移除：將電腦關機，拔除插座上所有電源線，移除電池包，並拔開任何交互連接的線材。

Chapter 2. Important service information

This chapter introduces following important service information that applies to all machine types supported by this manual:

- "Strategy for replacing FRUs" on page 19
  - "Strategy for replacing a hard disk drive, a hybrid drive, or a solid-state drive" on page 19
  - "Important notice for replacing a system board" on page 20
  - "How to use error message" on page 20
- "Strategy for replacing FRUs for CTO, special bid model, and standard models" on page 20
  - "Product definition" on page 20
  - "FRU identification" on page 21

Important:

- If the computer is equipped with both a hard disk drive and an mSATA solid-state drive, do not use the mSATA solid-state drive as a bootable device. The mSATA solid-state drive is designed and developed for "cache" function purpose only.
- Advise customers to contact the Lenovo® Customer Support Center if they need any assistance in obtaining or installing any software fixes, drivers, and UEFI BIOS downloads. Telephone numbers for Lenovo Support are available at: http://www.lenovo.com/support/phone
- System Disassembly/Reassembly videos that show the FRU removals or replacements for the Lenovo authorized service technicians are available in the following support site: http://www.lenovoservicetraining.com/ion/

Strategy for replacing FRUs

Before replacing parts:

Ensure that all software fixes, drivers, and UEFI BIOS downloads are installed before replacing any FRUs listed in this manual.

After a system board is replaced, ensure that the latest UEFI BIOS is loaded to the system board before completing the service action.

To download software fixes, drivers, and UEFI BIOS, go to http://www.lenovo.com/ThinkPadDrivers and follow the instructions on the screen.

Use the following strategy to prevent unnecessary expense for replacing and servicing FRUs:

- If you are instructed to replace a FRU but the replacement does not correct the problem, reinstall the original FRU before you continue.
- Some computers have both a processor board and a system board. If you are instructed to replace either the processor board or the system board, and replacing one of them does not correct the problem, reinstall that board, and then replace the other one.
- If an adapter or a device consists of more than one FRU, any of the FRUs may be the cause of the error. Before replacing the adapter or device, remove the FRUs, one by one, to see if the symptoms change. Replace only the FRU that changed the symptoms.

Strategy for replacing a hard disk drive, a hybrid drive, or a solid-state drive

Always try to run a low-level format before replacing a hard disk drive, a hybrid drive, a solid-state drive. This will cause all customer data on the drive to be lost. Be sure that the customer has a current backup of the data before doing this task.

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Attention: The drive startup sequence in the computer you are servicing may have been changed. Be extremely careful during write operations such as copying, saving, or formatting. If you select an incorrect drive, data or programs can be overwritten.

If the computer is shipped with both an mSATA solid-state drive and a hard disk drive, the mSATA solid-state drive is used for the “cache” function and to support the Intel® Rapid Start Technology. It is recommended that users do not replace the mSATA solid-state drive by themselves. Otherwise, the “cache” function will not work and the Intel Rapid Start Technology cannot be used any more.

Attention: Ensure that you partition the mSATA solid-state drive after installing it on the computer you are servicing. Otherwise, the mSATA solid-state drive will not function correctly. For instructions on how to partition an mSATA solid-state drive, go tohttp://www.lenovo.com/support/msata-fru.

Important notice for replacing a system board

Some components mounted on a system board are very sensitive. Improper handling of a system board can cause damage to those components, and may cause a system malfunction.

Attention: When handling a system board:
- Do not drop a system board or apply any excessive force to it.
- Avoid rough handling of any kind.
- Avoid bending a system board and hard pushing to prevent cracking at each BGA (Ball Grid Array) chipset.

How to use error message

Use the error codes displayed on the screen to diagnose failures. If more than one error code is displayed, begin the diagnosis with the first error code. Whatever causes the first error code may also cause false error codes. If no error code is displayed, see whether the error symptom is listed in the Symptom-to-FRU Index for the computer you are servicing.

Strategy for replacing FRUs for CTO, special bid model, and standard models

This topic provides information about the model types and FRU identification.

Product definition

This topic introduces different model types and how to identify each type.

Dynamic Configure To Order (CTO)

This model provides the ability for a customer to configure a Lenovo solution from a web site, and have this configuration sent to fulfillment, where it is built and shipped directly to the customer. The machine label and eSupport will load these products as the 4-character MT, 4-character model and 2-character country code. The model is “CTO1” and the default country code is “WW” (example: 20AACTO1WW).

Special bid model

This model is a unique configuration that has been negotiated between Lenovo and the customer. A unique MTM consists of a 4-character MT, a 4-character model, and a numeric 2-character country code is provided to the customer to place orders (example: 20AA000955). The country code assigned is numeric and does not designate a specific country or region. The custom model factsheet for the MTM indicates which country the special bid MTM is set up for. Special bid offering is not generally announced.

Standard model

Standard models (fixed configuration) are announced and offered to all customers. The MTM portion of the machine label consists of a 4-character MT, a 4-character model, and an alphabetic 2-character country

code. The country code assigned is alphabetic and represents a designated country or region (example: 20AA0009UK).

FRU identification

Use Lenovo eSupport to identify major FRUs, FRU part numbers, and FRU descriptions for a product at an MT - serial number level. Examples of major FRUs are hard disk drive, system board, liquid crystal display (LCD), and memory module.

To identify the major FRUs for a product, do the following:

1. Go to
   http://www.lenovo.com/support.
2. Click **Warranty & Services**.
3. Click **Check Warranty Status**.
4. On the Warranty Status Lookup page, click **Parts Lookup**.
5. Type your machine type and serial number, and then click **Submit**.

eSupport also can be used to view the general FRU list for a product.

To get the general FRU list for a product, do the following:

1. Go to
   http://www.lenovo.com/support.
2. Click **Parts & Accessories**.
3. Follow the instructions on the screen to select product.
4. Click **Product and Parts Detail**.
5. On the PRODUCT AND PARTS DETAIL page, click **Parts Detail** tab to view the FRU list.

   Note: The FRU list is a general list of components and does not contain specific model information.

Chapter 3. General checkout

This chapter introduces following information:

- "What to do first" on page 23
- "Checkout guide" on page 24
  - "Lenovo Solution Center" on page 24
  - "Quick test programs" on page 24
  - "UEFI diagnostic program" on page 25
  - "Bootable diagnostic programs" on page 25
- "Power system checkout" on page 26

Before you go to the checkout guide, be sure to read the following important notes.

Important notes:
- **Only certified trained personnel should service the computer.**
- **Before replacing any FRU, read the entire page on removing and replacing FRUs.**
- **When you replace FRUs, it is recommended use new nylon-coated screws.**
- **Be extremely careful during such write operations as copying, saving, or formatting.** The sequence of the drives in the computer that you are servicing might have been altered. If you select an incorrect drive, data or programs might be overwritten.
- **Replace a FRU only with another FRU of the correct model.** When you replace a FRU, ensure that the model of the machine and the FRU part number are correct by referring to the web site: http://www.lenovo.com/serviceparts-lookup
- **A FRU should not be replaced because of a single, unreproducible failure.** Single failures can occur for a variety of reasons that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. Consider replacing a FRU only when a problem recurs. If you suspect that a FRU is defective, clear the error log and run the test again. If the error does not recur, do not replace the FRU.
- **Be careful not to replace a nondefective FRU.**

What to do first

When you return a FRU, you must include the following information in the parts exchange form or parts return form that you attach to it:

1. Name and phone number of service technician
2. Date of service
3. Date on which the machine failed
4. Date of purchase
5. Failure symptoms, error codes appearing on the display, and beep symptoms
6. Procedure index and page number in which the failing FRU was detected
7. Failing FRU name and part number
8. Machine type, model number, and serial number
9. Customer's name and address

Note: During the warranty period, the customer may be responsible for repair costs if the computer damage was caused by misuse, accident, modification, unsuitable physical or operating environment, or improper maintenance by the customer. Following is a list of some common items that are not covered under warranty and some symptoms that might indicate that the system was subjected to stress beyond normal use.

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Before checking problems with the computer, determine whether the damage is covered under the warranty by referring to the following list:

The following are not covered under warranty:
- LCD panel cracked from the application of excessive force or from being dropped
- Scratched (cosmetic) parts
- Distortion, deformation, or discoloration of the cosmetic parts
- Plastic parts, latches, pins, or connectors that have been cracked or broken by excessive force
- Damage caused by liquid spilled into the system
- Damage caused by the improper insertion of a PC card or the installation of an incompatible card
- Improper disc insertion or use of an optical drive
- Fuses blown by attachment of a nonsupported device
- Forgotten computer password (making the computer unusable)
- Sticky keys caused by spilling a liquid onto the keyboard
- Use of an incorrect ac power adapter on laptop products

The following symptoms might indicate damage caused by nonwarranted activities:
- Missing parts might be a symptom of unauthorized service or modification.
- Check for obvious damage to a hard disk drive. If the spindle of a hard disk drive becomes noisy, the hard disk drive might have been dropped or subject to excessive force.

Checkout guide

Use the following procedures as a guide in identifying and correcting problems with the ThinkPad notebook computers.

Note: The diagnostic tests are intended to test only ThinkPad products. The use of non-ThinkPad products, prototype cards, or modified options can lead to false indications of errors and invalid system responses.

1. Identify the failing symptoms in as much detail as possible.
2. Verify the symptoms. Try to re-create the failure by running the diagnostic test or by repeating the operation.

Lenovo Solution Center

The Lenovo Solution Center program enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for maximum system performance.

The Lenovo Solution Center program is available for download at http://www.lenovo.com/diags.

To run the Lenovo Solution Center program, go to Control Panel and click **System and Security → Lenovo - System Health and Diagnostics**, and then follow the instructions on the screen.

For more information about the Lenovo Solution Center program, refer to the help information system of the program.

Quick test programs

Run quick test programs to troubleshoot and resolve computer problems, especially when the computer does not have the Lenovo Solution Center program installed.

Lenovo provides the following quick test programs:
- **Lenovo Hard Drive Quick Test**: Use this program to troubleshoot and resolve internal storage problems.
- **Lenovo Memory Quick Test**: Use this program to troubleshoot and resolve memory module problems.

The quick test programs are applicable on the following operating systems:
- Microsoft® Windows® 8
- Microsoft Windows 7
- Microsoft Windows Server® 2003
- Microsoft Windows Server 2008

To download and install a quick test program, go to http://www.lenovo.com/diags, and follow the instructions on the Web site.

To run a test using quick test program, do the following:

1. Go to the C:\SWTOOLS\ldiag directory.
2. Double-click the gui_lsc_lite.exe file.
3. When the **User Account Control** window opens, click **Yes**.
4. Select the device class to be tested.
5. Select the devices to be tested.
6. Select the test to be performed.
7. Follow the instructions on the screen to start the test. When a problem is detected, information messages are displayed. Refer to the messages to troubleshoot the problem.

UEFI diagnostic program

A UEFI diagnostic program is preinstalled on the computer. It enables you to test memory modules and internal storage devices, view system information, and check and recover bad sectors on internal storage devices.

To run the UEFI diagnostic program, do the following:

1. Turn on the computer. If the computer cannot be turned on, go to “Power system checkout” on page 26, and check the power sources. If an error code is displayed, go to “Symptom-to-FRU index” on page 41 for error code descriptions and troubleshooting hints.
2. When the ThinkPad logo is displayed, repeatedly press and release the F10 key. The main screen of the UEFI diagnostic program is displayed.
3. Follow the instructions on the screen to use the diagnostic program.

The options on the main screen are as follows:

Table 1. Items on the main screen of the UEFI diagnostic program

Tests	Tools
• Quick Memory Test • Quick Storage Device Test • Exit Application • Extended Memory Test • LCD test • Memory Bit Fade Test (180 min) • Motherboard Buses Test • PCI-e test	• Execute from configuration file • Generate configuration file • Recover bad sectors tool • System Information

Note: The recover bad sectors tool is only available on computers that have hard disk drives installed.

Bootable diagnostic programs

If the computer you are servicing is not installed with the UEFI diagnostic program, you can download a bootable diagnostic program from the Lenovo Support Web site. The bootable diagnostic programs enable

you to test computer memory and internal storage devices, view system information, and check and recover the internal storage devices. To use the bootable diagnostic programs, you can create a bootable diagnostic medium on a USB device or CD.

To create a bootable diagnostic medium, do the following:

1. Go to http://www.lenovo.com/diags.
2. Click **Lenovo Bootable Diagnostics**.
3. Follow the instructions on the Web site to create a bootable diagnostic medium on a USB device or CD.

To use the diagnostic medium you have created, do one of the following:

- If you have created the bootable diagnostic medium on a USB device, do the following:
  1. Attach the USB device to the computer.
  2. Turn on the computer. If the computer cannot be turned on, go to “Power system checkout” on page 26, and check the power sources. If an error code is displayed, go to “Symptom-to-FRU index” on page 41 for error code descriptions and troubleshooting hints.
  3. When the ThinkPad logo is displayed, repeatedly press and release the F12 key. When the Boot Menu window opens, release the F12 key.
  4. Use the arrow keys to select **USB HDD** and then press Enter. The diagnostic program will be launched automatically.
  5. Follow the instructions on the screen to use the diagnostic program.
- If you have created the bootable diagnostic medium on a CD, do the following:
  1. Turn on the computer. If the computer cannot be turned on, go to “Power system checkout” on page 26, and check the power sources. If an error code is displayed, go to “Symptom-to-FRU index” on page 41 for error code descriptions and troubleshooting hints.
  2. Insert the CD into the optical drive.
  3. Restart the computer.
  4. When the ThinkPad logo is displayed, repeatedly press and release the F12 key. When the Boot Menu window opens, release the F12 key.
  5. Use the arrow keys to select **ATAPI CDx** (x: 0, 1, ...) and then press Enter. The diagnostic program will be launched automatically.
  6. Follow the instructions on the screen to use the diagnostic program.

Power system checkout

To verify a power symptom, do the following:

1. Turn off the computer.
2. Connect the ac power adapter.
3. Turn on the computer. If the computer can be turned on, it means that either the battery pack or the ac power adapter is functional.
4. Insert a straightened paper clip into the emergency reset hole to reset the computer. If the computer is still powered on, it means that the ac power adapter is functional.
5. Turn off the computer.
6. Disconnect the ac power adapter and turn on the computer. If the computer can be turned on, it means that the battery pack is functional.

If you suspect a power problem, see the appropriate one of the following power supply checkouts:

- “Checking the ac power adapter” on page 27
- “Checking the built-in battery and operational charging” on page 27
- “Checking the coin-cell battery” on page 28

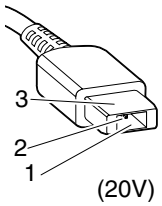
Checking the ac power adapter

You are here because the computer fails only when the ac power adapter is used.

- If the power problem occurs only when the docking station or the port replicator is used, replace the docking station or the port replicator.
- If the system status indicator does not blink three times when an ac power source is connected, check the power cord of the ac power adapter for correct continuity and installation.
- If the computer does not charge during operation, go to “Checking the built-in battery and operational charging” on page 27.

To check the ac power adapter, do the following:

1. Unplug the ac power adapter cable from the computer.
2. Measure the output voltage at the plug of the ac power adapter cable. See the following illustration:



Pin	Voltage (V dc)
1	+20
2	0
3	Ground

   Note: Output voltage of pin 2 of the ac power adapter might differ from the one you are servicing.
3. If the voltage is not correct, replace the ac power adapter.
4. If the voltage is acceptable, replace the system board.

Note: Noise from the ac power adapter does not always indicate a defect.

Checking the built-in battery and operational charging

This computer supports only batteries specially designed for this specific system and manufactured by Lenovo or an authorized builder. The system does not support unauthorized batteries or batteries designed for other systems. If an unauthorized battery or a battery designed for another systems is installed, the system will not charge.

Attention: Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.

The battery status icon in the Windows notification area displays the percentage of the remaining battery power.

To check for detailed battery status information, do the following:

- **For Windows 7**: Open the Power Manager program and click the **Battery** tab.
- **For Windows 8.1**: Open the Lenovo Settings program and click **OK**.

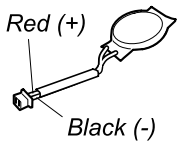
To check whether the battery charges properly during operation, do the following:

1. Discharge the battery until the remained battery power is less than 50%.
2. Connect the computer to ac power to charge the battery. If the battery status icon in the Windows notification area indicates that the battery is not charging, remove the battery and let it return to room temperature.
3. Reinstall the battery. If the battery is still not charging, replace the battery pack.
4. Check the battery status icon again. If the same error still exists, replace the system board.

Checking the coin-cell battery

To check the coin-cell battery, do the following:

1. Disconnect the battery connector. See “Disconnect the battery” on page 64.
2. Remove the coin-cell battery. See “1060 Coin-cell battery” on page 68.
3. Measure the voltage of the coin-cell battery. See the following illustration.



Wire	Voltage (V dc)
Red	+2.5 to +3.2
Black	Ground

- If the voltage is correct, replace the system board.
- If the voltage is not correct, replace the coin-cell battery.
- If the coin-cell battery discharges quickly after replacement, replace the system board.

Chapter 4. Related service information

This chapter presents following information:

- “Restoring the factory contents by using the Recovery Disc Set” on page 29
- “Recovery overview for the Windows 7 operating system” on page 30
- “Recovery overview for the Windows 8.1 operating system” on page 35
- “Passwords” on page 38
- “Power management” on page 40
- “Symptom-to-FRU index” on page 41

Service Web site: When the latest maintenance diskette and the system program service diskette become available, they will be posted on http://www.lenovo.com/support

Restoring the factory contents by using the Recovery Disc Set

When the main storage drive is replaced because of a failure, no product recovery program is on the new drive. In this case, the customer must use the Recovery Disc Set to recover the computer. Order the Recovery Disc Set and the drive at the same time so that the customer can restore the computer to the factory default settings by using the Recovery Disc Set after the new drive is installed. For information about which discs to order, go to http://www.lenovo.com/serviceparts-lookup.

Depending on the model, the number of recovery discs included in the Recovery Disc Set differs. The Recovery Disc Set might consist of the user instructions and the following set of DVDs to restore the computer to the original factory configuration.

- *Operating System Recovery Disc* (one disc): This disc restores the Microsoft Windows operating system. Use this disc to start the recovery process.
- *Applications and Drivers Recovery Disc* (one or more discs): This disc restores the preinstalled applications and drivers on the computer.
- *Supplemental Recovery Disc*: This disc contains additional content, such as updates to the software that was preinstalled on the computer. Not all recovery disc sets come with a *Supplemental Recovery Disc*.

Notes:

- You must have a DVD drive to use the recovery discs. If you do not have an internal DVD drive, you can use an external USB DVD drive.
- During the recovery process, all data on the drive will be deleted. If possible, copy any important data or personal files that you want to keep onto removable media or a network drive before you start the recovery process.

To restore the computer to the original factory configuration using the Recovery Disc Set, do the following:

Note: Recovery can take one to two hours to complete. The length of time depends on the method you use. If you use recovery discs, the recovery process will take about two hours.

1. Make the CD/DVD drive the first startup device in the startup sequence using the following procedure:
   a. Press and hold down the F1 key, and then turn on the computer. When the logo screen is displayed or when you hear repeating beeps, release the F1 key. The ThinkPad Setup program opens.
   b. Use the arrow keys to select **Startup → Boot**.
   c. Select the CD/DVD drive as the **1st Boot Device**.
2. Insert the *Operating System Recovery Disc* into the DVD drive.

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3. Press F10 to save the ThinkPad Setup program configuration changes. Follow the instructions on the screen to begin the recovery process.
4. Select your language and click **Next**.
5. Read the license. If you agree with the terms and conditions, select **I accept these terms and conditions** and then click **Next**. If you do not agree with the terms and conditions, follow the instructions on the screen.
6. Click **Yes** in the displayed window to begin the operating system recovery process.
7. Insert the *Applications and Drivers Recovery Disc* when prompted and then click **OK** to begin the process of recovering applications and drivers.
8. If you have a *Supplemental Recovery Disc*, insert it when prompted and click **Yes**. If you do not have a *Supplemental Recovery Disc*, click **No**.
9. When all of the data has been copied from the last disc in the set and has been processed, remove the disc and restart the computer.

   Note: The rest of the recovery process is fully automated and no action from you is required. The computer will restart into the Microsoft Windows desktop several times and you might experience periods when no activity is apparent on the screen for several minutes at a time. This is normal.
10. When the recovery process is complete, the Set Up Windows screen is displayed. Follow the instructions on the screen to complete the Windows setup.
11. After you have completed the Windows setup, you might want to restore the original startup sequence. Start the ThinkPad Setup program and then press F9 to restore the default settings. Press F10 to save changes and exit the ThinkPad Setup program.

Note: After restoring a drive to the factory default settings, you might need to reinstall some device drivers.

Recovery overview for the Windows 7 operating system

This section provides information about the recovery solutions provided by Lenovo on the Windows 7 operating system.

Notes:

- There are a variety of methods to choose from when considering how to recover in the event of a software- or hardware-related problem. Some methods vary depending on the type of your operating system.
- The product on the recovery media might be used only for the following purposes:
  - Restore the product preinstalled on your computer
  - Reinstall the product
  - Modify the product using the Additional Files

To prevent potential performance risks or unexpected behavior that might be caused by the new hard disk drive technology, it is recommended that you use one of the following software programs for backup:

- ThinkVantage Rescue and Recovery version 4.23 or later
- Symantec Norton Ghost version 15 or later
  To start the Symantec Norton Ghost program, do the following:
  1. Click **Start → Run**. The Run window opens.
  2. Type `cmd` in the field. Then click **OK.**
  3. Type `ghost -align=1mb` and press Enter.
- Acronis True Image 2010 or later
- Paragon Backup & Recovery 10 Suit or later, Paragon Backup & Recovery 10 Home or later

Creating and using a recovery media

You can use recovery media to restore the hard disk drive or hybrid drive to the factory default settings. Recovery media are useful if you transfer the computer to another area, sell the computer, recycle the computer, or put the computer in an operational state after all other methods of recovery have failed. As a precautionary measure, it is important to create recovery media as early as possible.

Note: The recovery operations you can perform using recovery media vary depending on the operating system from which the recovery media were created. The recovery media might contain a boot medium and a data medium. Your Microsoft Windows license permits you to create only one data medium, so it is important that you store the recovery media in a safe place after you have made them.

Creating recovery media

This section provides instructions on how to create recovery media.

Note: You can create recovery media using discs or external USB storage devices.

To create recovery media, click **Start → All Programs → Lenovo ThinkVantage Tools → Factory Recovery Disks**. Then, follow the instructions on the screen.

Using recovery media

This section provides instructions on how to use recovery media on different operating systems.

- You can use recovery media to restore the computer to the factory default settings only. You can use recovery media to put the computer in an operational state after all other methods of recovery have failed.

  Attention: When you use recovery media to restore the computer to the factory default settings, all the files currently on the hard disk drive or hybrid drive will be deleted and replaced by the factory default settings.

  To use recovery media, do the following:

  1. Depending on the type of your recovery media, connect the boot medium (memory key or other USB storage device) to the computer, or insert the boot disc into an external optical drive.
  2. Repeatedly press and release the F12 key when turning on the computer. When the Boot Menu window opens, release the F12 key.
  3. Select the desired startup device and press Enter. The restore process begins.
  4. Follow the instructions on the screen to complete the operation.

  Notes:

  1. After restoring your computer to the factory default settings, you might have to reinstall device drivers for some devices. See “Reinstalling preinstalled applications and device drivers” on page 34.
  2. Some computers come with Microsoft Office or Microsoft Works preinstalled. If you need to recover or reinstall your Microsoft Office or Microsoft Works applications, you must use the *Microsoft Office CD* or *Microsoft Works CD*. These discs are provided only with computers preinstalled with Microsoft Office or Microsoft Works.

Performing backup and recovery operations

The Rescue and Recovery program enables you to back up all your hard disk drive or hybrid drive contents including the operating system, data files, software programs, and personal settings. You can designate where the Rescue and Recovery program stores the backup:

- In a protected area of your hard disk drive or hybrid drive
- On an attached external USB hard disk drive

- On a network drive
- On recordable discs (an external recordable optical drive is required for this option)

After you have backed up the contents on the hard disk drive or hybrid drive, you can restore the complete contents of the hard disk drive or hybrid drive, restore only the selected files, or restore only the Windows operating system and applications.

Performing a backup operation

This section provides instructions on how to perform a backup operation using the Rescue and Recovery program.

1. From the Windows desktop, click **Start → All Programs → Lenovo ThinkVantage Tools → Enhanced Backup and Restore**. The Rescue and Recovery program opens.
2. In the Rescue and Recovery main window, click the **Launch advanced Rescue and Recovery** arrow.
3. Click **Back up your hard drive** and select backup operation options. Then, follow the instructions on the screen to complete the backup operation.

Performing a recovery operation

This section provides instructions on how to perform a recovery operation using the Rescue and Recovery program.

1. From the Windows desktop, click **Start → All Programs → Lenovo ThinkVantage Tools → Enhanced Backup and Restore**. The Rescue and Recovery program opens.
2. In the Rescue and Recovery program main window, click the **Launch advanced Rescue and Recovery** arrow.
3. Click the **Restore your system from a backup** icon.
4. Follow the instructions on the screen to complete the recovery operation.

For more information about performing a recovery operation from the Rescue and Recovery workspace, see “Using the Rescue and Recovery workspace” on page 32.

Using the Rescue and Recovery workspace

The Rescue and Recovery workspace resides in a protected, hidden area of your hard disk drive or hybrid drive that operates independently from the Windows operating system. This enables you to perform recovery operations even if you cannot start the Windows operating system. You can perform the following recovery operations from the Rescue and Recovery workspace:

- **Rescue files from your hard disk drive, your hybrid drive, or a backup**

  The Rescue and Recovery workspace enables you to locate files on your hard disk drive or hybrid drive and transfer them to a network drive or other recordable media, such as a USB device or a disc. This solution is available even if you did not back up your files or if changes were made to the files since your last backup operation. You also can rescue individual files from a Rescue and Recovery backup located on your local hard disk drive or hybrid drive, a USB device, or a network drive.

- **Restore your hard disk drive or hybrid drive from a Rescue and Recovery backup**

  If you have backed up your hard disk drive or hybrid drive using the Rescue and Recovery program, you can restore the hard disk drive or hybrid drive from a Rescue and Recovery backup, even if you cannot start the Windows operating system.

- **Restore your hard disk drive or hybrid drive to the factory default settings**

  The Rescue and Recovery workspace enables you to restore the complete contents of your hard disk drive or hybrid drive to the factory default settings. If you have multiple partitions on your hard disk drive or hybrid drive, you have the option to restore the factory default settings to the C: partition and leave

the other partitions intact. Because the Rescue and Recovery workspace operates independently from the Windows operating system, you can restore the factory default settings even if you cannot start the Windows operating system.

Attention: If you restore the hard disk drive or hybrid drive from a Rescue and Recovery backup or restore the hard disk drive or hybrid drive to the factory default settings, all files on the primary hard disk drive or hybrid drive partition (usually drive C:) will be deleted in the recovery process. If possible, make copies of important files. If you are unable to start the Windows operating system, you can use the rescue files feature of the Rescue and Recovery workspace to copy files from your hard disk drive or hybrid drive to other media.

To start the Rescue and Recovery workspace, do the following:

1. Ensure that the computer is turned off.
2. Repeatedly press and release the F11 key when turning on the computer. When you hear beeps or see a logo screen, release the F11 key.
3. If you have set a Rescue and Recovery password, type your password when prompted. The Rescue and Recovery workspace opens after a short delay.

   Note: If the Rescue and Recovery workspace fails to open, see “Solving recovery problems” on page 35.
4. Do one of the following:
   - To rescue files from your hard disk drive, your hybrid drive or a backup, click **Rescue files** and follow the instructions on the screen.
   - To restore your hard disk drive or hybrid drive from a Rescue and Recovery backup or to restore your hard disk drive or hybrid drive to the factory default settings, click **Restore your system** and follow the instructions on the screen.

For more information about the features of the Rescue and Recovery workspace, click **Help**.

Notes:

1. After restoring your hard disk drive or hybrid drive to the factory default settings, you might have to reinstall device drivers for some devices. See “Reinstalling preinstalled applications and device drivers” on page 34.
2. Some computers come with Microsoft Office or Microsoft Works preinstalled. If you need to recover or reinstall your Microsoft Office or Microsoft Works applications, you must use the *Microsoft Office CD* or *Microsoft Works CD*. These discs are provided only with computers preinstalled with Microsoft Office or Microsoft Works.

Creating and using a rescue medium

With a rescue medium, such as a disc or a USB hard disk drive, you can recover the computer from failures that prevent you from gaining access to the Rescue and Recovery workspace on your hard disk drive or hybrid drive.

Notes:

1. The recovery operations you can perform using a rescue medium vary depending on the operating system.
2. The rescue disc can be started in all types of external optical drives.

Creating a rescue medium

This section provides instructions on how to create a rescue medium.

1. From the Windows desktop, click **Start → All Programs → Lenovo ThinkVantage Tools → Enhanced Backup and Restore**. The Rescue and Recovery program opens.
2. In the Rescue and Recovery main window, click the **Launch advanced Rescue and Recovery** arrow.

3. Click the **Create Rescue Media** icon. The Create Rescue and Recovery Media window opens.
4. In the **Rescue Media** area, select the type of the rescue medium you want to create. You can create a rescue medium using a disc or a USB hard disk drive.
5. Click **OK** and follow the instructions on the screen to create a rescue medium.

Using a rescue medium

This section provides instructions on how to use the rescue medium you have created.

- If you have created a rescue medium using a disc, use the following instructions to use the rescue medium:
  1. Turn off your computer.
  2. Repeatedly press and release the F12 key when turning on the computer. When the Boot Menu window opens, release the F12 key.
  3. In the Boot Menu window, select the desired external optical drive as the first boot device. Then, insert the rescue disc into the optical drive and press Enter. The rescue medium starts.
- If you have created a rescue medium using a USB optical drive or a USB hard disk drive, use the following instructions to use the rescue medium:
  1. Turn on your computer. When the ThinkPad logo is displayed, press F1. The ThinkPad Setup program starts.
  2. Choose the **Config** menu and change the **USB 3.0 Mode** to be **Disabled** from the **USB** submenu**.**
  3. Turn off your computer.
  4. Attach the USB optical drive or hard disk drive to one of the USB connectors on your computer.
  5. Repeatedly press and release the F12 key when turning on the computer. When the Boot Menu window opens, release the F12 key.
  6. In the Boot Menu window, select the **USB CD** or **USB HDD** as the first boot device and press Enter. The rescue medium starts.

When the rescue medium starts, the Rescue and Recovery workspace opens. The help information for each feature is available from the Rescue and Recovery workspace. Follow the instructions to complete the recovery process.

Reinstalling preinstalled applications and device drivers

Your computer has provisions that enable you to reinstall selected factory-installed applications and device drivers.

Reinstalling preinstalled applications

To reinstall selected application programs, do the following:

1. Turn on your computer.
2. Go to the `C:\SWTOOLS` directory.
3. Open the APPS folder. In it are several subfolders named for the various preinstalled applications.
4. Open the subfolder for the application you are reinstalling.
5. Double-click **Setup**, and then follow the on-screen steps to reinstall the program.

Reinstalling preinstalled device drivers

Attention: When you reinstall device drivers, you are changing the current configuration of your computer. Reinstall device drivers only when it is necessary to correct a problem with your computer.

To reinstall a device driver for a factory-installed device, do the following:

1. Turn on your computer.
2. Go to the C:\SWTOOLS directory.
3. Open the DRIVERS folder. Within the DRIVERS folder are several subfolders named for the various devices installed in your computer (for example, AUDIO and VIDEO).
4. Open the subfolder for the device.
5. Reinstall the device driver by one of the following methods:
   - In the subfolder for the device, look for a text file (a file with the extension .txt). The text file contains information on how to reinstall that device driver.
   - If the subfolder for the device contains a file of setup information (a file with the extension .inf), you can use the Add New Hardware program (in the Windows Control Panel) to reinstall the device driver. Not all device drivers can be reinstalled by use of this program. In the Add New Hardware program, when prompted for the device driver you want to install, click **Have Disk** and **Browse**. Then select the device driver file from the device subfolder.
   - In the subfolder for the device, look for the executable file (a file with the extension .exe). Double-click the file, and follow the instructions on the screen.

Solving recovery problems

If you are unable to access the Rescue and Recovery workspace or the Windows environment, do one of the following:

- Use a rescue medium to start the Rescue and Recovery workspace. See “Creating and using a rescue medium” on page 33.
- Use recovery media if all other methods of recovery have failed and you need to restore the hard disk drive or hybrid drive to the factory default settings. See “Creating and using a recovery media” on page 31.
- Change the **USB 3.0 Mode** to be **Disabled** from the ThinkPad Setup menu. See “Creating and using a rescue medium” on page 33.

Note: If you are unable to access the Rescue and Recovery workspace or the Windows environment from a rescue medium or recovery media, you might not have the rescue device (an internal hard disk drive or hybrid drive, a disc, a USB hard disk drive, or other external devices) set as the first boot device in the startup device sequence. You must first ensure that your rescue device is set as the first boot device in the startup device sequence in the ThinkPad Setup program.

It is important to create a rescue medium and a set of recovery media as early as possible and store them in a safe place for future use.

Recovery overview for the Windows 8.1 operating system

This section provides information about the recovery solutions for the Windows 8.1 operating systems.

A Windows recovery image is preinstalled in the recovery partition on your computer. The Windows recovery image enables you to refresh your computer, or reset your computer to the factory default settings.

You can create recovery media as backups or replacement for the Windows recovery image. With the recovery media, you can troubleshoot and fix the problems on your computer even if you cannot start the Windows 8.1 operating system. It is recommended that you create recovery media as early as possible. For more information, see “Creating and using recovery media” on page 37.

Refreshing your computer

If your computer does not perform well and the problem might be caused by a recently installed program, you can refresh your computer without losing your personal files or changing your settings.

Attention: If you refresh your computer, the programs that came with your computer and the programs that you installed from Windows Store will be reinstalled, but all other programs will be removed.

1. Move your pointer to the top-right or bottom-right corner of the screen to display the charms. Click **Settings → Change PC settings → Update and recovery → Recovery**.
2. In the **Refresh your PC without affecting your files** section, click **Get started**.
3. Follow the instructions on the screen to refresh your computer.

Resetting your computer to the factory default settings

If you want to recycle your computer or just start over, you can reset your computer to the factory default settings. Resetting the computer will reinstall the operating system, reinstall all the programs that came with your computer, and reset all the settings to the factory default settings.

Attention: If you reset the computer to the factory default settings, all your personal files and settings will be deleted. To avoid data loss, make a backup copy of all the data that you want to keep.

To reset your computer to the factory default settings, do the following:

1. Move your pointer to the top-right or bottom-right corner of the screen to display the charms. Click **Settings → Change PC settings → Update and recovery → Recovery**.
2. In the **Remove everything and reinstall Windows** section, click **Get started**. Then click **Next** to confirm the operation.
3. Depending on your needs, do one of the following:
   - To perform a quick format, click **Just remove my files** to start the process. The process will take several minutes.
   - To perform a complete format, click **Fully clean the drive** to start the process. The process will take several hours.
4. Follow the instructions on the screen to reset your computer to the factory default settings.

Using the advanced startup options

With the advanced startup options, you can change the firmware settings of the computer, change the startup settings of the Windows operating system, start the computer from an external device, or restore the Windows operating system from a system image.

To use the advanced startup options, do the following:

1. Move your pointer to the top-right or bottom-right corner of the screen to display the charms. Click **Settings → Change PC settings → Update and recovery → Recovery**.
2. In the **Advanced startup** section, click **Restart now → Troubleshoot → Advanced options**.
3. Select a desired startup option, then follow the instructions on the screen.

Recovering your operating system if Windows 8.1 fails to start

The Windows recovery environment on your computer is capable of operating independently from the Windows 8.1 operating system. This enables you to recover or repair the operating system even if the Windows 8.1 operating system fails to start.

After two consecutive failed boot attempts, the Windows recovery environment starts automatically. Then you can choose repair and recovery options by following the instructions on the screen.

Note: Ensure that your computer is connected to ac power during the recovery process.

Creating and using recovery media

You can create recovery media as backups for the Windows recovery environment and the Windows recovery image. If you cannot start the computer, you can use recovery media to troubleshoot and fix the problems on your computer.

It is recommended that you create recovery media as early as possible. Once you create recovery media, keep them in a safe place and do not use them to store other data.

Creating recovery media

To create recovery media, you need a USB drive with at least 8 GB of storage. The required USB capacity depends on the size of the recovery image.

Attention: Creating recovery media will delete anything stored on the USB drive. To avoid data loss, make a backup copy of all the data that you want to keep.

To create recovery media, do the following:

Note: Ensure that your computer is connected to ac power.

1. Move your cursor to the top-right or bottom-right corner of the screen to display the charms, and click **Search**.
2. Type recovery in the **Search** field and click the Search button. Then click **Create a recovery drive**.
3. Click **Yes** in the User Account Control window to allow the Recovery Media Creator program to start.
4. Ensure that you select the **Copy the recovery partition from the PC to the recovery drive.** option. Then click **Next**.

   Important: If you clear the **Copy the recovery partition from the PC to the recovery drive.** option, you will create recovery media without the recovery partition content. You still can start the computer from the recovery media, but you might be unable to recover your computer if the recovery partition on your computer is damaged.
5. Connect a proper USB drive then click **Next**.
6. Click **Create** in the Recovery Drive window. The creation of the recovery media starts.
7. When the creation of the recovery media finishes, do one of the following:
   - To keep the recovery partition on your computer, click **Finish**.
   - To delete the recovery partition on your computer, click **Delete the recovery partition**.

     Attention: If you delete the recovery partition on your computer, do keep the recovery media in a safe place. The Windows recovery image will not be stored in your computer anymore, and you will need the recovery media to refresh or reset your computer.
8. Remove the USB drive. The recovery media are created successfully.

Using recovery media

If you cannot start your computer, or if you cannot start the Windows recovery image on your computer, use recovery media to recover your computer.

To use recovery media, do the following:

Note: Ensure that your computer is connected to ac power.

1. Turn on or restart the computer. Before the Windows operating system starts, repeatedly press the F12 key. The Boot Menu window opens.
2. Select the recovery drive as the boot device.

3. Select a preferred language and then select a preferred keyboard layout.
4. Click **Troubleshoot** to display the optional recovery solutions.
5. Select a corresponding recovery solution according to your situation. For example, select **Reset your PC** if you want to reset your computer to the factory default settings.

For more information about the recovery solutions provided by the Windows 8.1 operating system, go to: http://go.microsoft.com/fwlink/?LinkID=263800

Passwords

As many as three passwords may be needed for any ThinkPad notebook computer: the power-on password, the hard disk password, and the supervisor password.

If any of these passwords has been set, a prompt for it will be displayed on the screen whenever the computer is turned on. The computer does not start until the password is entered.

Note: If only a supervisor password is set, the password prompt will not be displayed when the operating system is started.

Power-on password

A power-on password protects the system from being powered on by an unauthorized person. The password must be entered before an operating system can be started. For instructions on how to remove the power-on password, see “How to remove the power-on password” on page 39.

Hard disk password

There are two kinds of hard disk passwords:
- User hard disk password - for the user
- Master hard disk password - for the system administrator, who can use it to get access to the hard disk even if the user has changed the user hard disk password

Note: There are two modes for the hard disk password: **User only** and **Master + User**. The **Master + User** mode requires two hard disk passwords; the system administrator enters both in the same operation. The system administrator then provides the user hard disk password to the system user.

Attention: If the user hard disk password has been forgotten, check whether a master hard disk password has been set. If it has, it can be used for access to the hard disk drive. If no master hard disk password is available, neither Lenovo nor Lenovo authorized service technicians provide any services to reset either the user or the master hard disk password, or to recover data from the hard disk drive. The hard disk drive can be replaced for a scheduled fee.

For how to remove the hard disk password, see “How to remove the hard disk password” on page 39.

Supervisor password

A supervisor password protects the system information stored in the ThinkPad Setup. The user must enter the supervisor password in order to get access to the ThinkPad Setup and change the system configuration.

Attention: If the supervisor password has been forgotten and cannot be made available to the service technician, there is no service procedure to reset the password. The system board must be replaced for a scheduled fee.

How to remove the power-on password

To remove a power-on password, do the following:

If no supervisor password has been set, do the following to remove the power-on password:

1. Turn off the computer.
2. Remove the battery pack. For instructions on how to remove the battery pack, see “1130 Battery pack” on page 81.
3. Remove the coin-cell battery. For instructions on how to remove the coin-cell battery, see “1060 Coin-cell battery” on page 68. Wait for a few seconds.
4. Reinstall the coin-cell battery. For instructions on how to install the coin-cell battery, see “1060 Coin-cell battery” on page 68.
5. Reinstall the battery pack. For instructions on how to install the battery pack, see “1130 Battery pack” on page 81.
6. Turn on the computer and wait until the POST ends. After the POST ends, the password prompt does not appear. The power-on password has been removed.

If a supervisor password has been set and is known to the service technician, do the following to remove the power-on password:

1. Turn on the computer.
2. When the ThinkPad logo comes up, immediately press F1.
3. Type the supervisor password to enter the ThinkPad Setup program.
4. Select **Security**.
5. Select **Password**.
6. Select **Power-On Password**.
7. Type the current supervisor password in the **Enter Current Password** field. Then leave the **Enter New Password** field blank, and press Enter twice.
8. In the Changes have been saved window, press Enter.
9. Press F10 to save changes and exit the ThinkPad Setup program.

How to remove the hard disk password

Attention: If **User only** mode is selected and the user hard disk password has been forgotten and cannot be made available to the service technician, neither Lenovo nor Lenovo authorized service technicians provide any services to reset the user hard disk passwords or to recover data from the hard disk drive. To put the system back to operational status, the only Lenovo and Lenovo-authorized service solution would be to replace the hard disk drive, hybrid drive, or solid-state drive with a scheduled fee.

To remove a user hard disk password that has been forgotten, when the supervisor password and master hard disk password are known, do the following:

1. Turn on the computer.
2. When the ThinkPad logo comes up, immediately press F1 to enter the ThinkPad Setup program.
3. Select **Security**.
4. Select **Password**.
5. Select **Hard-disk *x* password**, where *x* is the letter of the hard disk drive. A pop-up window opens.
6. Select **Master hard disk password**.
7. Type the current master hard disk password in the **Enter Current Password** field. Then leave the **Enter New Password** field blank, and press Enter twice.
8. Press F10.

9. Press F10 to save changes and exit the ThinkPad Setup program. The user hard disk password and the master hard disk password have been removed.

Power management

To reduce power consumption, the computer has three power management modes: screen blank, sleep, and hibernation.

Screen blank mode (for the Windows 7 operating system only)

If the time set on the “Turn off monitor” timer in the operating system expires, the LCD backlight turns off.

To put the computer into screen blank mode, do the following:

1. Right-click the battery gauge on the taskbar.
2. Select **Power off display**.

To end screen blank mode and resume normal operation, press any key.

Sleep mode

When the computer enters sleep mode, the following events occur in addition to what occurs in screen blank mode:

- The LCD is powered off.
- The hard disk drive, hybrid drive, or solid-state drive is powered off.
- The microprocessor stops.

To enter sleep mode, do one of the following:

- For Windows 7: Click the arrow beside the **Shut down** icon, and then select **Sleep**. To return from sleep mode, press the Fn key.
- For Windows 8.1: Move the pointer to the top-right or bottom right corner of the screen to bring up the charms. Then click **Settings → Power → Sleep**.

In certain circumstances, the computer goes into sleep mode automatically:

- After a period of inactivity specified in power plan settings
- When the battery power is low

To cause the computer to return from sleep mode and resume operation, do one of the following:

- Press the Fn key.
- Open the LCD cover.
- Turn on the power button.

Also, in either of the following events, the computer automatically returns from sleep mode and resumes operation:

- The ring indicator (RI) is signaled by a serial device or a PC Card device.
- The time set on the resume timer elapses.

  Note: The computer does not accept any input immediately after it enters sleep mode. Wait a few seconds before taking any action to reenter operation mode.

Hibernation mode

In hibernation mode, the following occurs:

- The system status, RAM, VRAM, and setup data are stored on the hard disk drive, hybrid drive, or solid-state drive.
- The system is powered off.

Note: If the computer enters the hibernation mode while it is docked to the docking station or the port replicator, do not undock it before resuming normal operation. If you do undock it and then try to resume normal operation, you will get an error message, and you will have to restart the system.

If you have defined one of the following actions as the event that causes the system to go into hibernation mode, perform that action.
- Closing the lid.
- Pressing the power button.

Also, the computer goes into hibernation mode automatically after a period of inactivity specified in power plan settings.

When the power is turned on, the computer returns from hibernation mode and resumes operation. The hibernation file in the boot record on the hard disk drive, hybrid drive, or solid-state drive is read, and system status is restored from the hard disk drive, hybrid drive, or solid-state drive.

Symptom-to-FRU index

This section contains following information:

- “Numeric error codes” on page 42
- “Error messages” on page 43
- “Beep symptoms” on page 43
- “No-beep symptoms” on page 44
- “LCD-related symptoms” on page 44
- “Intermittent problems” on page 44
- “Undetermined problems” on page 45

The symptom-to-FRU index in this section lists symptoms and errors and their possible causes. The most likely cause is listed first, in boldface type.

Note: Do the FRU replacement or other actions in the sequence shown in the column headed “FRU or action, in sequence.” If replacing a FRU does not solve the problem, put the original part back in the computer. Do not replace a nondefective FRU.

This index can also help you determine, during regular servicing, what FRUs are likely to need to be replaced next.

A numeric error is displayed for each error detected in POST or system operation. In the displays, **n** can be any number.

If no numeric code is displayed, check the narrative descriptions of symptoms. If the symptom is not described there, go to “Intermittent problems” on page 44.

Note: For a device not supported by diagnostic codes in the ThinkPad notebook computers, see the manual for that device.

Numeric error codes

Table 2. Numeric error codes

Symptom or error	FRU or action, in sequence
0177 Bad SVP data, stop POST task— Checksum of the supervisor password in the EEPROM is not correct.	**Replace the system board.**
0183 Bad CRC of Security Settings in EFI Variable. Enter the ThinkPad Setup program. – The checksum of the Security settings in the EFI Variable is not correct.	1. **Run the ThinkPad Setup program. The settings will be corrected automatically. Then save the current settings by pressing F10.** 2. Replace the system board.
0187 EAIA data access error	**Replace the system board.**
0188 Invalid RFID Serialization Information Area.	**Replace the system board.**
0189 Invalid RFID Configuration Information Area.	**Replace the system board.**
0190 Critical low-battery error	1. **Charge the battery pack.** 2. Replace the battery pack.
0191 System Security—Invalid Remote Change requested.	1. **Run the ThinkPad Setup program, and then save current setting by pressing F10.** 2. Replace the system board.
0199 System Security— Security password retry count exceeded.	1. **Run the ThinkPad Setup program. The retry count will be reset. Then save the current settings by pressing F10.** 2. Replace the system board.
0251 System CMOS checksum bad - Default configuration used.	1. **Charge the coin-cell battery for more than 8 hours by connecting the ac adapter.** 2. Replace the coin-cell battery and run ThinkPad Setup to reset the time and date.
0271 Real-Time Clock Error. Check Date and Time settings.	1. **Run ThinkPad Setup to reset the time and date** 2. Replace the coin-cell battery and run ThinkPad Setup to reset the time and date.
1802 Unauthorized network card is plugged in—Power off and remove the network card.	1. **Remove network card.** 2. Replace the system board.
1820 More than one external fingerprint reader are attached. Power off and remove all but the reader that you set up within your main operating system.	**Remove all but the reader that you set up for the authentication.**
2000 ThinkVantage Active Protection sensor diagnostics failed.	**Have the computer serviced.**
2100 Detection error on HDD0 (Main HDD)	1. **Reseat the hard disk drive.** 2. Replace the main hard disk drive. 3. Replace the system board.
2101 Detection error on HDD1 (Mini SATA)	1. **Reseat the Mini SATA device.** 2. Replace the mini SATA device. 3. Replace the system board.
2110 Read error on HDD0 (Main HDD)	1. **Reseat the hard disk drive.** 2. Replace the main hard disk drive. 3. Replace the system board.

Table 2. Numeric error codes (continued)

Symptom or error	FRU or action, in sequence
2111 Read error on HDD1 (Mini SATA)	1. **Reseat the Mini SATA device.** 2. Replace the mini SATA device. 3. Replace the system board.
2200 Machine Type and Serial Number are invalid.	**Replace the system board.**
2201 Machine UUID is invalid	**Replace the system board.**

Error messages

Table 3. Error messages

Symptom or error	FRU or action, in sequence
Fan error.	1. **Replace the fan**. 2. Apply thermal grease. 3. Replace the system board.
Thermal sensing error.	**Replace the system board**.
This system does not support batteries that are not genuine Lenovo-made or authorized. The system will continue to boot, but may not charge unauthorized batteries. **Attention:** Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.	**Replace the battery**.

Beep symptoms

Table 4. Beep symptoms

Symptom or error	FRU or action, in sequence
Four cycles of four short beeps	**Replace the system board.**
One short beep, pause, three short beeps, pause, three more short beeps, pause, and one short beep	1. **Replace the memory module**. 2. Replace the system board.
Three short beeps, pause, one short beep, pause, one more short beep, pause, and three short beeps	Remove the device from ExpressCard slot.
Five short beeps	**Replace the system board.**
One long and two short beeps	**Replace the system board.**
Five short beeps, pause, five short beeps, and pause	**Replace the system board.**

No-beep symptoms

Table 5. No-beep symptoms

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, LCD blank, and no POST.	1. **Ensure that every connector is connected tightly and correctly**. 2. Reseat memory module. 3. Replace the system board.
No beep, power-on indicator on, and LCD blank during POST.	1. **Reseat memory module**. 2. Replace the system board.
The power-on password prompt appears.	A power-on password or a supervisor password is set. Type the password and press **Enter**.
The hard-disk password prompt appears.	A hard disk password is set. Type the password and press **Enter**.

LCD-related symptoms

Important: The TFT LCD for the notebook computer contains many thin-film transistors (TFTs). The presence of a small number of dots that are missing, discolored, or always lighted is characteristic of TFT LCD technology, but excessive pixel problems can cause viewing concerns.If the LCD you are servicing has two or less visible defective pixels, it should not be considered faulty. However, if the LCD has three or more visible defective pixels, it will be deemed as defective by Lenovo and it should be replaced.

Notes:

- This policy applies to all ThinkPad notebooks purchased on 1 January, 2008 or later.
- Lenovo will not provide warranty replacement if the LCD is within specifications because we cannot guarantee that any replacement LCD will have zero pixel defects.
- One pixel consists of R, G, B sub-pixels.

Table 6. LCD-related symptoms

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, and a blank LCD during POST.	**Replace the system board.**
• LCD backlight not working. • LCD too dark. • LCD brightness cannot be adjusted. • LCD contrast cannot be adjusted.	1. **Reseat the LCD connectors**. 2. Replace the LCD assembly. 3. Replace the system board.
• LCD screen unreadable. • Characters missing pixels. • Screen abnormal. • Wrong color displayed.	1. **See important note for "LCD-related symptoms."** 2. Reseat all LCD connectors. 3. Replace the LCD assembly. 4. Replace the system board.
Horizontal or vertical lines displayed on LCD.	**Replace the LCD assembly**.

Intermittent problems

Intermittent system hang problems can be due to a variety of causes that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. FRU replacement should be considered only when a problem recurs.

When analyzing an intermittent problem, do the following:

1. Run the diagnostic test for the system board in loop mode **at least 10 times**.

2. If no error is detected, do not replace any FRUs.
3. If any error is detected, replace the FRU shown by the FRU code. Rerun the test to verify that no more errors exist.

Undetermined problems

If the diagnostic tests did not identify the adapter or device that has failed, if wrong devices are installed, or if the system simply is not operating, follow these procedures to isolate the failing FRU (do not isolate FRUs that have no defects).

Verify that all attached devices are supported by the computer.

Verify that the power supply being used at the time of the failure is operating correctly. See “Power system checkout” on page 26.

1. Turn off the computer.
2. Visually check each FRU for damage. Replace any damaged FRU.
3. Remove or disconnect all of the following devices:
   a. Non-ThinkPad devices
   b. Devices attached to the docking station or the port replicator
   c. Printer, mouse, and other external devices
   d. Battery pack
   e. Hard disk drive, hybrid drive, or solid-state drive
   f. External diskette drive or optical drive
   g. Memory module
   h. PC cards
4. Turn on the computer.
5. Determine whether the problem has been solved.
6. If the problem does not recur, reconnect the removed devices one at a time until you find the failing FRU.
7. If the problem remains, replace the following FRUs one at a time (do not replace a nondefective FRU):
   a. System board
   b. LCD assembly

Chapter 5. Status indicators

This chapter presents the status indicators that show the status of the computer.

Note: Depending on the model, the ThinkPad pointing device might look different from the following illustration.

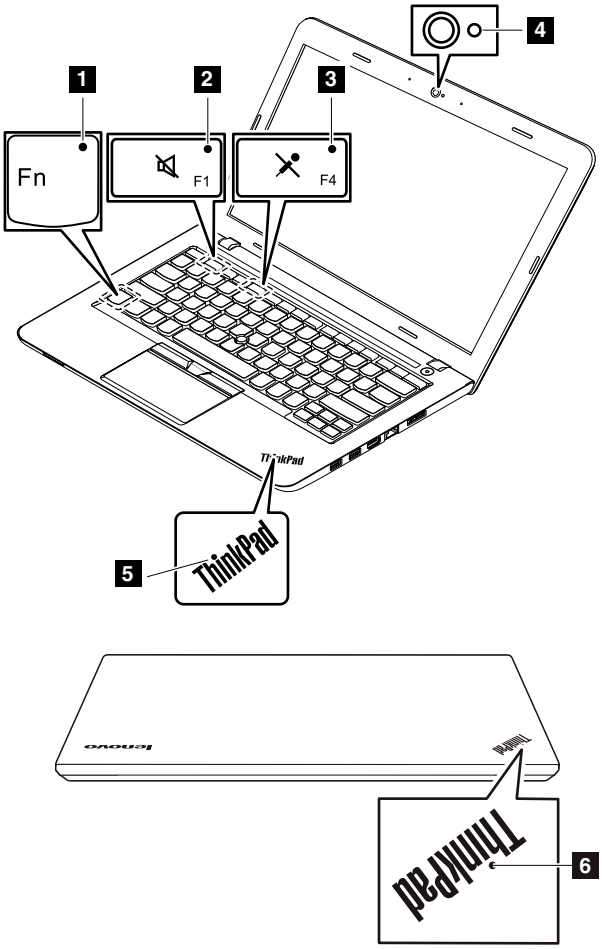

Table 7. Status indicators

Indicator	Meaning
1 Fn Lock indicator	**Off** (default mode): The Fn Lock function is disabled. To initiate the special function of each key, press the corresponding function key directly. To input F1-F12, press the Fn key and the corresponding function key. **On** (legacy mode): The Fn Lock function is enabled. To input F1- F12, press the corresponding function key directly. To initiate the special function of each key, press the Fn key and the corresponding function key.
2 Speaker mute indicator	**On**: The speakers are muted.
3 Microphone mute indicator	**On**: The microphones are muted.

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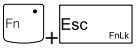
Table 7. Status indicators (continued)

Indicator	Meaning
4 Camera status indicator	**On**: The camera is in use.
5 6 System status indicator	**Blinking three times**: The computer is initially connected to power. **On**: The computer is in use. **Off**: The computer is off or in hibernation mode. **Slow blinking**: The computer is in sleep mode. **Fast blinking**: The computer is entering sleep or hibernation mode.

Chapter 6. Function keys

The following table describes the functions of function keys and key combinations.

Table 8. Function keys

Function key and key combination	Description
	Press Fn+Esc to enable or disable the Fn Lock function and switch between default mode and legacy mode of using the function keys. • **When the Fn Lock function is disabled**: The Fn Lock indicator is off (default mode). To initiate the special function of each function key, press the corresponding function key directly. To input F1- F12, press the Fn key and the corresponding function key. • **When the Fn Lock function is enabled**: The Fn Lock indicator turns on (legacy mode). To input F1- F12, press the corresponding function key directly. To initiate the special function of each function key, press the Fn key and the corresponding function key.
	Mutes or unmutes the speakers. If you mute the sound and turn off your computer, the sound will remain muted when you turn on your computer again. To turn on the sound, press F2 or F3.
	Decreases the speaker volume.
	Increases the speaker volume.
	Mutes or unmutes the microphones.
	Darkens the display.
	Brightens the display.
	Switches the display output location between the computer display and an external monitor.
	Enables or disables the wireless features.
	For Windows 7: Opens **Control Panel**. For Windows 8.1: Opens the **Settings** charm.
	For Windows 7: Opens **Windows Search**. For Windows 8 and Windows 8.1: Opens the **Search** charm.
	Views the programs that you have opened.
	For Windows 7: Opens **Computer**. For Windows 8.1: Views all the programs.

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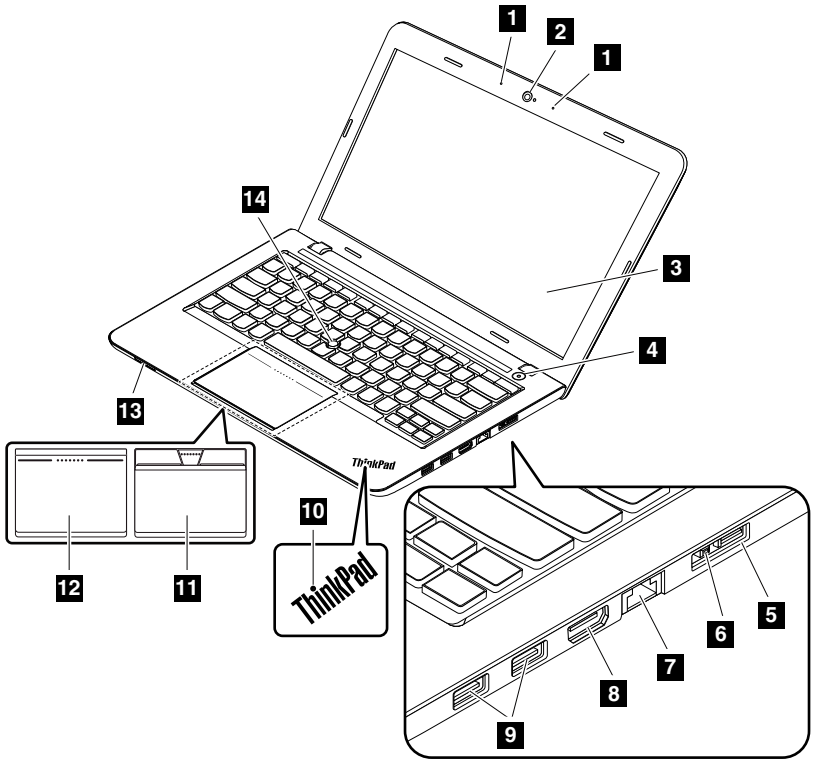
Chapter 7. Locations

This chapter helps you locate the hardware components on your computer.

Locating computer controls, connectors, and indicators

This topic helps you locate the controls, connectors, and indicators on your computer.

Front view



1 Microphones

2 Camera

3 Screen

4 Power button

5 Lenovo OneLink connector

6 ac power connector

7 Ethernet connector

8 High-Definition Multimedia Interface (HDMI™) connector

9 USB 3.0 connectors

10 System status indicator

11 ThinkPad® pointing device with TrackPoint buttons (available on some models)

12 ThinkPad pointing device without TrackPoint buttons (available on some models)

13 Media-card slot

14 TrackPoint® pointing stick

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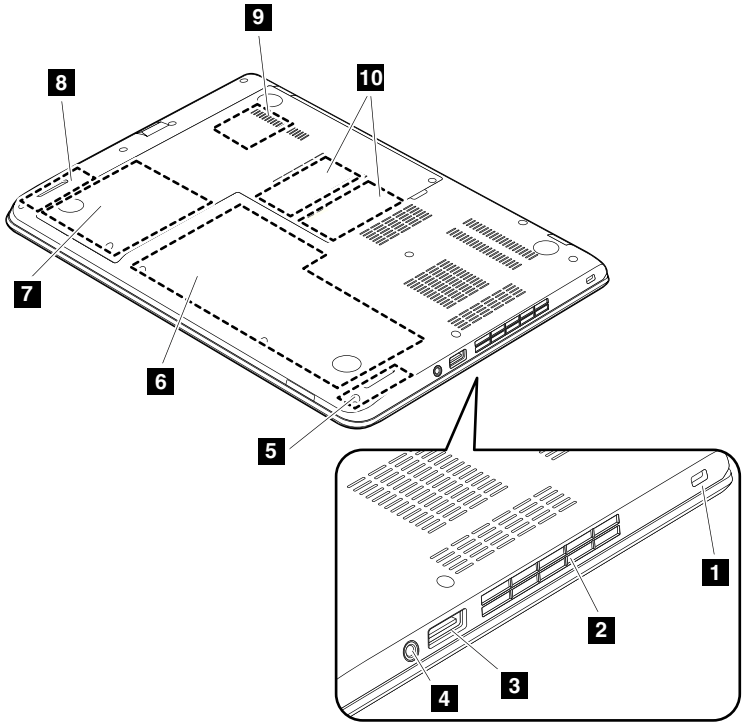
Bottom view



1 Security-lock slot
2 Fan louvers
3 Always On USB connector
4 Combo audio connector
5 Speaker
6 Battery
7 Internal storage drive[1]
8 Speaker
9 Wireless LAN card
10 Memory modules

[1]: Internal storage drive refers to the installed hard disk drive, solid-state drive, or hybrid drive.

Locating FRUs and CRUs

This topic introduces the following service parts:

- “Major FRUs” on page 54
- “LCD FRUs” on page 56

Notes:

- Each FRU is available for all types or models, unless otherwise specified.
- **CRU statement for customers:**
  You can resolve some problems with your product with a replacement part you can install yourself, called a “Customer Replaceable Unit” or “CRU.” Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. *Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product.* If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this *Hardware Maintenance Manual*. An electronic version of this manual can be found at http://www.lenovo.com/support. Click **Guides & Manuals** and then follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

  ThinkPad computers contain the following types of CRUs:
  - **Self-service CRUs:** These CRUs unplug or are held by no more than two screws. Examples of these types of CRUs include the ac power adapter, power cord, and hard disk drive. Other self-service CRUs depending on product design might include the memory module, wireless card, keyboard, and palm rest with fingerprint reader assembly and touch pad.
  - **Optional-service CRUs:** These CRUs are isolated parts within the computer that are concealed by an access panel that is typically secured by more than two screws. Once the access panel is removed, the specific CRU is visible.

Major FRUs

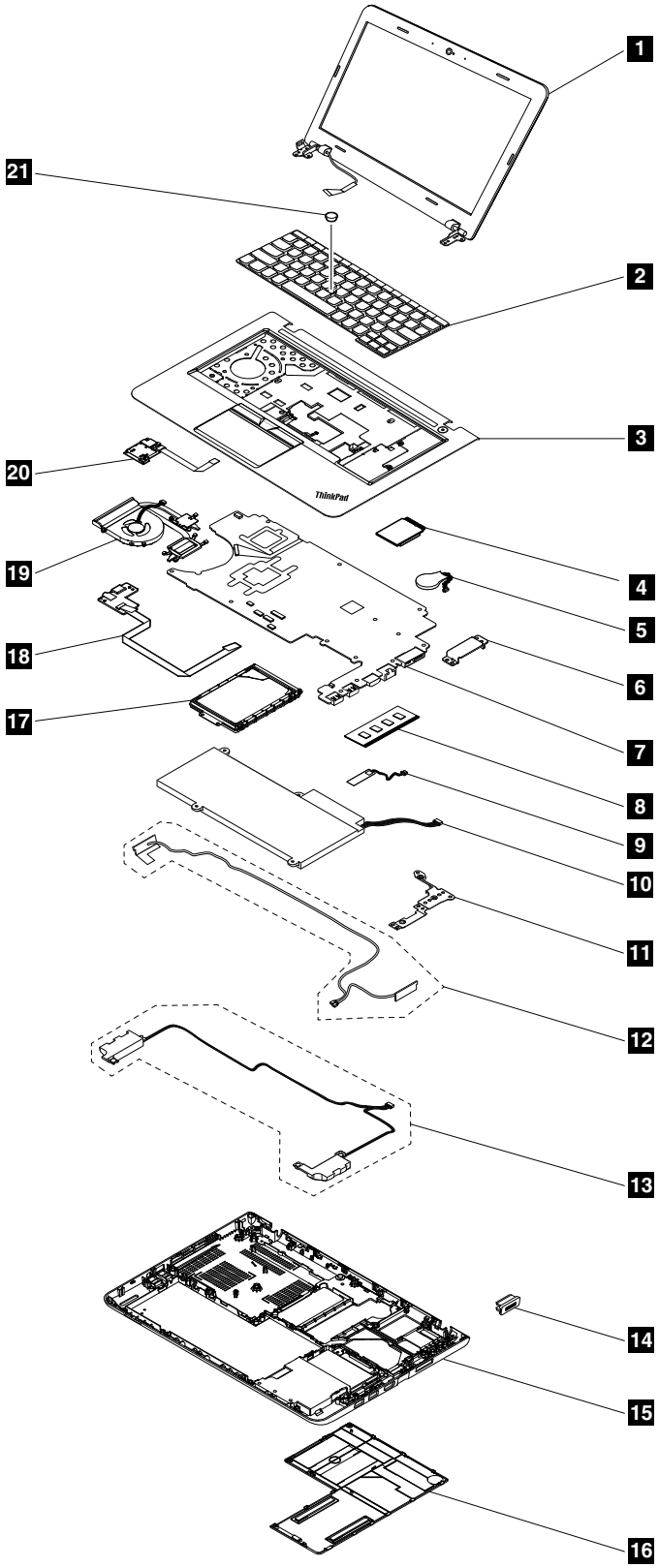


Table 9. Major FRUs

No.	FRU descriptions	Self-service CRU	Optional service CRU
1	LCD unit	No	No
2	Keyboard	No	Yes
3	Keyboard bezel assembly **Note:** Depending on the model, the ThinkPad pointing device might look different from the above illustration.	No	No
4	Wireless LAN card	No	Yes
5	Coin-cell battery	Yes	No
6	dc-in support bracket	No	No
7	System board	No	No
8	Memory module	Yes	No
9	ThinkPad-logo-LED card	No	No
10	Battery	No	No
11	Hinge support bracket	No	No
12	Wireless LAN antenna	No	No
13	Speaker assembly	No	No
14	Lenovo OneLink connector cover	Yes	No
15	Base cover assembly	No	No
16	DIMM door	Yes	No
17	Internal storage drive (hard disk drive, hybrid drive, or solid-state drive)	Yes	No
18	USB/audio card	No	No
19	Thermal fan assembly	No	No
20	Media card reader	No	No
21	TrackPoint cap	Yes	No

LCD FRUs

For models with non-touch panel

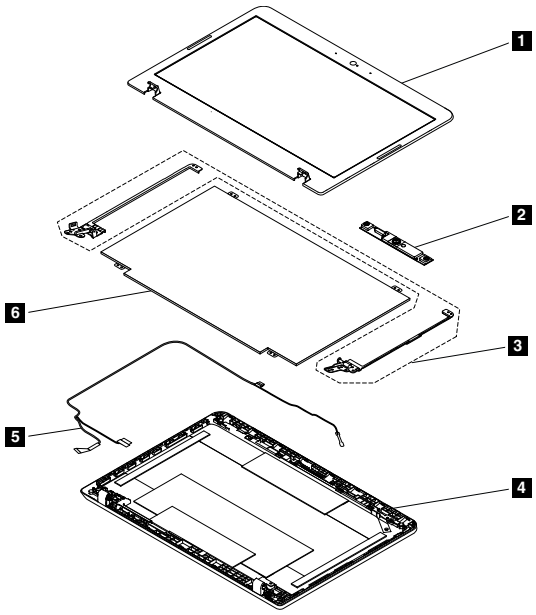


Table 10. LCD FRUs

No.	FRU descriptions	Self-service CRU	Optional service CRU
1	LCD bezel assembly	No	No
2	Camera and microphone combo card	No	No
3	LCD Hinge assembly	No	No
4	LCD cover assembly	No	No
5	LCD/camera card/ThinkPad logo card combo cable	No	No
6	LCD module	No	No

Miscellaneous parts and other FRUs

Table 11. Miscellaneous part

FRU descriptions	Self-service CRU	Optional service CRU
Screw kit	No	No

Table 12. Other FRUs

FRU descriptions	Self-service CRU	Optional service CRU
ac power adapter	Yes	No
Power cord	Yes	No

Looking up FRU information

For detailed FRU information, including part numbers, descriptions, and substitution part numbers, go to: http://www.lenovo.com/serviceparts-lookup

Chapter 8. FRU replacement notices

This chapter presents notices related to removing and replacing parts. Read this chapter carefully before replacing any FRU.

CRU statement for customers:
You can resolve some problems with your product with a replacement part you can install yourself, called a “Customer Replaceable Unit” or “CRU.” Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. *Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product.* If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this *Hardware Maintenance Manual*. An electronic version of this manual can be found at http://www.lenovo.com/support. Click **Guides & Manuals** and then follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

Screw notices

Loose screws can cause a reliability problem. In the ThinkPad notebook computer, this problem is addressed with special nylon-coated screws that have the following characteristics:

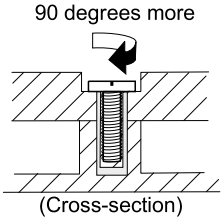
- They maintain tight connections.
- They do not easily come loose, even with shock or vibration.
- They are harder to tighten.

Do the following when you service this machine:

- Keep the screw kit in your tool bag. For the part number of the screw kit, go to http://www.lenovo.com/serviceparts-lookup.
- It is recommended to use new screws.
- It is recommended to use each screw only once.

Tighten screws as follows:

- **Plastic to plastic**
  Turn an additional 90 degrees after the screw head touches the surface of the plastic part.



- **Logic card to plastic**
  Turn an additional 180 degrees after the screw head touches the surface of the logic card.

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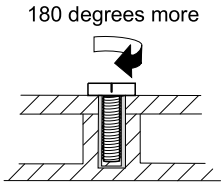

Notes:

- Ensure that you use the correct screw. It is recommended to use new screws for replacements. If you have a torque screwdriver, tighten all screws firmly to the torque specified in the screw information table for each step.
- Ensure that torque screwdrivers are calibrated correctly following country specifications.

Retaining serial numbers

This topic provides instructions on the following:

- "Restoring the serial number of the system unit" on page 60
- "Retaining the UUID" on page 61

Restoring the serial number of the system unit

When the computer was manufactured, the EEPROM on the system board was loaded with the serial numbers of the system and all major components. These numbers need to remain the same throughout the life of the computer.

If you replace the system board, you must restore the serial number of the system unit to its original value.

The serial number of the system unit is written on the label attached to the bottom of the computer.

If you can not find the serial number of the system unit on the bottom of the computer, try the following method to get the number:

Note: Before you perform the operation, ensure that the UEFI/Legacy setting within the **Startup** menu in the ThinkPad Setup program is set to **UEFI Only**.

1. Connect a USB memory key to the computer.
2. Go to http://www.lenovo.com/maintenanceutilities and follow the instructions on the screen to create a Maintenance Key.

   Note: Only an authorized Lenovo service technician can access the above Web site.
3. Restart the computer.
4. When the logo screen is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.
5. Type 1 under **Enter the action desired**, then press Enter. The ThinkPad Serial Number Update Utility for Asset ID screen is displayed.
6. Type 2 under Enter the action desired, then press Enter. The serial number of each device in your computer is displayed; the serial number of the system unit is listed as follow:
   20- Serial number
7. Record the serial number of the system unit.

After you replace the system board, do the following to restore the serial number of the system unit:

1. Connect the Maintenance Key to the computer.

2. When the logo screen is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.
3. Type 1 under **Enter the action desired**, then press Enter. The ThinkPad Serial Number Update Utility for Asset ID screen is displayed.
4. Type 1 under **Enter the action desired**, then press Enter. Then follow the instructions on the screen to restore the serial number of the system unit.

Retaining the UUID

The Universally Unique Identifier (UUID) is a 128-bit number uniquely assigned to your computer at production and stored in the EEPROM of your system board.

The algorithm that generates the number is designed to provide unique IDs until the year A.D. 3400. No two computers in the world have the same number.

When you replace the system board, perform the following steps to create a new UUID for the system board if the system board does not have a UUID:

Note: Before you perform the operation, ensure that the UEFI/Legacy setting within the Startup menu in the ThinkPad Setup program is set to UEFI Only.

1. Connect a USB memory key to the computer.
2. Go to http://www.lenovo.com/maintenanceutilities and follow the instructions on the screen to create a Maintenance key.

   Note: Only an authorized Lenovo service technician can access the above Web site.
3. Restart the computer.
4. When the logo screen is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.
5. Type 2 under **Enter the action desired**, then press Enter. The Auto UUID generation utility interface is displayed.
6. Type y under **Change UUID. OK? [Y/N]**, then press Enter. A new UUID is created and written. If a valid UUID already exists, it is not overwritten.

Chapter 9. Removing or replacing a FRU

This chapter provides instructions on how to remove or replace a FRU.

CRU statement for customers:

You can resolve some problems with your product with a replacement part you can install yourself, called a “Customer Replaceable Unit” or “CRU.” Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. *Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product.* If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this *Hardware Maintenance Manual*. An electronic version of this manual is available for downloading at http://www.lenovo.com/support. You might be required to return the defective CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective part within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

General guidelines

When removing or replacing a FRU, be sure to observe the following general guidelines:

1. Do not try to service any computer unless you have been trained and certified. An untrained person runs the risk of damaging parts.
2. Before replacing any FRU, review Chapter 8 “FRU replacement notices” on page 59.
3. Begin by removing any FRUs that have to be removed before replacing the failing FRU. Any such FRUs are listed at the beginning of each FRU replacement section. Remove them in the order in which they are listed.
4. Follow the correct sequence in the steps for removing a FRU, as given in the illustrations by the numbers in square callouts.
5. When turning a screw, turn it in the direction as given by the arrow in the illustration.
6. When removing a FRU, move it in the direction as given by the arrow in the illustration.
7. To put the new FRU in place, reverse the removal procedure and follow any notes that pertain to replacement.
8. When replacing a FRU, use the correct screws as shown in the replacement procedures.

DANGER

Before removing any FRU, turn off the computer, unplug all power cords from electrical outlets, disable the built-in battery, and then disconnect any interconnecting cables.

Attention: After replacing a FRU, do not turn on the computer until you have made sure that all screws, springs, and other small parts are in place and none are loose inside the computer. Verify this by shaking the computer gently and listening for rattling sounds. Metallic parts or metal flakes can cause electrical short circuits.

Attention: The system board is sensitive to, and can be damaged by, electrostatic discharge (ESD). Before touching it, establish personal grounding by touching a ground point with one hand or by using an electrostatic discharge strap.

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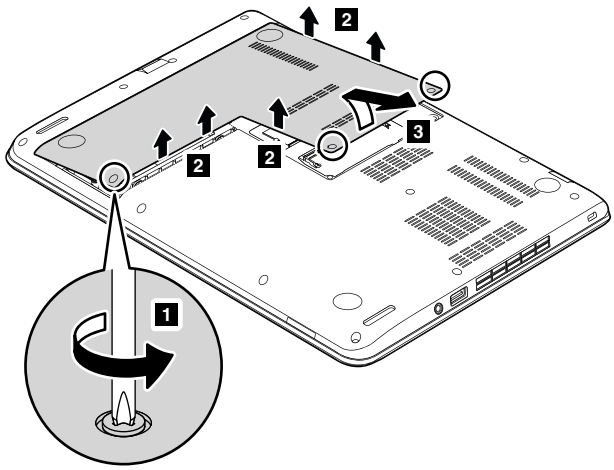
Before servicing the computer

Carefully read this topic before servicing the computer.

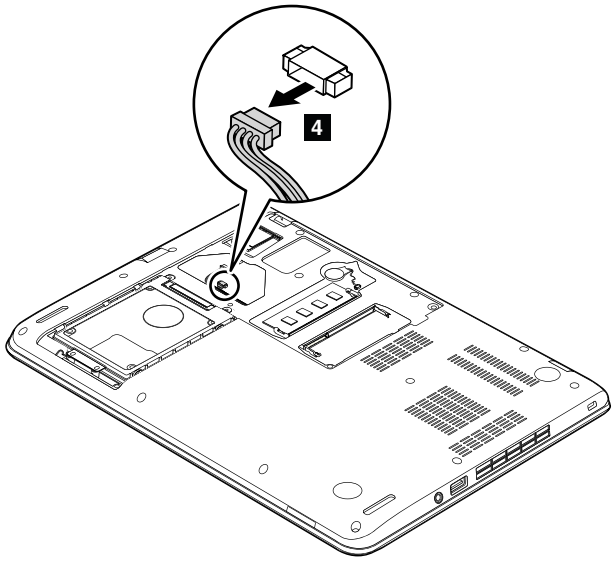
Disconnect the battery

Before replacing any FRU, ensure that you have disconnected the battery by doing the following:

1. Loosen the screws **1**, and then remove the base cover **2** **3**.



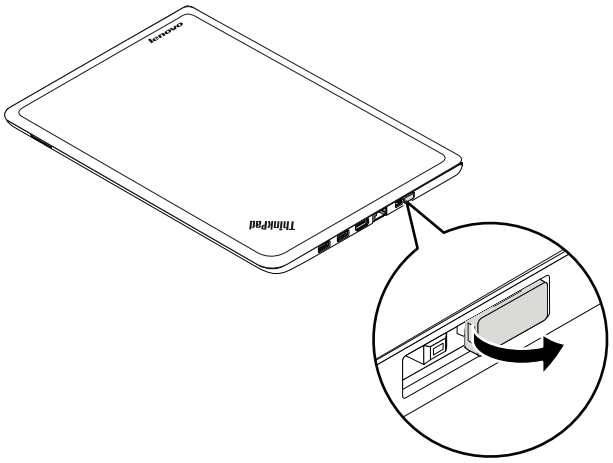
2. Disconnect the battery **4**.



1010 Lenovo OneLink connector cover

Removal steps of the Lenovo OneLink connector cover

Remove the connector cover as shown in the following illustration.

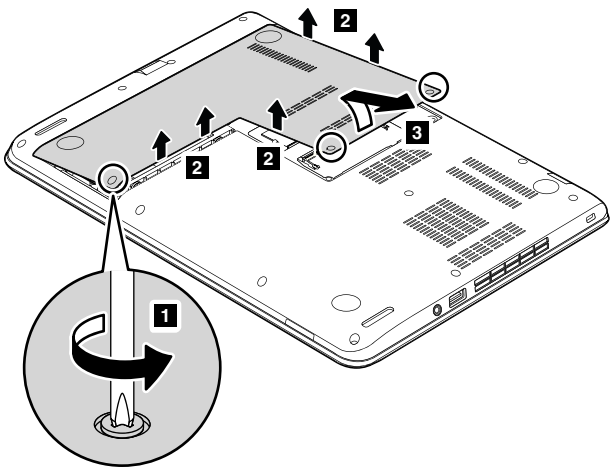


Note: Ensure that you reattach the connector cover to the Lenovo OneLink connector after finishing the servicing.

1020 DIMM door

Removal steps of the DIMM door

Loosen the screws 1, and then remove the base cover 2 3.



Step	Screw (quantity)	Color	Torque
1	M2 × 4 mm, flat-head, nylon-coated (3)	Black	0.181 Nm (1.85 kgf-cm)

1030 Internal storage drive

For access, remove this FRU:

- “1020 DIMM door” on page 65

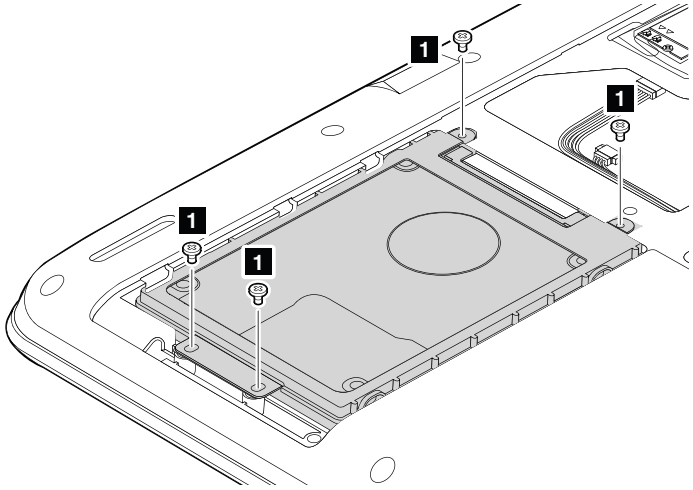
Attention:

- Do not drop the drive or apply any physical shock to it. The drive is sensitive to physical shock. Improper handling can cause damage and permanent loss of data.

- Before removing the drive, have the user make a backup copy of all the information on it if possible.
- Never remove the drive while the system is operating or in suspend mode.

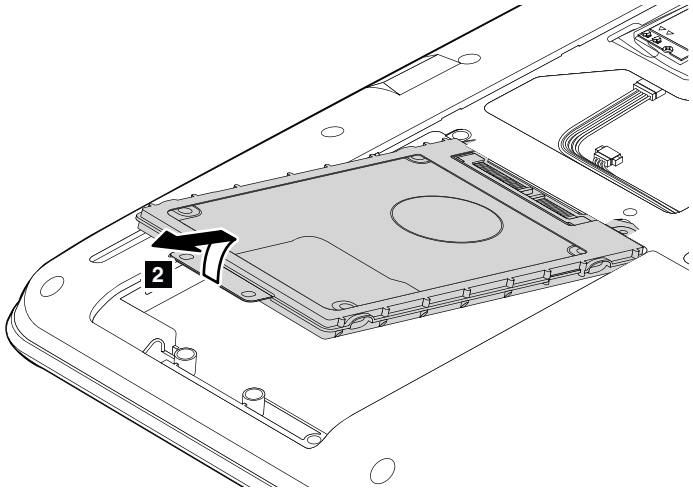
Removal steps of the storage drive

Remove the screws that secure the storage drive **1**.



Step	Screw (quantity)	Color	Torque
1	M2 × 5 mm, flat-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)

Remove the storage drive **2**.



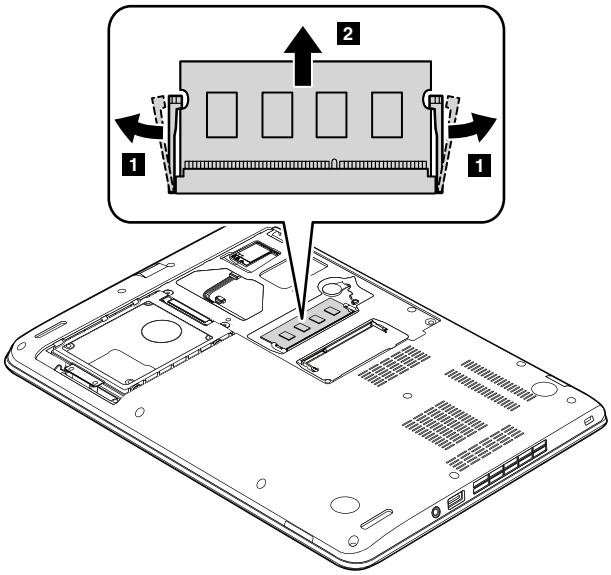
When installing:

Ensure that the storage drive is firmly attached.

1040 Memory module

For access, remove this FRU:
- “1020 DIMM door” on page 65

Removal steps of the memory module



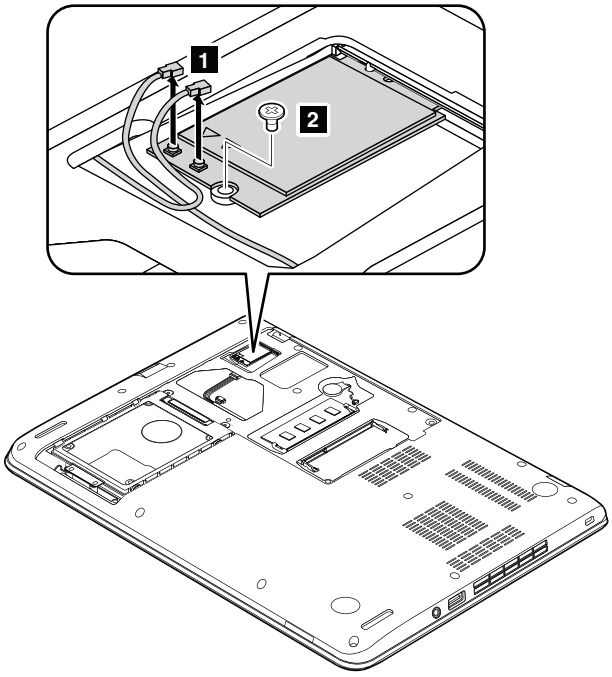
When installing:

Insert the notched end of the memory module into the memory slot. Press the memory module in firmly, and pivot it downward until it snaps into place. Ensure that the memory module is firmly installed in the slot and does not move easily.

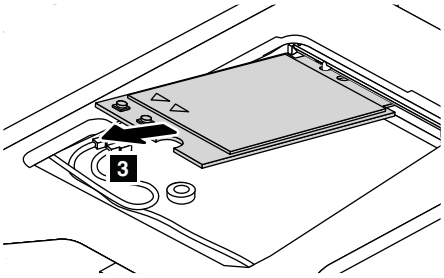
1050 Wireless LAN card

For access, remove this FRU:
- “1020 DIMM door” on page 65

Removal steps of the wireless LAN card



Step	Screw (quantity)	Color	Torque
2	M2 × 3.5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)



When installing:

Plug the gray cable into the connector labeled **MAIN** or **1** on the card; and plug the black cable into the connector labeled **AUX** or **2** on the card.

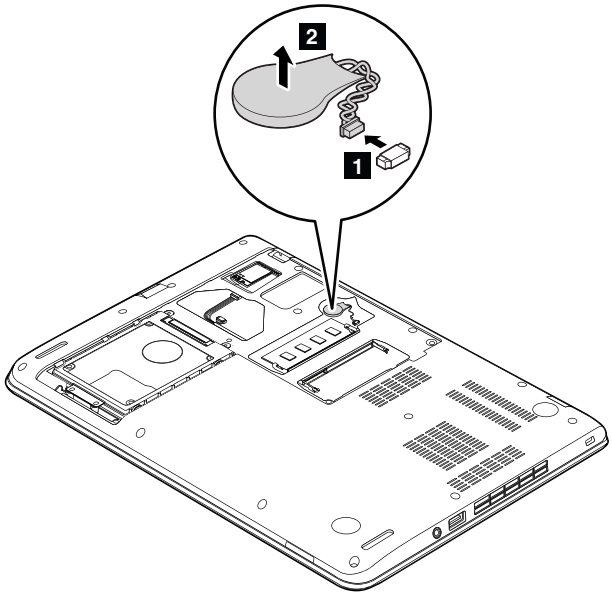
1060 Coin-cell battery

For access, remove this FRU:
- "1020 DIMM door" on page 65

DANGER

Use only the authorized battery specified for your computer. Any other battery could ignite or explode.

Removal steps of the coin-cell battery



When installing:

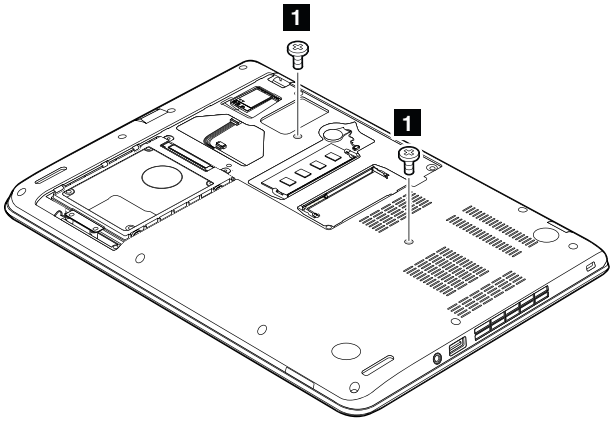
Ensure that the connector is attached firmly.

1070 Keyboard

For access, remove this FRU:
- “1020 DIMM door” on page 65

Removal steps of the keyboard

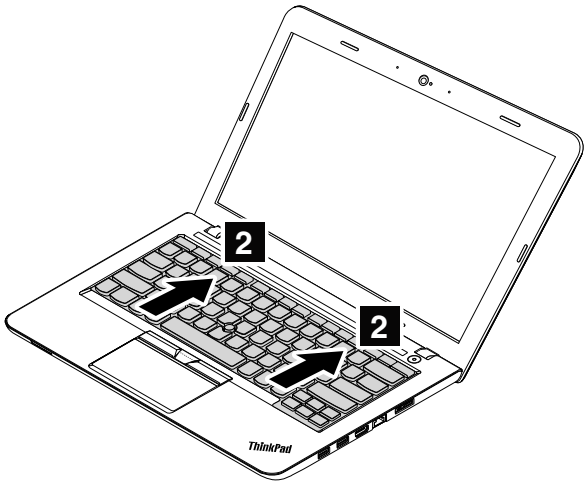
Remove the screws that secure the keyboard.



Step	Screw (quantity)	Color	Torque
1	M2 × 7 mm, flat-head, nylon-coated (2)	Black	0.181 Nm (1.85 kgf-cm)

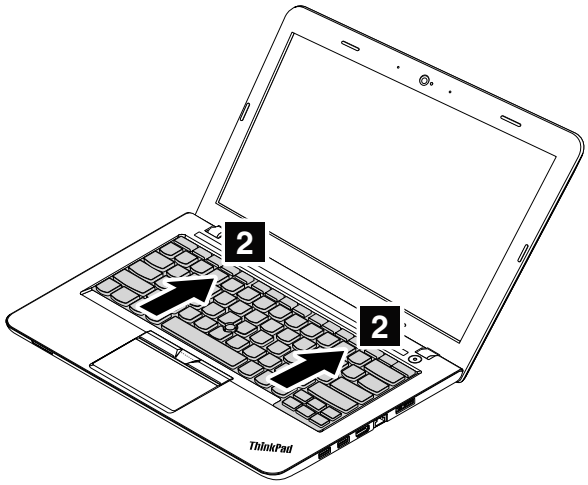
Push hard in the direction as shown to unlatch the keyboard.

Note: Depending on the model, the ThinkPad pointing device might look different from the following illustration.

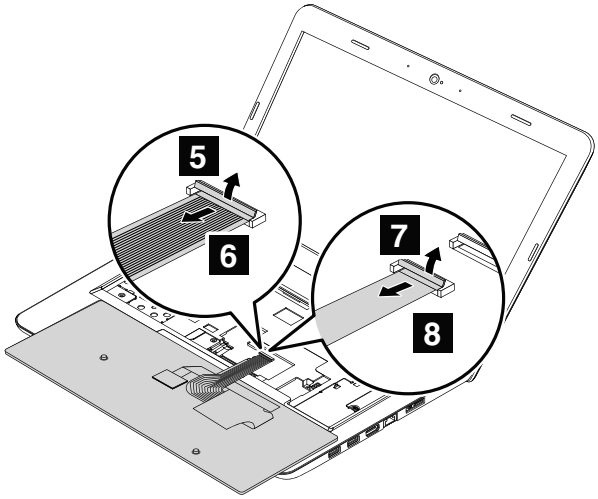


Pivot the keyboard slightly upward 3 until you can see the connectors on the bottom side of the keyboard. Then turn over the keyboard as shown 4 .

Note: Depending on the model, the ThinkPad pointing device might look different from the following illustration.



Gently put the keyboard on the palm rest and detach the connectors. Then remove the keyboard.

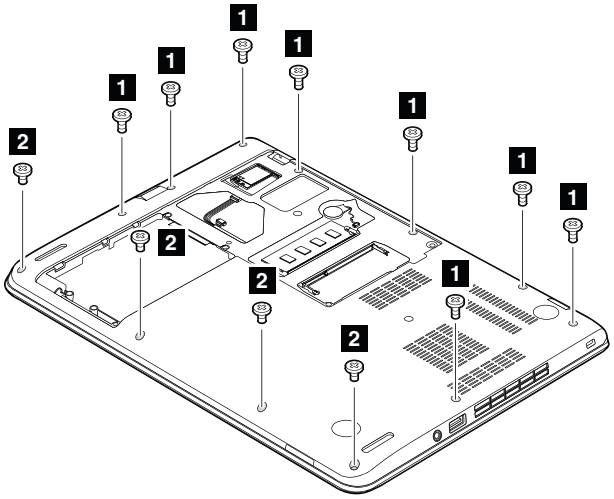


1080 Keyboard bezel assembly

For access, remove this FRU:

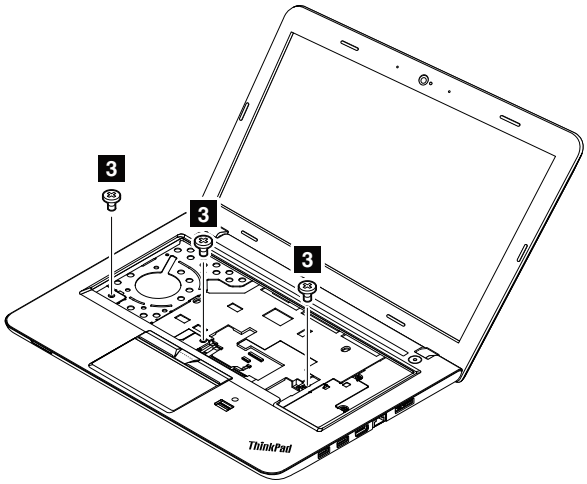
- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1070 Keyboard” on page 69

Removal steps of the keyboard bezel assembly



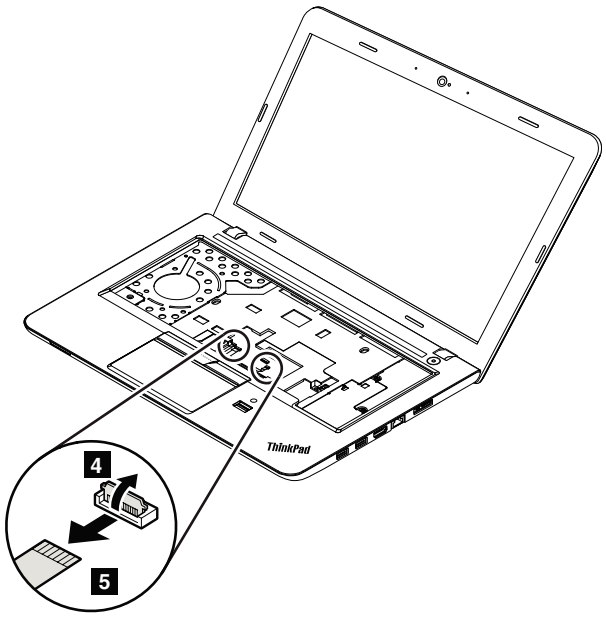
Step	Screw (quantity)	Color	Torque
1	M2 × 7 mm, flat-head, nylon-coated (8)	Black	0.181 Nm (1.85 kgf-cm)
2	M2 × 5 mm, flat-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)

Note: Depending on the model, the ThinkPad pointing device might look different from the following illustration.

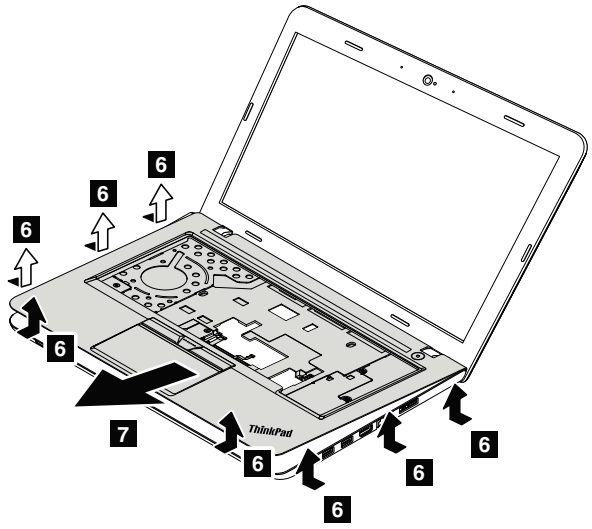


Step	Screw (quantity)	Color	Torque
3	M2 × 5 mm, flat-head, nylon-coated (3)	Black	0.181 Nm (1.85 kgf-cm)

Note: Depending on the model, the ThinkPad pointing device might look different from the following illustration.



Note: Depending on the model, the ThinkPad pointing device might look different from the following illustration.

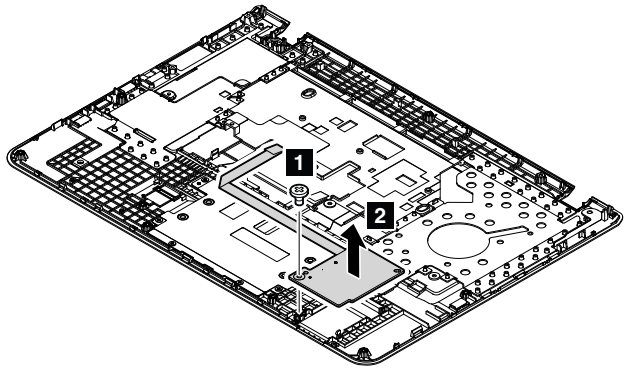


1090 Media card reader

For access, remove these FRUs in order:

- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70

Removal steps of the media card reader

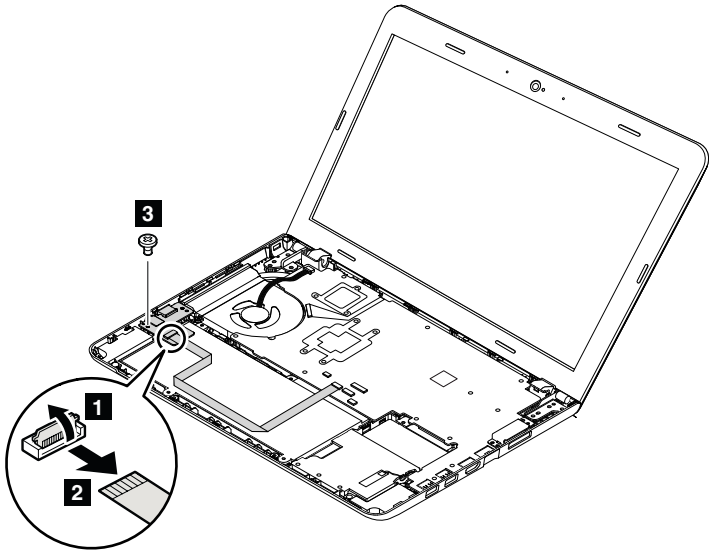


Step	Screw (quantity)	Color	Torque
1	M2 × 3.5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

1100 USB/audio card

For access, remove these FRUs in order:
- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70

Removal steps of the USB/audio card



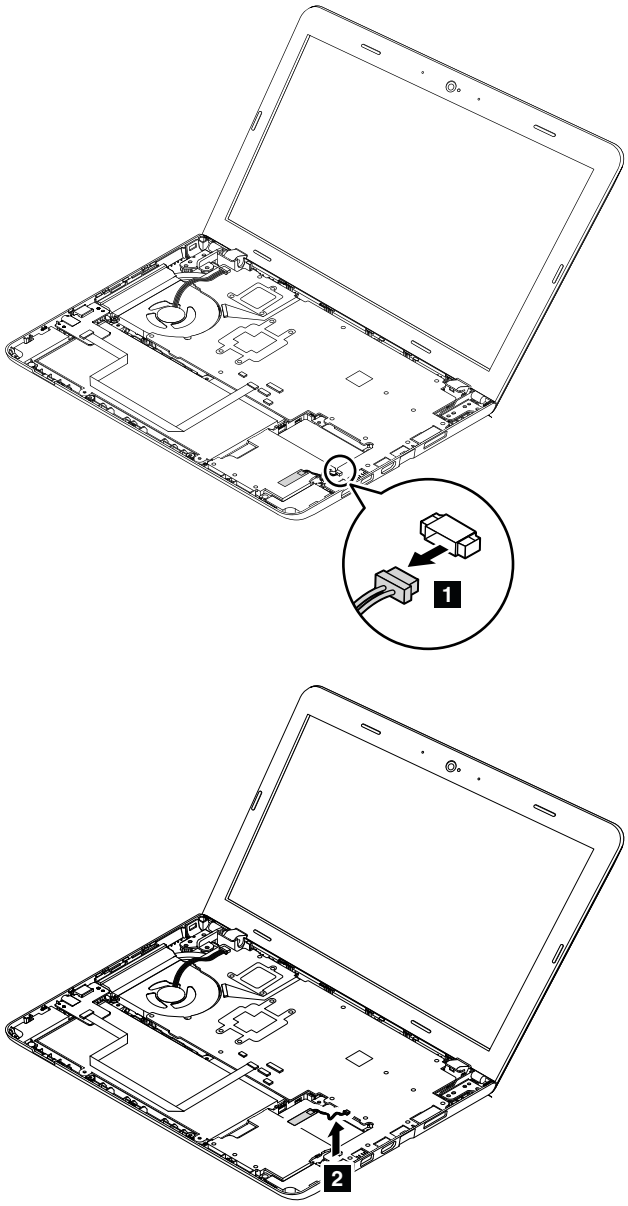
Step	Screw (quantity)	Color	Torque
3	M2.0 × 3.5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)

1110 ThinkPad-logo-LED card

For access, remove these FRUs in order:
- “1010 Lenovo OneLink connector cover” on page 64

- “1020 DIMM door” on page 65
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70

Removal step of the ThinkPad-logo-LED card



1120 System board, dc-in support bracket, and thermal fan assembly

Important notices for handling the system board

When handling the system board, read the following:

- The system board has an accelerometer, which can be broken when several thousands of G-forces are applied.

  Note: Dropping a system board from a height of as little as 0.15 m (6 inches) so that it falls flat on a hard bench can subject the accelerometer to as much as 6000 G's of shock.

- Be careful not to drop the system board on a bench top that has a hard surface, such as metal, wood, or composite.
- Avoid rough handling of any kind.
- At every point in the process, be sure not to drop or stack the system board.
- If you put a system board down, be sure to put it only on a padded surface such as an ESD mat or a corrugated conductive material.

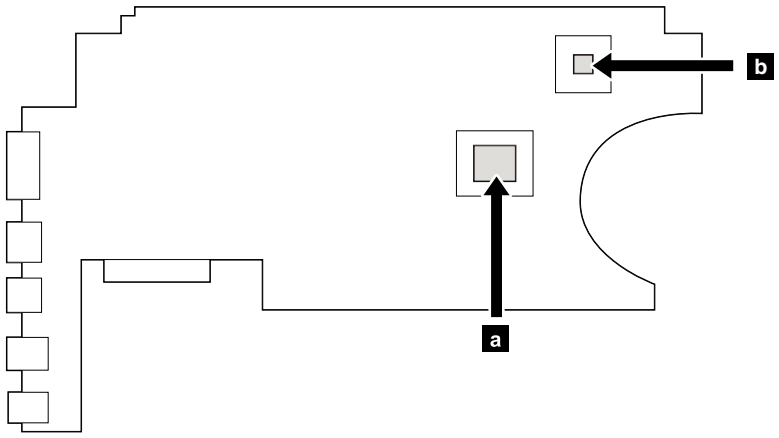
For access, remove these FRUs in order:
- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1030 Internal storage drive” on page 65
- “1040 Memory module” on page 66
- “1050 Wireless LAN card” on page 67
- “1060 Coin-cell battery” on page 68
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70
- “1100 USB/audio card” on page 73

Attention: The following components soldered on the top side of the system board is extremely sensitive. When you service the system board, avoid any kind of rough handling.

ThinkPad E450 and E450c

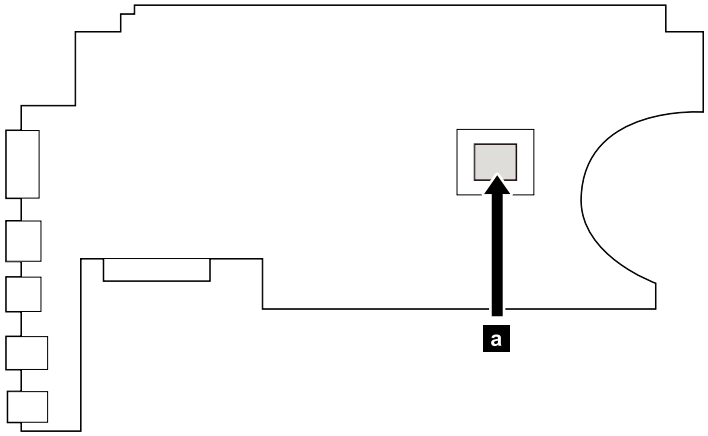
For models with a discrete thermal module

a Microprocessor
b Video Graphic card (VGA)



For models with an integrated thermal module

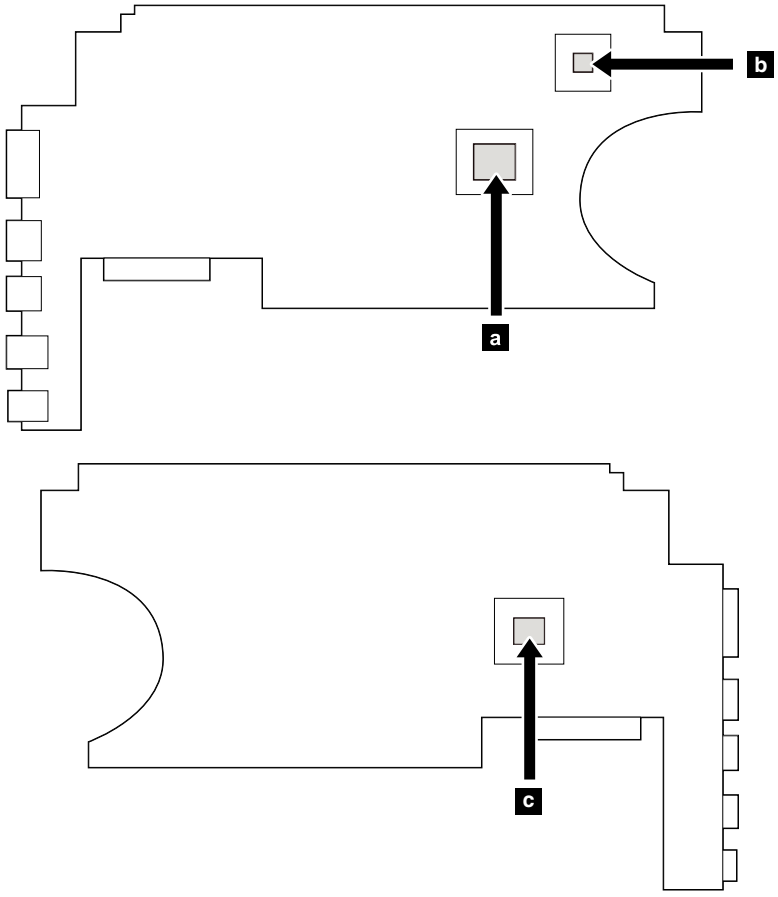
a Microprocessor



ThinkPad E455

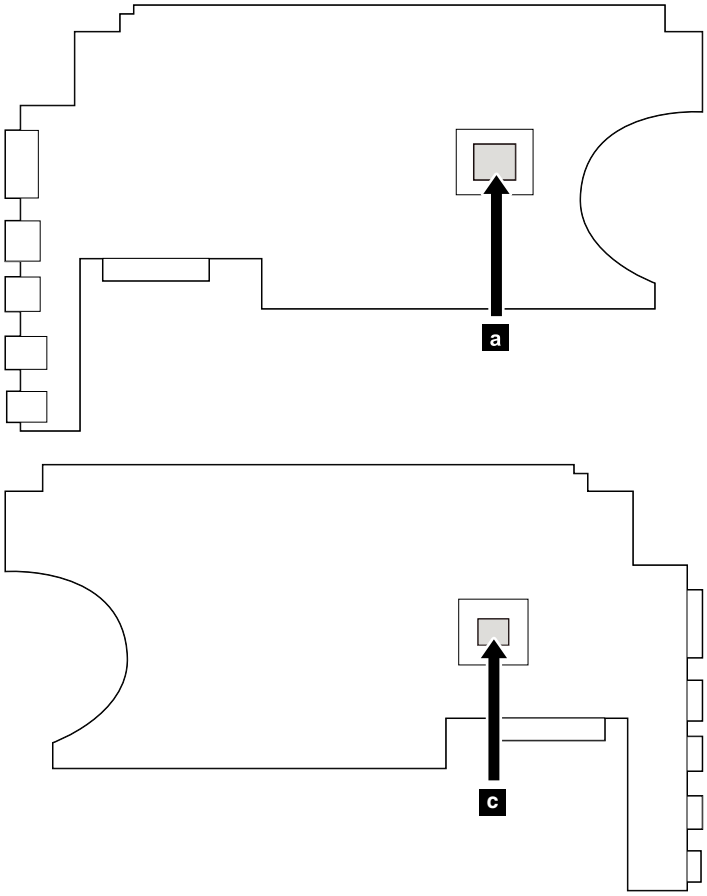
For models with a discrete thermal module

a Microprocessor
b Video Graphic Array card (VGA)
c Fusion Controller Hub (FCH)



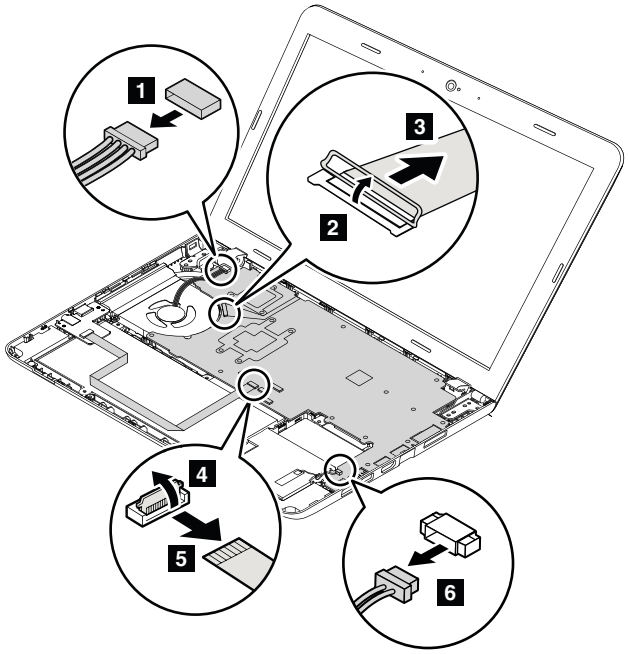
For models with an integrated thermal module

a Microprocessor
c Fusion Controller Hub (FCH)

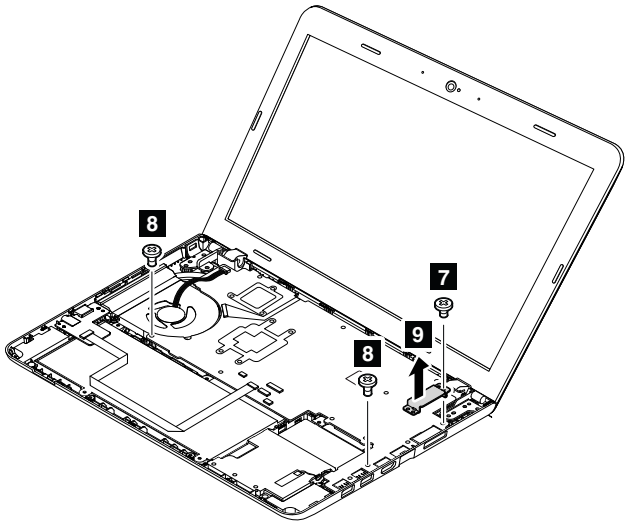


Removal steps of the system board

Disconnect the connectors attached to the system board.

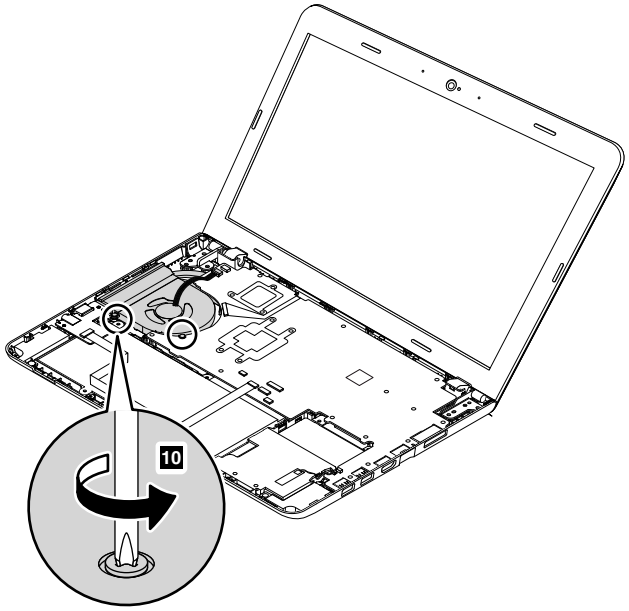


Remove the screws that secure the system board and the dc-in support bracket. Then remove the dc-in support bracket.

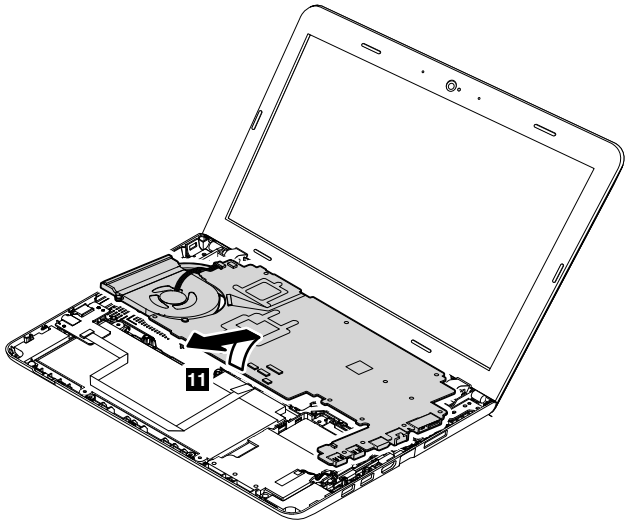


Step	Screw (quantity)	Color	Torque
7	M2.0 × 5 mm, flat-head, nylon-coated (1)	Black	0.181 Nm (1.85 kgf-cm)
8	M2.0 × 3.5 mm, flat-head, nylon-coated (2)	Black	0.181 Nm (1.85 kgf-cm)

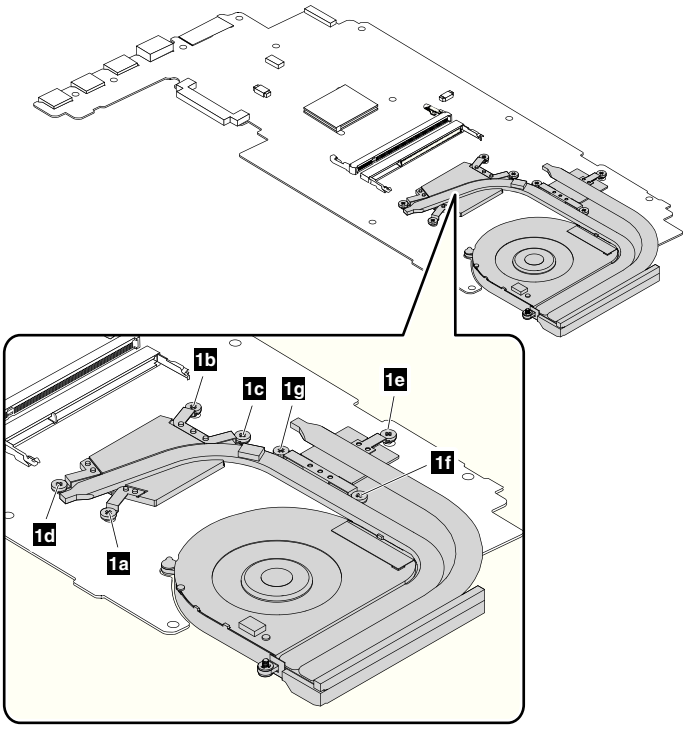
Loosen the screws.



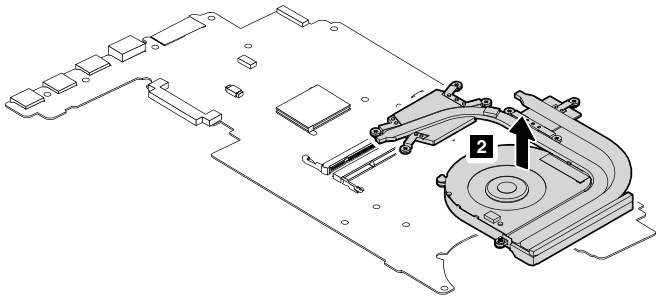
Remove the system board together with the thermal fan assembly.



Turn over the system board. The thermal fan assembly is on the other side of the system board. Then loosen the screws in the alphabetical order as shown.

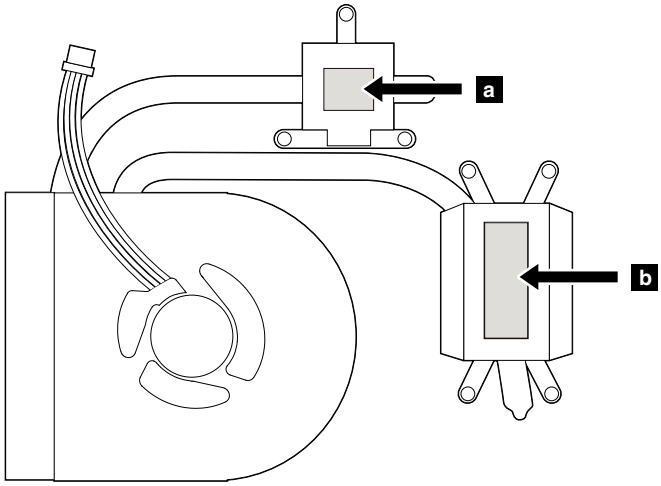


Remove the thermal fan assembly.



When you install the thermal fan assembly:

- Always wear fingerstalls when handling the thermal fan assembly. Do not touch or hold any part of the thermal fan assembly with bare fingers.
- Before you attach the thermal fan assembly to the computer, apply thermal grease, at an amount of 0.2 grams, on the part marked **a** as shown in the following illustrations. Either too much or too less application of grease can cause a thermal problem due to imperfect contact with a component. You must peel the thin film off from the rubbers marked **b**.



- Do not touch the thermal grease.
- Do not press, touch, or rotate the fan impeller.
- Do not touch the fan inlet hole.
- Do not twist or pull the cable of the thermal fan assembly.
- Do not apply pressure on the top and bottom covers of the thermal fan assembly.
- Do not press the heat pipe. Hold both sides of the heat pipe if you must take the thermal fan assembly.
- Do not shake or drop the thermal fan assembly.
- Ensure that the fan connector is attached firmly.
- Replace the thermal fan assembly if you observe the following:
  - The cover of the thermal fan assembly is deformed or damaged.
  - There is abnormal noise during rotation.

When you install the system board:

Ensure that all the connectors are attached firmly to the system board.

1130 Battery pack

For access, remove this FRU:
- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1030 Internal storage drive” on page 65
- “1040 Memory module” on page 66
- “1050 Wireless LAN card” on page 67
- “1060 Coin-cell battery” on page 68
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70
- “1090 Media card reader” on page 72
- “1100 USB/audio card” on page 73
- “1120 System board, dc-in support bracket, and thermal fan assembly” on page 74

Important notices for replacing a battery pack

Attention: Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.

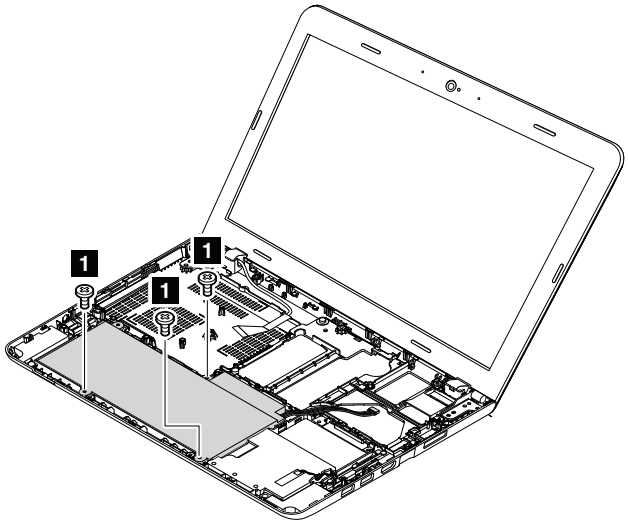
The Lenovo Solution Center program provides an automatic battery diagnostic test that determines if the battery pack is defective. A battery pack FRU should not be replaced unless this diagnostic test shows that the battery is defective. The only exception to this is if the battery pack is physically damaged or a customer is reporting a possible safety issue.

If the Lenovo Solution Center program is not installed on the computer, the customer should download and install the program to diagnose the battery pack, before getting a non-physically damaged battery pack replaced. Note that the replacement of a physically damaged battery pack is not covered by the warranty.

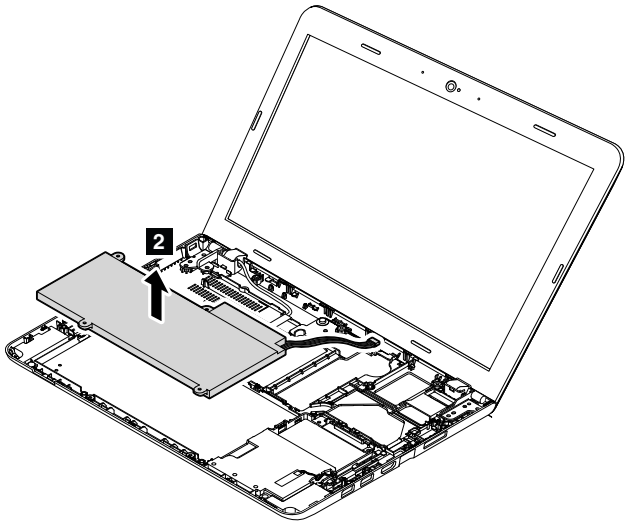
Removal steps of the battery pack

DANGER

Use only the authorized battery specified for your computer. Any other battery could ignite or explode.



Step	Screw (quantity)	Color	Torque
1	M2 × 3.5 mm, small-head, nylon-coated (3)	Silver	0.181 Nm (1.85 kgf-cm)



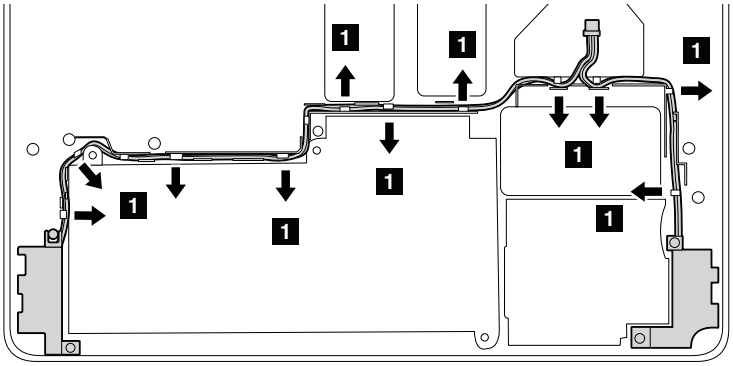
1140 Speaker assembly

For access, remove these FRUs in order:

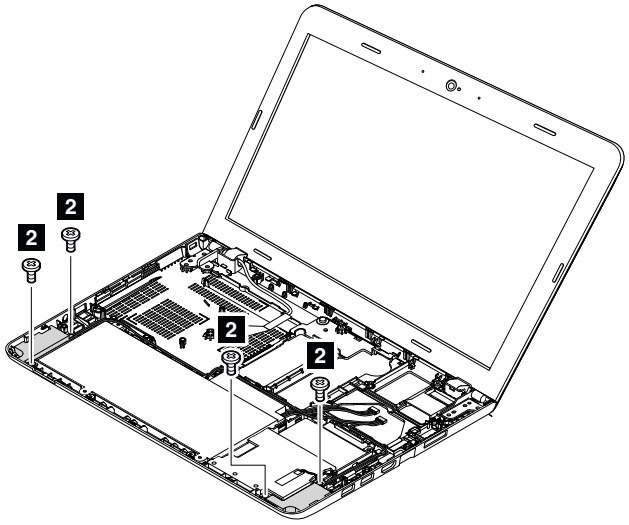
- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1030 Internal storage drive” on page 65
- “1040 Memory module” on page 66
- “1050 Wireless LAN card” on page 67
- “1060 Coin-cell battery” on page 68
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70
- “1090 Media card reader” on page 72
- “1100 USB/audio card” on page 73
- “1120 System board, dc-in support bracket, and thermal fan assembly” on page 74
- “1120 System board, dc-in support bracket, and thermal fan assembly” on page 74
- “1130 Battery pack” on page 81

Removal steps of the speaker assembly

Remove the speaker cables as shown.

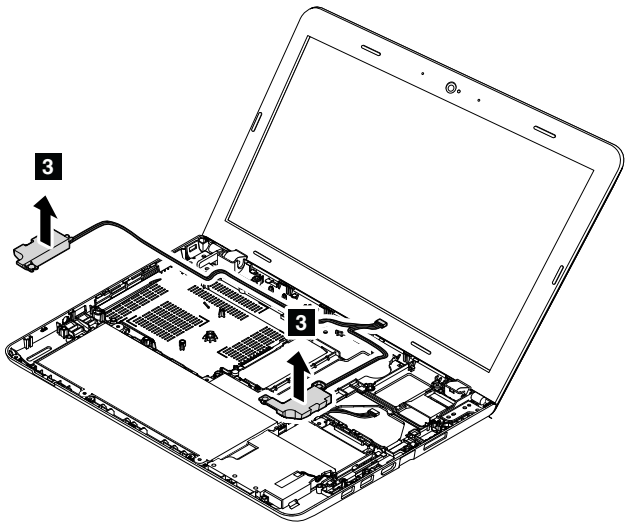


Remove the screws that secure the speaker assembly.



Step	Screw (quantity)	Color	Torque
2	M2 × 2.5 mm, big-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)

Remove the speaker assembly.



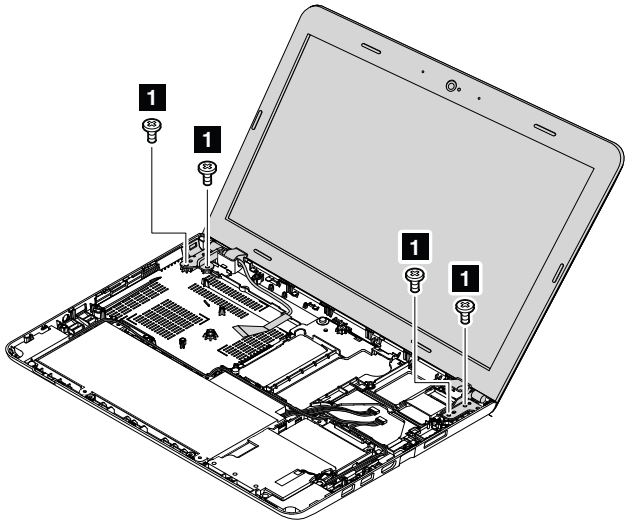
When installing:

Ensure that the cables are properly.

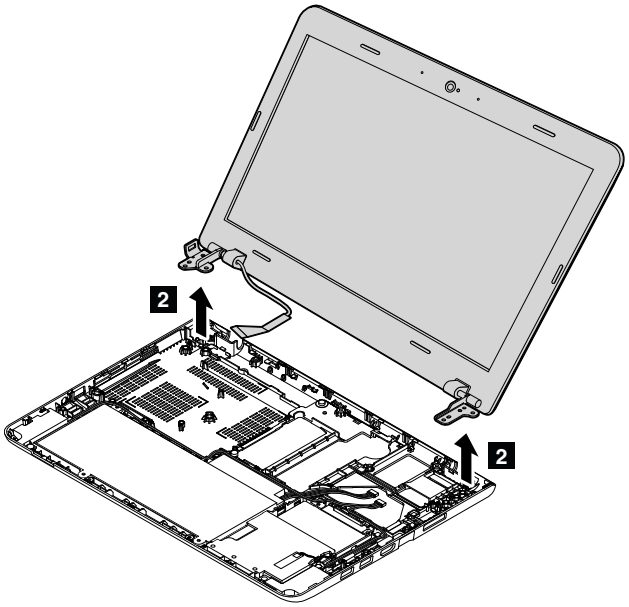
1150 LCD unit

For access, remove these FRUs in order:
- “1020 DIMM door” on page 65
- “1030 Internal storage drive” on page 65
- “1050 Wireless LAN card” on page 67
- “1070 Keyboard” on page 69
- “1080 Keyboard bezel assembly” on page 70
- “1120 System board, dc-in support bracket, and thermal fan assembly” on page 74

Removal steps of the LCD unit



Step	Screw (quantity)	Color	Torque
1	M2.5 × 5 mm, flat-head, nylon-coated (4)	Black	0.249 Nm (3 kgf-cm)



1160 Hinge support bracket, wireless LAN antennas assembly, and base cover assembly

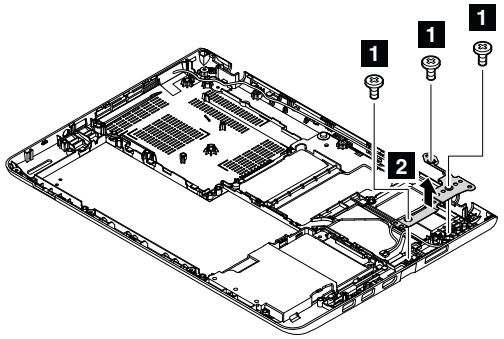
For access, remove these FRUs in order:

- “1010 Lenovo OneLink connector cover” on page 64
- “1020 DIMM door” on page 65
- “1030 Internal storage drive” on page 65
- “1040 Memory module” on page 66
- “1050 Wireless LAN card” on page 67
- “1060 Coin-cell battery” on page 68
- “1070 Keyboard” on page 69

- “1080 Keyboard bezel assembly” on page 70
- “1090 Media card reader” on page 72
- “1100 USB/audio card” on page 73
- “1110 ThinkPad-logo-LED card” on page 73
- “1120 System board, dc-in support bracket, and thermal fan assembly” on page 74
- “1130 Battery pack” on page 81
- “1140 Speaker assembly” on page 83
- “1150 LCD unit” on page 84
- “1160 Hinge support bracket, wireless LAN antennas assembly, and base cover assembly” on page 85

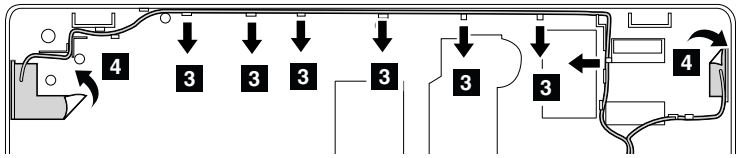
Removal steps of the hinge support bracket, wireless LAN antennas assembly, and base cover assembly

Remove the screws that secure the hinge support bracket. Then remove the hinge support bracket.



Step	Screw (quantity)	Color	Torque
1	M2 × 3 mm, wafer-head, nylon-coated (3)	Black	0.181 Nm (1.85 kgf-cm)

Release the wireless LAN antennas assembly from the tabs as shown.

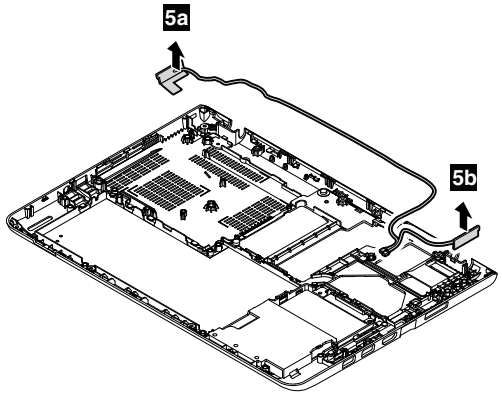


Remove the wireless LAN antennas assembly from the base cover assembly.

Antenna locations

a Wireless LAN auxiliary antenna (black)

b Wireless LAN main antenna (gray)

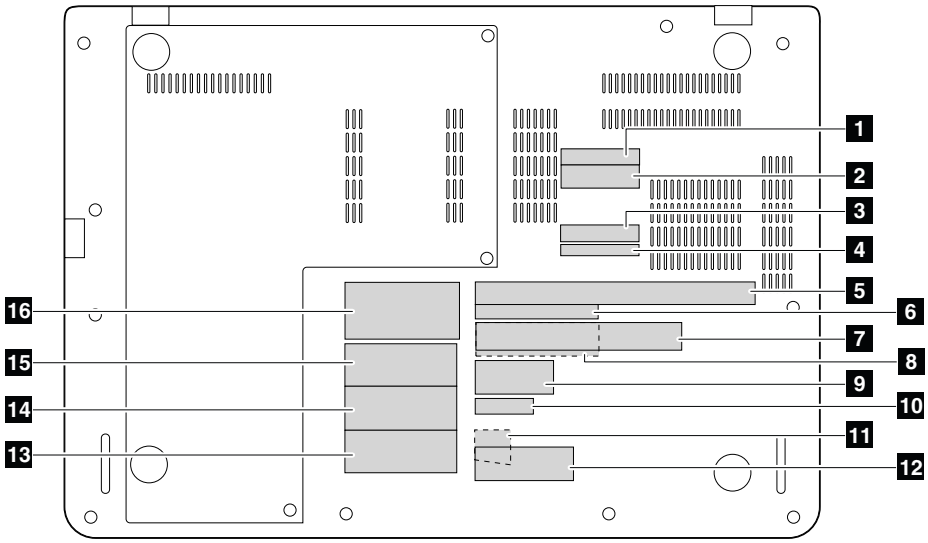


Attention: When you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.

Applying labels to the base cover

The new base cover FRU is shipped with a kit containing labels of several kinds. Apply those labels when you replace the base cover. For the labels that are not shipped with the new base cover, peel them off from the old base cover, and adhere them to the new one.

The following illustration shows the location of each label.



If the Windows Certificate of Authentication (COA) label **12** is attached to a part that is replaced, do one of the following:

- Return the old part with the label attached to the customer.

- Provide a letter to the customer stating what the label was originally on the computer and what the part number, serial number, and product key were on the label.

When you replace the base cover, apply the serial number label **1**.

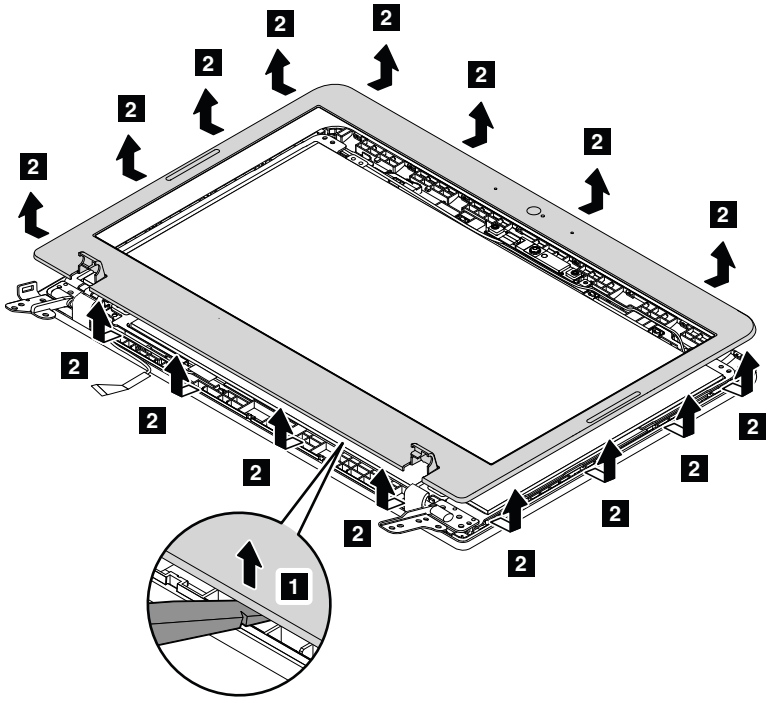
The following labels must be peeled off from the old base cover, and then adhere to the new base cover.

2 GEO label
3 FCC label
4 GEO label for Taiwan only
5 Rating label
6 Japan GEO label Indonesia rating label
7 India BIS label
8 Indonesia Rating
9 GEO label for China only
10 Product label (CECP) for China only
11 Genuine Microsoft label
13 Israel homologation (3G) label
14 Israel homologation (BT) label
15 Israel homologation (WL) label
16 Asset tag

2010 LCD bezel assembly

Removal steps of the LCD bezel assembly

For access, remove this FRU in order:
- "1150 LCD unit" on page 84



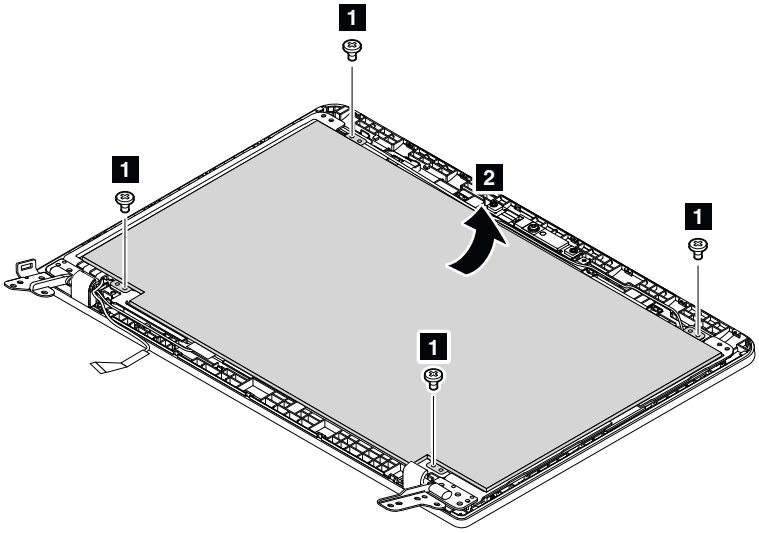
When installing:

Ensure that all the latches are attached firmly.

2020 LCD module

For access, remove these FRUs in order:
- “1150 LCD unit” on page 84
- “2010 LCD bezel assembly” on page 88

Removal steps of the LCD module

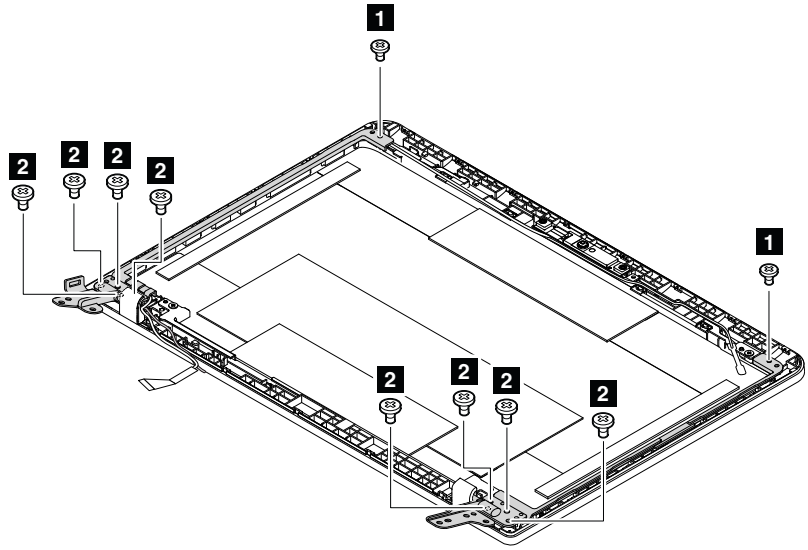


Step	Screw (quantity)	Color	Torque
1	M2 × 3 mm, flat-head, nylon-coated (4)	Black	0.181 Nm (1.85 kgf-cm)

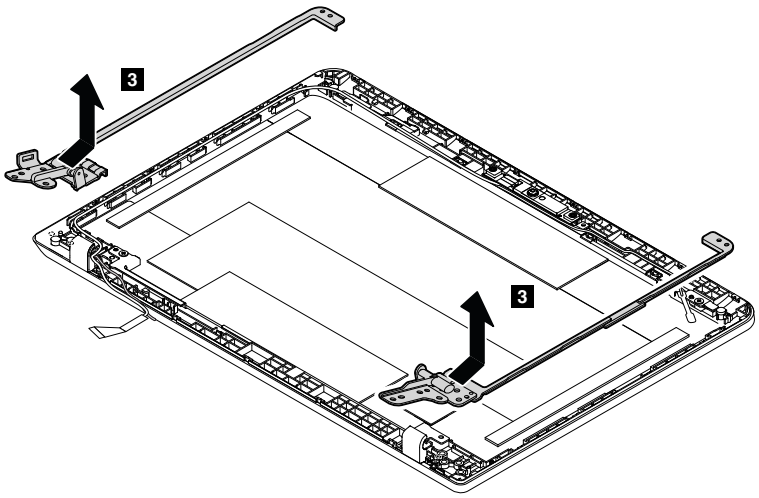
2030 Hinge kit

For access, remove these FRUs in order:
- “1150 LCD unit” on page 84
- “2010 LCD bezel assembly” on page 88
- “2020 LCD module” on page 89

Removal steps of the hinge kit



Step	Screw (quantity)	Color	Torque
1	M2 × 3.5 mm, flat-head, nylon-coated (2)	Black	0.181 Nm (1.85 kgf-cm)
2	M2.5 × 3.5 mm, flat-head, nylon-coated (8)	Silver	0.294 Nm (3.0 kgf-cm)

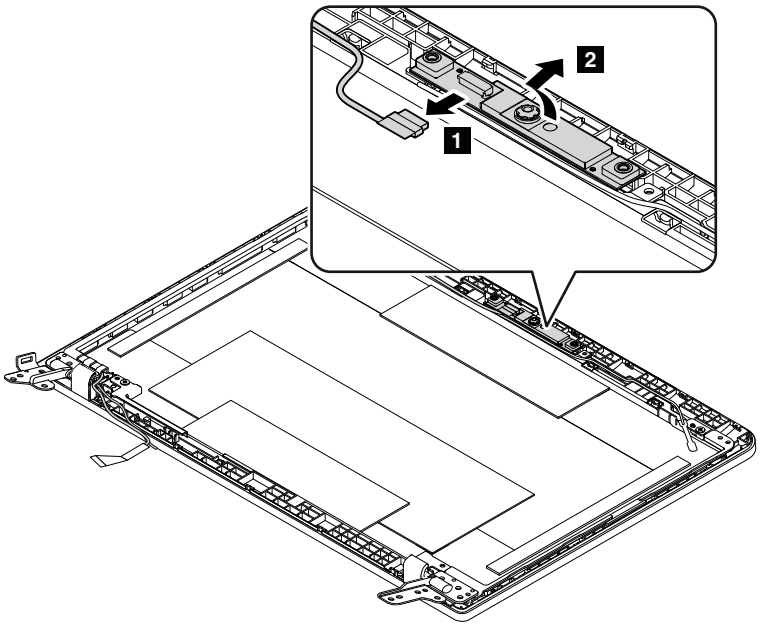


2040 Integrated camera and microphone combo card

For access, remove these FRUs in order:

- “1150 LCD unit” on page 84
- “2010 LCD bezel assembly” on page 88
- “2020 LCD module” on page 89

Removal steps of the integrated camera and microphone combo card



When installing:

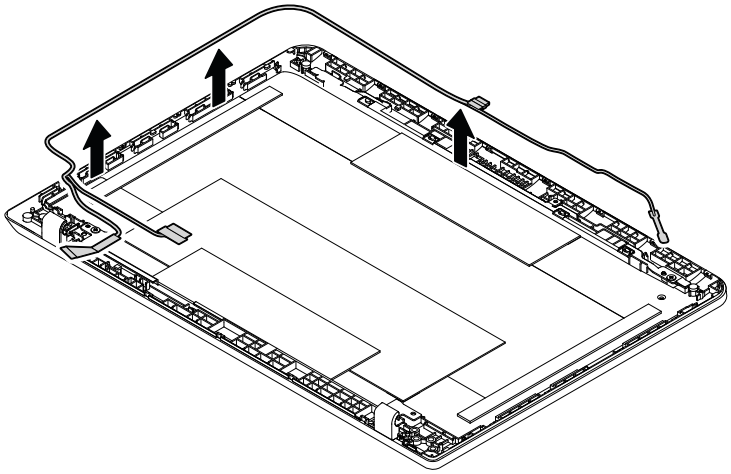
Ensure that the connector is attached firmly.

2050 LCD cable assembly and LCD rear cover assembly

For access, remove these FRUs in order:

- “1150 LCD unit” on page 84
- “2010 LCD bezel assembly” on page 88
- “2020 LCD module” on page 89
- “2030 Hinge kit” on page 89
- “2040 Integrated camera and microphone combo card ” on page 90

Removal step of the LCD cable assembly and LCD rear cover assembly



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Appendix B. Abbreviation table

The following table lists all abbreviations used in this manual.

Abbreviation	Term
BGA	Ball Grid Array
BIOS	Basic Input / Output System
CD	Compact Disc
CMOS	Complementary Metal Oxide Semiconductor
COA	Certificate of Authentication
CPU	Central Processing Unit
CRC	Cyclic redundancy check
CRT	Cathode ray tube
CRU	Customer Replaceable Unit
CTO	Configure To Order
DC	Direct current
DVD	Digital Video Disc
EAIA	Enhanced Asset Information Area
ECA	Engineering Change Announcements
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFI	Extensible Firmware Interface
EPO	Emergency power-off
ESD	Electrostatic discharge
EU	European Union
FCC	Federal Communications Commission
FRU	Field Replaceable Unit
GAV	General Announce Variant
GPU	Graphics Processing Unit
HDD	Hard Disk Drive
HDMI	High-definition multimedia interface
ICs	Integrated circuits
ICCID	Integrate circuit card identity
ISO	International Standardization Organization
LAN	Local area network
LCD	Liquid Crystal Display
MAC	Media Access Control
MT	Machine type
MTM	Machine type and model
PC	Personal Computer

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Abbreviation	Term
PCH	Platform Controller Hub
POST	Power-on self-test
RAM	Random Access Memory
RF	Radio frequency
RFID	Radio-frequency identification
RI	Ring indicator
RJ	Registered jack
SATA	Serial Advanced Technology Attachment
SIM	Subscriber Identity Module
SVP	Supervisor password
TFTs	Thin-film transistors
UEFI	Unified Extensible Firmware Interface
USB	Universal Serial Bus
UUID	Universally Unique Identifier
VRAM	Video Random Access Memory

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